Differences in Determinants: Racialized Obstetric Care and Increases in U.S. State Labor Induction Rates

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ABSTRACT

Induction of labor (IOL) rates in the United States have nearly tripled since 1990. We examine official U.S. birth records to document increases in states' IOL rates among pregnancies to Black, Latina, and white women. We test if the increases are associated with changes in demographic characteristics and risk factors among states' racial/ethnic childbearing populations. Among pregnancies to white women, increases in state IOL rates are strongly associated with changes in risk factors among white childbearing populations. However, the rising IOL rates among pregnancies to Black and Latina women are not due to changing factors in their own populations, but are instead driven by changing factors among states' *white* childbearing populations. The results suggest systemic racism may be shaping U.S. obstetric care, whereby care is not "centered at the margins" but is instead responsive to characteristics in states' white populations.

Differences in Determinants: Racialized Obstetric Care and Increases in U.S. State Labor Induction Rates

Racial-ethnic inequities in healthcare have been widely reported in the United States (U.S.), whereby the care and treatment of white people is often prioritized more than that of marginalized populations (Smedley, Stith, and Nelson 2003). Evidence for discrimination and unequal care in the United States has been documented in numerous settings (e.g., Daw 2015; Lewey and Choudhry 2014; Morris et al. 2010; Smedley et al. 2003). Unequal treatment in healthcare operates through multiple mechanisms, including policy creation and enforcement (Krieger 2001, 2012), the organization of U.S. healthcare systems (Popescu et al. 2010; Williams and Jackson 2005), medical training and culture (Cogburn 2019; Good et al. 2003), and interpersonal interactions between patients and providers (Hoffman et al. 2016). Combined, evidence suggests that systemic racism creates and maintains healthcare systems that underserve and harm communities of color in the United States. That is, the U.S. medical system has a history of centering care on the needs of dominant or majority populations (i.e., white patients), rather than centering care “at the margins” or considering the care needs of marginalized populations (Hardeman et al. 2016).

Failure to center U.S. obstetric care at the margins has likely produced unequal care and discriminatory services in obstetric settings (Davis 2019, 2020; Liese et al. 2021; Logan et al. 2022; Vedam et al. 2019). Indeed, "obstetric racism" (Davis 2019, 2020) is likely partly responsible for high rates of poor maternal and neonatal health outcomes among U.S. Black and Latina populations, such as elevated risks of maternal mortality and infant mortality (Peterson et al. 2019; Mathews et al 2015).[1] In her studies of "obstetric racism", Davis (2019, 2020) documents callous medical treatment of Black women during pregnancy and highlights multiple

instances in which they are disrespected and their birthing preferences are discounted and ignored. The racialized experiences of people during prenatal and obstetric care are documented further in an emerging body of literature that implicates systemic and interpersonal racism as drivers of inadequate care for obstetric patients of color (Chantarat et al. 2022; Janevic et al. 2020; Logan et al. 2022).

In the current study, we are primarily concerned with the rising use of obstetric interventions among pregnancies to U.S. women and how systemic racism has likely shaped these trends. Specifically, we consider racial/ethnic differences in the mechanisms driving the large increases in rates of induction of labor (IOL) among U.S. pregnancies. From 1990 to 2017, the average state IOL rate among singleton pregnancies to Black, Latina, and white women increased from 12.5% to 34.4% (NCHS 2020). We contend that the rising use of IOL in the United States provides a good case to illustrate how obstetric care is not being centered at the margins. Although racial/ethnic differences in IOL rates are small in the United States and the rising use of IOL has occurred among all race/ethnic populations (Martin et al. 2017; Tilstra and Masters 2020), we examine how the factors associated with increasing IOL rates differ for race/ethnic groups.

In the United States, birth attendants are afforded great discretion in decision-making, guidelines for IOL are not well-defined, and risk assessments of pregnancy and labor often use highly-subjective indications (ACOG 2007, 2019a, 2019b; Marconi 2019). Combined, U.S. obstetric environments likely allow implicit biases and obstetric racism to influence IOL decisions (Davis 2019; Liese et al. 2021; Verdam et al. 2019). More broadly, systemic and cultural racism shape social conditions and practices that generate racial inequities in healthcare access and heath policies (Cogburn 2019). These racialized processes likely shape obstetric

practices in the United States. As a result, it is possible that rising IOL rates among pregnancies to white women are partly responding to changes in the health and risk factors of this childbearing population. In contrast, rising IOL rates among U.S. Black and Latina women may not have occurred because of the changes or needs in these childbearing populations, but rather because of the standardization of U.S. obstetric care practices based on the changes and needs among white women. In short, obstetric racism and the failure to center U.S. obstetric care "at the margins" likely has produced more "interventions without explanation" among Black and Latina women than among white women (Davis 2019: 569).

