Afraid to Seek Care? A Fixed Effects Analysis of State Fetal Protection Legislation and Prenatal Healthcare Utilization from 2002 to 2015

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1. Introduction

PNC encompasses "services provided to improve pregnancy outcomes and engage the expectant mother, family members, and friends in healthcare decisions" (Daniels & Mayberry, 2006). Furthermore, it allows for pregnant individuals to be screened and treated for manageable conditions (Taylor, 2005). Early PNC utilization is also associated with lower risk for adverse fetal outcomes such as low birth weight and preterm birth (Daniels & Mayberry, 2006; Debiec, Paul, Mitchell, & Hitti, 2010; Partridge, Balayla, Holcroft, & Abenhein, 2012), and lower maternal health risk during and after pregnancy (Yan, 2017). Lack of PNC is associated with a variety of adverse outcomes including: preterm birth, low birth weight, fetal death, stillbirth, and infant mortality (Maupin et al., 2004; Partridge et al., 2012; Taylor et al., 2005; Vintzileos et al., 2002a; Vintzileos et al., 2002b; Yan, 2017).

Yet inadequate access to PNC remains a public health concern and policy focus (Debiec et al., 2010; Partridge et al., 2012; Yan, 2017). In 2019, approximately 6.4 percent of births (nearly 240,000 infants) in the U.S. received late or no PNC (March of Dimes, 2022). As part of its Healthy People 2020 initiative, U.S. Department of Health and Human Services focused on increasing PNC utilization, with a target of 84.8 percent of pregnant people receiving early and adequate care. However, in 2020, 1 in 7 infants was born to a pregnant woman with inadequate PNC (defined as care initiated late or fewer than recommended visits for gestational age) (National Center for Health Statistics, final natality data). While increasing utilization of PNC is a national public health priority, accessibility and utilization varies significantly across states. For example, in states such as California, Vermont, and New Hampshire, at least 85 percent of pregnant women initiate care in the first trimester, compared to states such as Texas, New Mexico, and Arkansas, where fewer than 70 percent of pregnant women initiate early care (Osterman & Martin, 2018).

Extant research focuses primarily on individual-level predictors of PNC utilization such as racial/ethnic background (Baer et al., 2019; Slaughter-Acey et al., 2019), immigration status (Korinek & Smith, 2011), insurance status (Baer et al., 2019; Green, 2018), exposure to intimate partner violence (Cha & Masho, 2014), and substance use (Stone, 2015). While individual-level predictors of PNC utilization are well understood, state-level analysis is scarce, but critical to evaluate structural conditions that shape health decisions and outcomes (Montez et al., 2020). An under-explored vein of research centers on the structural context influencing individuals during pregnancy and even prior to conception, such as the political and legislative environment, which has become increasingly tenuous with respect to reproductive health. In this...
paper, we extend emerging literature by investigating whether ‘fetal protection’ laws influence PNC timing and take-up at the state-level. These policies pertain to either fetal homicide or prenatal substance use, classify fetuses as entities separate from pregnant people, and provide for legal action in the case of fetal harm or death (Goodwin, 2020). Differentially defined state-to-state, fetal protection laws vary a great deal in scope, but are increasingly prevalent across states, with 38 states having at least one fetal homicide policy in place currently (National Conference of State Legislatures, 2018) and 32 states having at least one policy pertaining to maternal substance use (Guttmacher Institute, 2021). Fetal protection laws and other state level policies governing fetal outcomes have come under growing scrutiny for their potential to regulate pregnant people’s behavior, and sometimes have been used to prosecute individuals for actions during pregnancy (Goodwin, 2014, 2016, 2020; Morgan & Roberts, 2012; Waggoner, 2017; Weigel, Sobel, & Salganicoff, 2020).

Literature on this topic has been largely theoretical and philosophical, taken up in part by legal scholars (Weigel et al., 2020). While legal analysis suggests fetal protection laws may be leveraged to regulate and criminalize pregnant people’s behavior, there is a critical void of empirical research that investigates how these policies may influence PNC utilization at the state level. For example, pregnant people who use illicit or illegal substances may avoid medical guidance and services if they fear criminal prosecution (Stone-Manista, 2009), a concern echoed by health professionals (American Medical Association, 2020). Given the potential implications of these laws and scant quantitative analysis on the relationship between fetal protection laws and PNC utilization, further research is warranted. Addressing this gap in the literature, we investigate whether fetal protection laws are associated with take-up and timing of PNC at the state level. There is substantial variation in the implementation of fetal protection laws at the state level over time, which is ideal for empirically assessing whether these laws are associated with changes in PNC utilization. To investigate whether changes in fetal protection laws are associated with patterns of PNC use, we constructed an original state-level panel dataset from all 50 states from 2002 to 2015 for a total of 531 observations. By using fixed-effects models, we can make stronger claims regarding the relationship between fetal protection laws and PNC utilization within states over time.

1.1. Individual correlates of PNC

Extensive research documents individual-level correlates of PNC. Women who do not seek PNC are more likely to have children, lack health insurance, deny the pregnancy, use illicit substances, and be unmarried, young, and less educated (Maupin et al., 2004; Taylor et al., 2005; Friedman et al., 2009a; Schempf & Strobino, 2009; Partridge et al., 2012). Racial/ethnic disparities in access to and treatment within PNC settings are also well-documented (Rosenthal & Lobel, 2011). While the racial/ethnic gap in utilization narrowed toward the end of the 20th century (Alexander, Kogan, & Nabukera, 2002), racial/ethnic disparities persist, with Black and Hispanic women are less likely to receive adequate PNC than white women (Taylor et al., 2005; Partridge et al., 2012; Rosenthal & Lobel, 2011). White women have highest rates of early PNC, followed by Hispanic and Black women (Green, 2018). This may reflect difficulty obtaining care, as Black and Latina women report greater barriers when accessing care (Fryer, Munoz, Ranghagdale, & Stuebe, 2019). Qualitative research indicates Black women perceive discrimination based on insurance, income, and race while utilizing PNC (Rosenthal & Lobel, 2011; Salm Ward et al., 2013), and other studies suggest socioeconomic status is a key factor in racial disparities in PNC (Green, 2018).

1.2. Fetal protection policies and interactions with medical professionals

Research on interactions between medical professionals and pregnant people may shed light on mechanisms by which fetal protection policies might influence individuals’ PNC decisions. Fetal protection policies regarding substance use often position medical professionals as gatekeepers and mandatory reporters (Flavin & Paltrow, 2010); thus, pregnant individuals may distrust providers (Tucker et al., 2017; Roberts and Nuru-Jeter, 2016; Rosenthal & Lobel, 2020). Furthermore, given historically racialized legacies of medical maltreatment (Phelan & Link, 2015; Roberts, 1996; Washington, 2006), medical distrust among pregnant people is stratified along racial/ethnic lines, with Black and Hispanic patients frequently expressing less trust in medical professionals than white patients, although these differences are sometimes contingent on factors such as socio-economic status and geographic location (Armstrong, Ravennell, McMurphy, & Pitt, 2007; Halft, Armstrong, Gandy, and Shaker 2006; Rosenthal & Lobel, 2020). Qualitative research on women using substances during pregnancy suggests concerns about being identified as drug users by medical providers leads some to delay PNC or skip appointments (Roberts and Nuru-Jeter, 2010), potentially out of fear of being reported to Child Protective Services (CPS), arrest, forced abortion, or termination from PNC (Roberts and Nuru-Jeter, 2010; Roberts and Pies, 2011). Other studies suggest women may avoid medical care or schedule appointments around drug use (Schempf & Strobino, 2009; Stone, 2015). CPS referral is associated with inadequate PNC amongst pregnant women using illegal substances (Wu et al., 2013).

Qualitative research indicates pregnant people also face other factors—individual, interpersonal, and policy-level—that interact with substance use to become healthcare barriers (Roberts & Pies, 2011; Wu et al., 2013). For example, being reported for prenatal substance use is often stratified along racial lines (Whiteford & Vitucci, 1997). Chasnoff, Landress, and Barrett (1990) found that Black women were 10 times more likely than white women to be reported (despite similar rates of usage). A more recent examination found—even with universal screening—Black women were still four times more likely than white women to be reported to CPS after delivery (Roberts & Nuru-Jeter, 2012). Trust levels in medical providers vary across racial/ethnic groups (Feagin & Bennefield, 2014; Rosenthal & Lobel, 2011), as does the quality of PNC and guidance (Paul et al., 2006).

1.3. State-level fetal protection policies – fetal homicide and prenatal substance use legislation

Fetal homicide laws were initially enacted in part in response to violence directed against pregnant people (Weigel et al., 2020). During the 1990s, approximately one-third of injury deaths occurring during pregnancy resulted from homicide (Chang, Berg, Saltzman, & Herndon, 2005). Some states thus enacted fetal homicide laws that identify fetuses in utero as crime victims by including them legally as “persons” under existing state law or creating a separate offense entirely (Murphy, 2014; Weigel et al., 2020). As of 2022, approximately 38 states had passed fetal homicide laws, and 29 states have laws that apply to any stage of pregnancy including fertilization (National Conference of State Legislatures, 2018). Even when this legislation exempts a pregnant individual or abortion from prosecution, there are cases where such exemption offers incomplete legal protection (Murphy, 2014). For example, a study conducted by the National Advocates for Pregnant Women (Paltrow & Flavin, 2013) identified 413 instances from 1973 to 2005 in which state action was taken against pregnant people using laws on homicide, child abuse, drug possession/use, and drug distribution as the basis for prosecution. If not pregnant, many of these individuals would have avoided prosecution (Goodwin, 2016). Moreover, these prosecutions overwhelmingly target racially and economically marginalized groups (Paltrow & Flavin, 2013; Whiteford & Vitucci, 1997).

As of 2022, 32 states have passed at least one fetal protection policy targeting substance use during pregnancy, although the punitive extent of these laws varies. For example, in 24 states, substance use during pregnancy is legally considered child abuse, and in 3 of these states, pregnant people may be civilly committed. In some states (e.g. Alabama
and South Carolina), these policies constitute grounds for criminal prosecution. Furthermore, in 25 states, fetal protection policies identify physicians as mandatory reporters when substance use is suspected, and 8 states require drug testing in such instances.