In this paper, we first document increases in state IOL rates among pregnancies to U.S. states' Black, Latina and white childbearing populations between 1990 and 2017. The trends show similar monotonic increases in U.S. states' IOL rates among all three populations, although trends among white women exhibit some nonlinearity during the 2000s and 2010s. We then estimate how states' IOL trends are affected by changes in risk factors for “high-risk pregnancy” among states' childbearing populations.[2] Evidence suggests that increases in state IOL rates among pregnancies to white women were likely responding to changes in the demographic composition and changes in risk factors among states' white childbearing populations (e.g., increases in births to women with obesity, and increases in the prevalence of maternal hypertension and maternal diabetes). In contrast, the increases in state IOL rates among pregnancies to Black and Latina women are not associated with changes in demographics or changes in risk factors among states' Black and Latina childbearing populations. Instead, we find evidence to suggest that increases in U.S. states' IOL rates among Black and Latina women were strongly shaped by changes in the demographics and risk factors of the states' *white* childbearing populations. Taken together, our findings suggest a clear example in which U.S. obstetric care is

not being centered at the margins (Hardeman et al. 2016), as the rising IOL rates among all three racial/ethnic groups appear to be responding only to changes in risk factors among states' white childbearing populations.

BACKGROUND

In the United States, white people, on average, have greater access to and receive higher quality healthcare than people of color (Smedley et al. 2003). Inequities in care are extensively documented and span many clinical settings and health conditions, including cardiovascular care (Lewey and Choudhry 2014), diabetes treatment (Peek, Cargill, and Huang 2007), kidney transplantations (Daw 2015; Malak et al. 2011), mental health services (Neighbors et al. 2007), addiction treatment (Hansen, Parker, and Netherland 2020; Hansen and Skinner 2012), cancer screenings (Lansdorp-Vogelaar et al. 2012; Morris et al. 2010; Tehranifar et al. 2009), and HIV/AIDS treatment (Bogart et al. 2010). The experience of unequal care manifests across multiple settings, both directly and indirectly related to the healthcare system. The United States has a long and appalling history of racism in *policy creation and enforcement*. Policies are often enacted to maintain existing power structures and prioritize the dominant power group (Krieger 2001, 2012). Because the dominant power group in the United States has been historically white, policies and policy enforcement disadvantage and exclude people of color, often resulting in deleterious health consequences. Examples include the War on Drugs, which affected how pain was recognized and treated for Black patients, banks' redlining policies, highway construction, mass incarceration, and other segregationist measures that affect the neighborhoods and broader

environments in which people of color live and work (e.g., Bailey et al. 2017; Roberts 1999; Rothstein 2017).

Unequal care can also be a result of the *organization of U.S. healthcare systems*. Residential segregation, unequal education and opportunities, and discriminatory hiring practices have produced worse care and hindered adequate services in marginalized communities (Guagliardo et al. 2004; Hayanga et al. 2009; Odom Walker et al. 2010; White et al. 2012). This, in turn, limits Black Americans' access to high-quality medical care (Popescu et al. 2010; Williams and Braboy Jackson 2005), including Black infants receiving neonatal intensive care that is, on average, of poorer quality than care for white infants (Horbar et al. 2019).

Healthcare education and culture is built upon a history of racism that continues to inform the training and guidance received in healthcare professional education. The history of medicine is deeply rooted with horrific examples of racial exploitation and neglect (Feagin and Bennefield 2014; Washington 2006), from fabricating biological differences by race to experimentation and performing procedures on people of color without consent. This history is compounded by the lack of training on implicit bias in medical education (Holmes 2012; Green et al. 2021; Nieblas-Bedolla et al. 2020). In addition to affecting the behaviors and beliefs of medical professionals, this history has also seeped into the algorithms used in healthcare systems to guide care decisions, as they have been shown to exhibit racial bias (Obermeyer et al. 2019). Cultural racism also more broadly reflects the ideology and intent of health policy and practice, wherein whiteness is often embedded and centered in evaluations, metrics, and expectations of care (Cogburn 2019).