A descriptive analysis of state policies from 1970 through 2013 found policies pertaining to alcohol (one category of substance use) and pregnancy became increasingly punitive over time and were correlated with attempts to limit reproductive rights rather than address public health concerns (Roberts, Thomas, Ryan, & Drabbe, 2017). While punitive policies have increased, the number of states offering pregnant people priority access to treatment have increased little (Drabbe, Thomas, O’Connor, Sarah, & Roberts, 2014). Thus, fetal protection policies concerning substance use may be interpreted as threatening by pregnant individuals, rather than supportive.

The literature on state-level fetal protection policies and PNC utilization is limited; yet, some research addresses how fetal protection policies may influence reproductive decision-making. One state-level analysis investigated policies that mandate placing alcohol warning signs (regarding prenatal risks associated with consumption) near locations that sell alcohol, and found these policies were associated with reduced alcohol use in pregnancy, lowered odds of very pre-term births and very low birth weight, but did not examine PNC utilization (Cil, 2017). Subsequent analysis by Subbaraman et al. (2018) found state policies regarding prenatal alcohol use are associated with myriad adverse outcomes—including greater odds of low birth weight and premature birth, and accessing PNC late—while supportive policies were not associated with better birth outcomes. Furthermore, mandatory alcohol warning signs and legislation defining prenatal alcohol consumption as child abuse were associated with lower odds of obtaining PNC, while these policies and those legislating involuntary commitment of pregnant individuals using alcohol were associated with higher odds of receiving late PNC (Subbaraman et al., 2018).

This study adds to existing research by evaluating the impact of both types of fetal protection policies on state-level PNC utilization. We use a panel of 14 years to examine within-state variation over time to analyze how legislative changes pertaining to fetal protection laws affect changes in PNC utilization. We investigate the years 2002–2015, which include expansions in legislation on fetal protection. Therefore, we can compare how changes in fetal protection laws are associated with changes in PNC utilization across the United States over time.

2. Methods

To investigate whether changes in state-level fetal protections laws are associated with changes in PNC utilization, this study utilizes an original panel dataset from all 50 states from 2002 to 2015, compiled from multiple sources.

2.1. Dependent variables

The outcome variables are derived from a continuous measure of percentage of births within a given state-year that utilized PNC. We obtained these data from the Centers for Disease Control and Prevention (CDC) WONDER database, which used birth certificates for live births to U.S. residents in the United States and indicate the month PNC was initiated. Response options ranged from “No PNC” to “10th Month”. Responses were compiled to calculate the percentage of individuals in a given state per year that initiated PNC in each month of pregnancy. We note that a 2003 revision to birth certificates made data incomparable and render these data incomplete across all states for all years. Therefore, data are missing across various state-years from 2003 to 2015 (for a full list, see the appendix). In spite of this limitation, this remains the best data for our investigation. Notably, the overwhelming majority of states have measured PNC utilization at multiple time points in the panel, allowing us to examine how this has changed within states over the years in our sample.

We examine two aspects of PNC utilization. First, No Care measures the percentage of individuals in a state in a given year that indicated they did not receive any PNC during pregnancy. Second, in line with past research defining Late PNC as beginning in the third trimester, we measure the percentage of individuals in a state in a given year that indicated they initiated PNC in the 7th month of pregnancy or later (Osterman & Martin, 2018; Slaughter-Acey, Sneed, Keith, Lee, and Misra, 2019). Examining both of these continuous dependent variables indicated it was positively skewed (e.g. not normally distributed), with No Care exhibiting a skewness value of 2.63 while Late Care only had a value of 0.22. To address this and assist in comparison across values, both variables were logged, with No Care resulting in a skewness value of 0.14 and Late Care a value of –0.57.

2.2. Independent variables

States with fetal protection legislation regarding fetal homicide were first identified through the National Conference of State Legislatures (NCSL), which provides a summary of statutes and case law by state. Next, we conducted original legal research using Westlaw in consultation with law librarians to verify the year each statute became effective in each state. Westlaw also provides information regarding enactment of each statute and challenges in court. Changes in statutes were assessed in January of each state-year to assure temporal ordering, and thus include a lag to account for time between a law taking effect and subsequent impacts on individual behavior. Throughout this process, we kept a codebook detailing each policy and tracking changes in definitions or coding decisions.

We then constructed four dichotomous variables measuring fetal homicide statutes: 1) a fetal homicide law is effective in a given state-year 2) the fetal homicide law exempts the pregnant person 3) the fetal homicide law exempts abortion and 4) the fetal homicide law applies to all stages of pregnancy. Years for which a state had these measures effective in January were coded 1, and 0 otherwise. It should be noted, three states exempt mothers from prosecution with stipulations: Utah, Oklahoma, and Missouri. Since these states hold mothers responsible for harm that befalls fetuses while engaging in criminal behavior, these states are coded “0” for maternal exemption. Additionally, in many of these statutes, abortion exemption refers to legally-obtained abortions only. For more detailed information on our coding strategy, please contact the authors.

We obtained data on states with fetal protection legislation concerning drug use during pregnancy from Guttmacher Institute. This analysis focuses on three policies: 1) mandatory testing of suspected drug use by healthcare professionals 2) mandatory reporting of suspected drug use by healthcare professionals and 3) classifying drug use during pregnancy as child abuse. Years for which a state had this measure in place in January were coded 1, and 0 otherwise, which allows a lag to account for time between a law taking effect and subsequent impacts on individual behavior. For a full list of fetal protection policies and years that they were in effect across states, see the appendix.

2.3. Control variables

To ensure any relationship between fetal protection policies and PNC utilization is not due to other factors, we control for whether the state legislature is majority Republican, as well as state racial/ethnic demographics, and the percentage of state residents in poverty. Data on the state legislatures’ partisan composition come from NCSL, which categorizes states as Republican if both legislative chambers have Republican majorities, Democrat if both legislative chambers have Democratic majorities, and split if neither party had majorities in both legislative chambers. Data are biannual, assessed in January when changes to legislature composition occur, and carried through the next election cycle. We constructed a dummy variable for whether a state legislature is controlled by Republicans. States that had a Republican majority in
both legislative chambers in a given year were coded 1, and 0 otherwise, with the exception of Nebraska because of its unicameral legislature. To determine partisan control in Nebraska, we examined party control history over the panel period.

We collected population data from the U.S. Census Bureau’s (U.S. Census) Population Division intercensal estimates. This analysis distinguishes between racial/ethnic groups as follows: 1) White, non-Hispanic 2) Black, non-Hispanic 3) Hispanic and 4) Other race, non-Hispanic. Each group is measured as the percent of the population within the state classified as a given racial/ethnic category per year.

The poverty rate comes from the U.S. Census Current Population Survey Annual Social and Economic Supplements. It is calculated by comparing a family’s total income to poverty thresholds for a family of a given size. If the total income of a family is less than official poverty thresholds, the family is classified as being in poverty.

### Table 1

| Variable                      | Mean/Prop. | SD | Min | Max |
|-------------------------------|------------|----|-----|-----|
| **PNC**                       |            |    |     |     |
| (log) Percent No Care         | 0.001      | 0.66 | -1.71 | 2.11 |
| (log) Percent Late Care       | 1.24       | 0.43 | -0.12 | 2.08 |
| **Legislation**               |            |    |     |     |
| Fetal Homicide                | 0.70       | 0.46 | 0    | 1   |
| Mother Exempt                 | 0.41       | 0.49 | 0    | 1   |
| Abortion Exempt               | 0.50       | 0.50 | 0    | 1   |
| Early Stages                  | 0.43       | 0.50 | 0    | 1   |
| Drug Reporting                | 0.22       | 0.42 | 0    | 1   |
| Drug Testing                  | 0.09       | 0.29 | 0    | 1   |
| Child Abuse                   | 0.30       | 0.46 | 0    | 1   |
| **State-level Control Variables** |          |    |     |     |
| Percent Uninsured Residents   | 13.22      | 4.11 | 2.80 | 26.10 |
| Percent Residents on Medicaid | 14.51      | 4.43 | 5.40 | 31.10 |
| Republican Legislature        | 0.46       | 0.50 | 0    | 1   |
| Percent non-Hispanic white    | 72.61      | 15.13 | 22.40 | 96.15 |
| Percent non-Hispanic Black    | 9.83       | 9.29 | 0.33 | 37.31 |
| Percent non-Hispanic other    | 7.12       | 8.04 | 1.62 | 67.10 |
| Percent Hispanic              | 10.43      | 10.26 | 0.78 | 48.20 |
| Percent in Poverty            | 12.91      | 3.25 | 5.80 | 23.10 |
| **Observations**              | 531        |      |      |     |

PNC utilization is an interval-ratio variable and the dataset consists of observations for U.S. states from 2002 to 2015. A Hausman test indicated the data were better suited for a fixed-effects analysis instead of a random-effects analysis. Fixed-effects models address unobserved heterogeneity between states by focusing on within-state variation (Cameron and Trivedi, 2009). The strength of a fixed effects model is that it controls for time-invariant variables that might influence the outcome. Since these do not change over time, their effect is controlled even though these variables are not explicitly included in the model. In essence, each state acts as its own control (Allison, 2009).

Fixed effects models are estimated using the equation: \( \Delta y = \Delta x + \beta \Delta r + \Delta \epsilon \). In this equation, \( \Delta \) indicates a difference score (each time-varying variable is transformed into a deviation from its state-specific mean) and the outcome is a function of \( \alpha \) (an intercept that may vary at each point in time), \( \beta \) (the vector of coefficients), and the error term, which measures random variation at each point in time. All analyses utilize fixed-effects regressions to establish whether changes in state-level fetal protection laws are associated with changes in PNC utilization within states.