Finally, *interpersonal racism*, or racism experienced via interactions between individuals, is a common form of medical racism that directly biases individual-level care. Two-thirds of

studies analyzed in a meta-analysis found evidence of interpersonal racism in the medical setting (Paradies et al. 2014). This can manifest as implicit bias against Black and Latina patients (Blair et al. 2013; Hoffman et al. 2016) and indeed, Black women report more mistreatment and disrespect during childbirth than white women (Altman et al. 2019; Logan et al. 2022; McLemore et al. 2018; Slaughter-Acey et al. 2016; Vedam et al. 2019). Across all levels, the U.S. healthcare system directly and implicitly centers itself on the needs of the white population, often resulting in the poor access and mistreatment of patients from marginalized racial/ethnic groups. In response, scholars have called for healthcare providers and researchers to "center at the margins – that is, to shift our viewpoint from a majority group's perspective to that of the marginalized group or groups" (Hardeman et a. 2016). Hardeman and colleagues encourage the healthcare community to redefine "normal" and center the perspectives and needs of marginalized groups at the forefront of care (Hardeman et al. 2016).

Within U.S. obstetric care, examples of healthcare prioritizing the welfare and needs of the white population include inequitable access to assisted reproductive technology for Black women compared to white women (ECASRM 2015) and white infants receiving higher-quality care in neonatal intensive care units than non-white infants (Profit et al. 2017; Sigurdson et al. 2019). The failure to center obstetric care at the margins manifests as "obstetric racism" more broadly, which Davis (2019: 562) notes, "includes, but is not limited to, critical lapses in diagnosis; being neglectful, dismissive, or disrespectful; causing pain; and engaging in medical abuse through coercion to perform procedures or performing procedures without consent." While obstetric racism often manifests through interpersonal racism, existing work also highlights how systemic and structural biases are deeply rooted in U.S. healthcare systems, including policies, organization, and education. Indeed, Davis (2019: 561) sees "obstetric racism [as] an extension

of racial stratification" and the result of "the historically constituted stigmatization of Black women." The coercive nature of obstetric racism is particularly important to consider within the context of U.S. childbirth. Childbirth in the United States presents a unique healthcare interaction, which necessitates the balance of (1) the health and risks for the pregnant person and the fetus with (2) the pregnant person's preferences and (3) the providers' preferences and decisions. In many cases, these risks and preferences may compete during pregnancy care and labor. This strain can be exacerbated by the great amount of power and flexibility in obstetric decision making by healthcare providers (ACOG 2007) and the highly subjective risk criteria across many birth procedures, including labor inductions (Marconi 2019).

The use of induction of labor, or "the initiation of uterine contractions before the spontaneous onset of labor by medical and/or surgical means for the purpose of delivery", has steadily increased among U.S. pregnancies since the 1990s (NVSS 1990:22). In 2015, nearly one quarter of all U.S. births were induced (Martin et al. 2017), up from just 10% in 1990 (Osterman and Martin 2014). Labor induction is an important obstetric intervention for minimizing risks to maternal and fetal health and increases in IOL have also come on the heels of efforts to reduce cesarean deliveries (Nicholson et al. 2004, 2007, 2009a, 2009b). Indeed, scholars and practitioners use the term "preventative labor induction" when considering how elective IOL might be used to reduce risks associated with pregnancy and childbirth (Caughey 2009, Caughey et al. 2009, Grobman et al. 2018, Nicholson et al. 2008). However, IOL is often overused in the United States, as evidenced by research suggesting that two-thirds of the increase in IOL during the 1990s was a result of "nonmedically indicated" inductions (Ramsey et al. 2000), and gestational distributions of U.S. births have been dramatically changed by the increasing use of IOL at select gestations (Tilstra and Masters 2020).

In the United States, IOL rates do not substantially differ across race/ethnic childbearing populations and the increasing trends in IOL have occurred in all race/ethnic groups in similar ways (Martin et al. 2017). While IOL rates among pregnancies to U.S. Black, Latina, and white childbearing populations are similar, we suspect that the reasons for the high and rising use of IOL are different for white, Black, and Latina women in the United States. For instance, inductions among pregnancies to Latina and Black women may be more likely to occur due to "nonmedically indicated" reasons than inductions among pregnancies to white women. Multi-level racism in the U.S. healthcare system has possibly contributed to the perception that U.S. pregnancies among Black and Latina women are more likely to be "high-risk" than pregnancies among white women. The deeply ingrained racist perceptions of risk in the U.S. healthcare system may affect IOL decisions, where providers intervene in pregnancies to Black and Latina women to reduce harm from these perceived risks. Also, higher rates of interventions without consent during Black and Latina pregnancies reflect the callous and egregious care that patients of color receive during childbirth (Logan et al. 2022). Indeed, for women of color in the United States, "neglect, lack of information, dismissiveness, disrespect, *and interventions without explanation*, permeate maternal care and coalesce into obstetric racism" (Davis 2019: 569). These forms of obstetric racism have likely shaped the rising use of IOL in the United States in significantly racialized ways.