All independent and control variables were simultaneously examined for multi-collinearity using the STATA command “collin” (Ender, 2010). Mean VIF values ranged from 1.24 to 2.36 with no individual VIF >3.84, indicating no issue with multicollinearity (Ender, 2010). We tested the full model for serial correlation with the STATA command "xtserial" (Drukker, 2003) and heteroskedasticity with a likelihood-ratio test (Wiggins & Poi, 2020). Both were significant, therefore robust standard errors were clustered at the state-level in order to correct for autocorrelation and heteroskedasticity.

Our analysis proceeds as follows. First, we investigate how fetal homicide laws and substance use policies are independently associated with PNC utilization rates, controlling for the effects of state partisan control, state racial/ethnic demographics, and state poverty rate. Next, as a robustness check, we conduct the same analysis, but add in additional control variables: percent uninsured and Medicaid prevalence in the state. Finally, we present our full model, which includes both fetal homicide laws and policies concerning substance use, as well as all of our control variables.

### 3. Results

Table 2 shows the effect of fetal homicide laws and policies on substance use during pregnancy on the natural log of PNC utilization, controlling for Republican-controlled Congress, state racial/ethnic demographics, and state poverty rates. The coefficients reported in the table are interpreted as approximate percentage changes in the dependent variable that corresponds to a one-unit increase in the independent variable. However, a key concern with logged dependent variables is that approximate percentage changes are less accurate as coefficient size grows. Therefore, for our variables of interest (e.g. fetal protection policies), we also obtain the exact percentage change in the dependent variable that corresponds to a one-unit change in the independent variable in the following way: exponentiating the coefficient, subtracting one, and multiplying the difference by 100 \( \times (exp(\beta)-1) \times 100 \) (Palmer, 2011).

The results indicate changes in certain fetal protection legislation are significantly associated with changes in PNC utilization. Model 1 shows a statistically significant relationship between the passage of fetal homicide laws that exempt abortion from prosecution and increases in that state’s percentage of pregnant people who did not obtain PNC. In this case, the percentage of people not receiving PNC is predicted to increase by 49 percent \( \times (exp(0.4008)-1) \times 100 \) as states implement this policy, and is statistically significant (p < 0.01). Turning to the results in Model 2, which evaluates changes in people accessing late PNC, the effect of fetal homicide laws that exempt abortion from prosecution are not significant. None of the other fetal homicide policy variables reach significance for lack of or delayed PNC.
Models 3 and 4 examine the impact of prenatal substance use policies controlling for Republican-controlled Congress, state racial/ethnic demographics, and state poverty rates. Policies mandating testing of suspected drug use are significantly associated with increases in the percentage of pregnant people not utilizing PNC. Model 3 indicates the implementation of a state mandatory drug testing policy is associated with a 39.64 percent \([\exp(0.3339)-1] \times 100\) increase in a state’s percentage of people not receiving PNC \((p < 0.05)\). The effect of this policy on late prenatal is even greater, and is associated with a 50.73 percent \([\exp(0.3892)-1] \times 100\) increase in the percentage of pregnant people not utilizing PNC after the recommendation point \((p < 0.001)\). None of the other policies on prenatal substance use are significantly associated with lack of or delayed PNC utilization.

### 3.1. Robustness check – controlling for insurance status and Medicaid

Table 3 adds two additional control variables as a robustness check to ensure that lack of PNC utilization is not related to insurance or Medicaid prevalence in the state. Model 5 indicates after controlling for Medicaid coverage and insurance status, a fetal homicide policy that exempts abortion from prosecution is associated with a 47.58 percent \([\exp(0.3892)-1] \times 100\) increase in the proportion of pregnant people who received no PNC within states \((p < 0.01)\). None of the other policy variables are significant. In Model 6, a fetal homicide that exempts abortion from prosecution is associated with a 21.66 percent \([\exp(0.1961)-1] \times 100\) increase in the percentage of pregnant individuals initiating PNC later than recommended \((p < 0.05)\), controlling for Medicaid prevalence and insurance coverage.

In Models 7 and 8, a law mandating testing of suspected drug use during pregnancy is associated with increases in pregnant people both not receiving PNC and initiating care late even after controlling for Medicaid coverage and insurance status. In this case, when a state implements this policy it is associated with a 38.50 percent \([\exp(0.3257)-1] \times 100\) increase in the percentage of individuals initiating PNC late \((p < 0.001)\). Taken together, the results from Table 3 suggest the relationships between fetal protection policies and PNC utilization are not due to factors such as insurance coverage or Medicaid, which may limit access to PNC.

### Table 3

|                  | Model 5          | Model 6          | Model 7          | Model 8          |
|------------------|------------------|------------------|------------------|------------------|
|                  | No Care          | Late Care        | No Care          | Late Care        |
| **Fetal Homicide Laws** |                  |                  |                  |                  |
| Death Classified as Homicide | –0.0254** (0.11) | 0.0224 (0.08)  | 0.3257** (0.14) | 0.3546*** (0.04) |
| Mother Exempt    | –0.2195 (0.14)   | –0.0232 (0.10)  | 0.1854 (0.11)   | 0.2382 (0.13)   |
| Abortion Exempt  | 0.3892*** (0.14) | 0.1961* (0.09)  | –0.0522 (0.10)  | –0.1915 (0.12)  |
| Applies to Early stages of Pregnancy | 0.1057 (0.11) | 0.0140 (0.09)  |                  |                  |

**Laws on Drug Use During Pregnancy**

|                  |                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|------------------|
| Mandatory Drug Testing |                  |                  |                  |                  |
| Mandatory Drug Reporting |                  |                  |                  |                  |
| Classified as Child Abuse |                  |                  |                  |                  |
| Percent State Residents Uninsured | 0.0156 (0.01) | 0.0306*** (0.01) | 0.0139 (0.01) | 0.0295*** (0.01) |
| Percent State Residents on Medicaid | 0.0017 (0.01) | 0.0345*** (0.01) | 0.0006 (0.01) | 0.0319*** (0.01) |
| Republican-Controlled Legislature | –0.0368 (0.06) | 0.0327 (0.06) | –0.0027 (0.06) | 0.0292 (0.06) |
| Percent Black Residents | 0.1460* (0.07) | 0.0914 (0.05) | 0.1311 (0.09) | 0.0933 (0.05) |
| Percent Other Race Residents | 0.1219* (0.05) | 0.0896 (0.07) | 0.1069 (0.05) | 0.0684 (0.08) |
| Percent Hispanic Residents | 0.0068 (0.03) | 0.0291 (0.04) | 0.0341 (0.03) | 0.0522 (0.04) |
| Percent State Residents in Poverty | –0.0025 (0.01) | –0.0047 (0.01) | 0.0034 (0.01) | –0.0022 (0.01) |
| Intercept | –2.7175*** (0.60) | –1.5714* (0.66) | –2.6949*** (0.75) | –1.6255** (0.58) |

N = 531

Standard errors in second column; *p < 0.05 **p < 0.01 ***p < 0.001.
### 3.2. Full model – both types of fetal protection policies

To determine whether these relationships hold when all policy variables are in the model, Table 4 examines the relationship between fetal homicide policies and laws concerning prenatal substance use on PNC utilization simultaneously, controlling for insurance and Medicaid coverage, Republican-controlled legislature, state demographics, and state poverty rates. Model 9 indicates the only variable significantly associated with the percentage of people not obtaining PNC is mandatory drug testing. In this case, when a state implements this policy the percentage of people receiving no prenatal during pregnancy is predicted to increase by 27.01 percent \([exp(0.02391)-1] \times 100\) \((p < 0.05)\). The effect of this variable is even greater in Model 10, and the implementation of this policy is associated with a 39.71 percent \([exp(0.03344)-1] \times 100\) increase in the percentage of individuals initiating PNC late \((p < 0.001)\).

### 4. Discussion

To our knowledge, this is the first investigation of how state-level changes in two types of fetal protection legislation (those pertaining to fetal homicide and those pertaining to substance use) are associated with utilization of PNC at the state level. Our findings suggest certain fetal protection policies may potentially deter PNC utilization. First, we find that fetal homicide legislation policies which exempt abortion from prosecution are associated with a significant increase in births to people who either go without or seek PNC later in pregnancy, even after controlling for insurance and Medicaid access. However, this does not hold when all policy variables are included in the model. More importantly, we find fetal protection laws mandating drug testing are associated with an increase in individuals not receiving or initiating PNC later than recommended. This particular finding holds in all models, regardless of controls. States with such laws are likely to place pregnant individuals in contact with the criminal justice system or other services that intervene in pregnancy. In states with history of punitive action against prenatal substance use, pregnant individuals may be aware of potential consequences if reported and avoid care. While past research suggests this relationship with birth outcomes or demonstrates selective effects remains debated (see Alexander & Kotelchuck, 2001). Therefore, additional analyses may shed more light on how these policies impact decision-making by race or socioeconomic status. However, future research should investigate whether these laws influence people’s PNC decisions and access in ways that are different across various racial/ethnic sub-populations. In addition, because we only observe state-level utilization of PNC, rather than the decision-making process, we cannot determine why pregnant people are not receiving or delaying PNC. Thus, while our results suggest fetal protection legislation may cause pregnant people who use illegal or illicit substances to avoid PNC, we cannot definitively determine this.

Though we try to account for temporal ordering by assessing whether each policy is in effect in each state in January of a given year, this falls short of knowing a policy is in effect before any individual became pregnant. However, this method accounts for a natural lag that occurs between the passage of a policy and its effects, and policy likely takes time to result in behavioral change. While more fine-tuned analysis by state and month might yield more precise measurement, it is unlikely to result in drastically different results and is outside the scope of this analysis.