DATA & METHODS

We examined trends in U.S. states' IOL rates using the National Vital Statistics Systems (NVSS) restricted birth data for years 1990 through 2017 (NCHS 2020). To reduce the confounding

effects of multiparous women and multiple pregnancies on risk for obstetric interventions (Denona et al. 2020; Donahue et al. 2010), we restricted the analytic samples to include only singleton first-births among non-Hispanic white, non-Hispanic Black, and Hispanic women (henceforth white, Black, and Latina). The data are composed of 41,126,037 singleton first-births: 26,446,616 to white women, 6,252,741 to Black women, and 8,426,680 to Latina women. We aggregated the data at the state-level by mother's race/ethnicity to create separate analytic samples for births among states' white, Black, and Latina childbearing populations (see Figure S1 in appendix for the creation of the analytic samples). Due to small counts of births, we omitted Idaho, Maine, Montana, North Dakota, South Dakota, Vermont, and Wyoming from the analytic sample for births to Black women; and we omitted Maine, Vermont, and West Virginia from the analytic sample for births to Latina women. The analytic sample for births to white women is composed of all 50 states plus the District of Columbia (DC) across 28 years (1,428 state-years), while the analytic samples for births to Black and Latina women were limited to 43 states plus DC (1,232 state-years) and 47 states plus DC (1,344 state-years), respectively.[3]

Measures

We calculated state-level time-varying measures of obstetric interventions, maternal demographics, and risk factors for "high-risk pregnancy" among states' Black, Latina, and white childbearing populations. Our outcome measure is the proportion of births in state i in year j in which labor was induced where i = Alabama, ... , Wyoming and j = 1990, ... , 2017.[4] Induction of labor is a characteristic of delivery that is comparable across the 1989 U.S. Standard Certificate of Live Birth and the 2003 U.S. Standard Certificate of Live Birth (NVSS 2007), and

IOL coding in the NVSS is also comparable across U.S. states.[5] As a control variable, we also created a measure of the cesarean delivery rate among first-birth singletons born to states' Black, Latina, and white women, calculated as the proportion of singleton first-births in state *i* delivered by cesarean in year *j*.

Several factors determine whether a pregnancy is considered “high risk” (Holness 2018; NICHD 2018). Risk of pregnancy complications is higher for women older than age 35, and pregnancies can also be affected by several health behaviors such as smoking cigarettes, drinking alcohol, and using other substances. Maternal health problems such as high blood pressure, obesity, diabetes, thyroid disease, infections, and heart or blood disorders can also influence pregnancy risks (NICHD 2018). Here, we included several state-level measures of maternal demographics as the proportion of births in state *i* in year *j* to women: younger than 20 years (i.e., proportion of births to teenagers); aged 35 years and older (i.e., proportion of births to women of advanced maternal age [AMA]);[6] who are married at time of birth; born in the United States; with an educational level less than high school degree; and with an educational level at or above a bachelor’s degree. Direct measures of risk factors for high-risk pregnancy included the proportion of births in state *i* in year *j* to women: who used tobacco products at any time during pregnancy; who experienced high gestational weight gain (i.e., 40 pounds or more); who had diabetes (gestational or pre-pregnancy); and who had hypertension (gestational or pre-pregnancy). Additional state-level proxies for high-risk pregnancies included the proportion of births in state *i* in year j delivered preterm (<37 weeks of gestation) and delivered late term or postterm (≥ 41 weeks of gestation).[7]