While our results suggest some fetal protection laws may discourage people from seeking PNC, further research should evaluate within-state variation. For example, it is possible these policies may have differential effects on individuals’ PNC utilization in rural vs. urban areas (Kozhimannil, Dowd, Ali, Novak, & Chen, 2019; Douds, Wyndham, & Ethan, 2021) or in areas that are healthcare deserts (Hung et al., 2018; Markus & Pillai, 2021). Furthermore, regional variation may characterize these relationships. For example, previous research indicated that over half of prosecutions under fetal homicide laws took place in the South (Paltrow & Flavin, 2013). Spatial analysis would be particularly helpful in investigating such nuances. Finally, since there is a link between fetal protection legislation and PNC take-up, it is also important to evaluate its impact on other outcomes, such as fetal, infant, and maternal health. PNC may serve as a proxy for other factors, and whether it has a causal relationship with birth outcomes or demonstrates selective effects remains debated (see Alexander & Kotelchuck, 2001). Therefore, additional analyses may shed more light on how fetal protection policies affect health outcomes.

### 5. Conclusion

Increasing PNC utilization is a stated public policy goal, yet the U.S. still has room for improvement. While the American Medical Association has expressed concern over fetal exposure to substances, its policy statements indicate healthcare professionals’ apprehension that criminalizing prenatal substance use may push people away from crucial medical care (American Medical Association, 2020). A growing body of research, including our own study, now suggests this may be the case. Furthermore, this state-based control is growing in its reach, extending even prior to pregnancy to encompass a “preconception” period, as

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**Table 4**

| Fetal Homicide Laws                  | Model 9  | Model 10  |
|--------------------------------------|----------|-----------|
| Death Classified as                  | −0.0586  | −0.0038   |
| Homicide                             |          | (0.12)    |
| Mother Exempt                        | −0.1447  | 0.0881    |
| (0.16)                               |          | (0.14)    |
| Abortion Exempt                      | 0.2954   | 0.0672    |
| (0.16)                               |          | (0.12)    |
| Applies to Early stages of Pregnancy| 0.1193   | 0.0124    |
| (0.12)                               |          | (0.10)    |
| Laws on Drug Use During Pregnancy    |          |           |
| Mandatory Drug Testing               | 0.2391*  | 0.3344*** |
| (0.10)                               | (0.06)   |
| Mandatory Drug Reporting             | 0.1362   | 0.2107    |
| (0.11)                               | (0.13)   |
| Classified as Child Abuse            | −0.0537  | −0.0076   |
| (0.11)                               | (0.13)   |
| Control Variables                    |          |           |
| Percent State Residents              | 0.0144   | 0.0288*** |
| (0.01)                               | (0.01)   |
| Uninsured                            | 0.0033   | 0.0331**  |
| (0.01)                               | (0.01)   |
| Medicaid                              | −0.0414  | 0.0229    |
| (0.06)                               | (0.06)   |
| Republican-Controlled Legislature    | 0.1420   | 0.0930    |
| (0.08)                               | (0.05)   |
| Percent Black Residents              | 0.1036   | 0.0627    |
| (0.05)                               | (0.08)   |
| Residents                            | −0.0027  | 0.0036    |
| (0.01)                               | (0.01)   |
| Percent Hispanic Residents           | 0.0153   | 0.0395    |
| (0.03)                               | (0.04)   |
| Residents                            | −2.6156***| −1.501*   |
| (0.65)                               | (0.59)   |

N  531   531

Standard errors in second column; \(^* p < 0.05 \)  \(^{**} p < 0.01 \)  \(^{***} p < 0.001 \).
evidenced by CDC recommendations that childbearing-aged individuals limit alcohol consumption to prevent harming potential unknown pregnancies (Waggoner, 2017). By casting pregnant people who engage in substance use as deviant, policies framed as safeguarding fetal health may have unintended ramifications for fetuses as well as for pregnant individuals.

Via criminalization of certain maternal acts through some fetal protection policies (e.g. substance use during pregnancy), fetal health is framed as a result of maternal decisions, while deleterious socioeconomic factors outside of maternal control (such as safe housing, accessible PNC, access to drug treatment programs, etc.) are marginalized (Gould, 1990; Springer, 2010). Greater focus on structural barriers that may have unintended ramifications for fetuses as well as for pregnant individuals.

Table 5

| State          | Homicide | Mother Exempt | Abortion Exempt | Applies to Early Stages | Mandatory Reporting | Mandatory Testing | Classified as Child Abuse |
|----------------|----------|---------------|-----------------|-------------------------|--------------------|---------------------|--------------------------|
| Alabama        | 2007-2015| 2007-2015     | 2007-2015       | 2007-2015               | 2007-2015          | 2001-2015           | 2015                     |
| Arizona        | 2006-2015| 2006-2015     | 2006-2015       | 2006-2015               | 2001-2015          | 2006-2015           | 2015                     |
| Arkansas       | 2000-2015| 2000-2015     | 2000-2015       | 2001-2015               | 2001-2015          | 2006-2015           | 2015                     |
| California     | 2000-2015| 2000-2015     | 2000-2015       | 2000-2015               | 2000-2015          | 2006-2015           | 2015                     |
| Colorado       |          |               |                 |                         |                    |                    |                          |
| Connecticut    |          |               |                 |                         |                    |                    |                          |
| Delaware       |          |               |                 |                         |                    |                    |                          |
| Florida        | 2000-2015| 2006-2015     | 2006-2015       | 2015                    | 2001-2015          | 2001-2015           | (continued on next page) |

Based on these results, we recommend that states approach fetal protection legislation with reference to substance abuse during pregnancy carefully, with the understanding that such policies may have unintended consequences for maternal and fetal outcomes. In addition, it seems likely that such policies should focus on rehabilitation rather than punishment in order to promote interaction between healthcare professionals and pregnant people rather than discourage it. Substance use during pregnancy, should not be viewed as crime, but instead a public health issue. States and legislators should consider the effects of such legislation on maternal decision-making and evaluate whether it is pushing pregnant people to make decisions that may be detrimental to their pregnancies, and possibly the infants to whom they give birth.

Ethical statement

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Declaration of competing interest

None.

Data availability

Data will be made available on request.

APPENDIX

The following areas and years had PNC data missing:

- 2003: Pennsylvania and Washington state
- 2004: Florida, Idaho, Kentucky, New Hampshire, New York, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, and Washington state
- 2005: Florida, Idaho, Kansas, Kentucky, Nebraska, New Hampshire, New York, Pennsylvania, South Carolina, Tennessee, Texas, Vermont, and Washington state
- 2006: California, Delaware, Florida, Idaho, Kansas, Kentucky, Nebraska, New Hampshire, New York, North Dakota, Ohio, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Vermont, Washington state, and Wyoming
- 2007: Alabama, Alaska, Arizona, Arkansas, Connecticut, Georgia, Hawaii, Illinois, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Oregon, Rhode Island, Utah, Virginia, West Virginia, and Wisconsin
- 2008: Alabama, Alaska, Arizona, Arkansas, Connecticut, Hawaii, Illinois, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nevada, New Jersey, North Carolina, Oklahoma, Rhode Island, Utah, Virginia, West Virginia, and Wisconsin
- 2009: Alabama, Alaska, Arizona, Arkansas, Connecticut, Hawaii, Illinois, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, Nevada, New Jersey, North Carolina, Rhode Island, Virginia, West Virginia, and Wisconsin
- 2010: Alabama, Alaska, Arizona, Arkansas, Connecticut, Hawaii, Louisiana, Maine, Massachusetts, Minnesota, Mississippi, New Jersey, North Carolina, Rhode Island, Virginia, West Virginia, and Wisconsin
- 2011: Alabama, Alaska, Arizona, Arkansas, Connecticut, Hawaii, Maine, Massachusetts, Minnesota, Mississippi, New Jersey, Rhode Island, Virginia, and West Virginia
- 2012: Alabama, Alaska, Arizona, Arkansas, Connecticut, Hawaii, Maine, Mississippi, New Jersey, Rhode Island, Virginia, and West Virginia
- 2013: Alabama, Arizona, Arkansas, Connecticut, Hawaii, Maine, New Jersey, Rhode Island, and West Virginia
- 2014: Connecticut, New Jersey, and Rhode Island
- 2015: Connecticut and New Jersey
Table 5 (continued)

| State         | Homicide  | Mother Exempt | Abortion Exempt | Applies to Early Stages | Mandatory Reporting | Mandatory Testing | Classified as Child Abuse |
|---------------|-----------|---------------|-----------------|--------------------------|---------------------|---------------------|---------------------------|
| Georgia       | 2000–2015 | 2007–2015     | 2007–2015       | 2007–2015                |                     |                     |                           |
| Hawaii        | 2003–2015 | 2003–2015     | 2003–2015       | 2003–2015                |                     |                     |                           |
| Illinois      | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                |                     |                     |                           |
| Indiana       | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                | 2001–2015           |                     |                           |
| Iowa          | 2001–2015 | 2001–2015     | 2001–2015       | 2001–2015                |                     |                     |                           |
| Kansas        | 2008–2015 | 2008–2015     | 2008–2015       | 2008–2015                |                     |                     |                           |
| Kentucky      | 2005–2015 | 2005–2015     | 2005–2015       | 2005–2015                |                     |                     |                           |
| Louisiana     | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                | 2006–2015           |                     |                           |
| Maine         | 2006–2015 | 2006–2015     | 2006–2015       | 2006–2015                |                     |                     |                           |
| Maryland      | 2006–2015 | 2006–2015     | 2006–2015       | 2006–2015                |                     |                     |                           |
| Massachusetts | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                |                     |                     |                           |
| Michigan      | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                |                     |                     |                           |
| Minnesota     | 2001–2015 | 2001–2015     | 2001–2015       | 2001–2015                |                     |                     |                           |
| Mississippi   | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                |                     |                     |                           |
| Missouri      | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                |                     |                     |                           |
| Montana       | 2014–2015 | 2014–2015     | 2014–2015       | 2008–2015                |                     |                     |                           |
| Nebraska      | 2003–2015 | 2003–2015     | 2003–2015       | 2003–2015                |                     |                     |                           |
| Nevada        | 2000–2015 | 2000–2015     | 2000–2015       | 2000–2015                |                     |                     |                           |
| New Hampshire | 2005–2015 | 2005–2015     | 2005–2015       | 2005–2015                |                     |                     |                           |

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