State-level Growth Curve Models

We modeled U.S. states' IOL rates between 1990 and 2017 separately to Black, Latina, and white women. We fit generalized linear mixed models to estimate the year-specific state-level rates as outcomes of a fixed effect linear slope, a random intercept, a random slope, and state-specific residual variance:

$$Y_{ij} = \pi_{0i} + \pi_{1i}\left(Year_{ij} - 1990\right)/5 + \varepsilon_{ij} \quad (1)$$

$$\pi_{0i} = \gamma_{00} + \mu_{0i}$$

$$\pi_{1i} = \gamma_{10} + \mu_{1i}$$

Assuming $\begin{matrix}\mu_{0i} \\ \mu_{1i}\end{matrix} \sim N\left(\begin{bmatrix}0 \\ 0\end{bmatrix}, \begin{bmatrix}\sigma_0^2 & \sigma_{01} \\ \sigma_{10} & \sigma_1^2\end{bmatrix}\right)$ and $\varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2)$

where Y_{ij} is the IOL rate for state *i* in year *j* where *i*=Alabama, …, Wyoming and *j*=1990, …, 2017; γ_{00} is the average IOL rate among U.S. states in year 1990; μ_{0i} is the estimated deviation from γ_{00} for state *i* in 1990; γ_{10} is the average five-year change in IOL rate between 1990 and 2017; μ_{1i} is the estimated deviation from γ_{10} for state *i*; and ε_{ij} is the level-1 residual variance for state *i* in year *j*. We divided the slope by five for interpretation reasons (i.e., the estimated coefficient indicates the expected change in states' IOL rates over a five-year time span), and increasing the slope size improves estimates of the variance component of μ_{1i}, σ_1^2 (Singer and Willett 2003).

We contrasted estimates from the random slope model in Equation (1) with estimates from an unconditional means model to illustrate a) the amount of variation in IOL rates that

exists within-states and between-states, b) the amount of within-state variation, σ_{ε}^2, that is accounted for by a linear approximation of a state-specific slope, π_{1i}, and c) the amount of between-state variation in the IOL rate in 1990, σ_0^2, and the amount of between-state variation in the change of IOL rate between 1990 and 2017, σ_1^2. Results from these models indicate the extent to which increases in IOL rates are similar or different across U.S. states and the extent to which the increases are similar or different for racial/ethnic populations.

State-level Fixed Effect Panel Regression

We then fitted trends in IOL rates among pregnancies to U.S. states' Black, Latina, and white women using state-level fixed effects panel regressions:

$$Y_{ij} = \beta_0 + \gamma_2 State_2 + \ldots + \gamma_n State_n + \delta_{1991} 1991 + \ldots + \delta_{2017} 2017 + \mu_{ij} \quad (2)$$

where Y_{ij} is the IOL rate among births to Black, white, or Latina women in state *i* in time *j*; β_0 is the IOL rate in the referent state in 1990; γ_n are the coefficients associated with the binary state regressors, $State_n$; δ_j are the coefficients associated with the binary time regressors, 1991, …, 2017; and μ_{ij} is the error term. These "within-estimator" models control for all time-invariant characteristics of U.S. states while also accounting for yearly trends in IOL rates shared across states (Halaby 2004). The models are well-suited for identifying average trends in U.S. states' IOL rates while controlling for time-invariant state characteristics, and for estimating how states' time-varying characteristics are associated with changes in states' IOL rates.

We refitted the models to include time-varying indicators of the demographic profiles and risk factors for high-risk pregnancy among states' racial/ethnic-specific childbearing populations:

$$Y_{ij} = \beta_0 + \gamma_2 State_2 + \cdots + \gamma_n State_n + \delta_{1992}1991 + \cdots + \delta_{2017}2017 + \beta_{teen}\%teen_{ij} + \beta_{AMA}\%AMA_{ij} + \beta_{married}\%married_{ij} + \beta_{USborn}\%USborn_{ij} + \beta_{<HS}\% < HS_{ij} + \beta_{BA}\%BA_{ij} + \beta_{tobacco}\%tobacco_{ij} + \beta_{diabetes}\%diabetes_{ij} + \beta_{hypertension}\%hypertension_{ij} + \beta_{weight}\%weight_{ij} + \beta_{cesarean}\%cesarean_{ij} + \beta_{preterm}\%preterm_{ij} + \beta_{postterm}\%postterm_{ij} + \mu_{ij} \quad (3)$$

where β_{teen} is the coefficient associated with the percent of births in state *i* to Black, Latina, or white women occurring among teenagers in year *j*, $\%teen_{ij}$; β_{AMA} is the coefficient associated with the percent of births among women age 35 years or older, $\%AMA_{ij}$; $\beta_{married}$ is the coefficient associated with the percent of births among married women, $\%married_{ij}$; β_{USborn} is the coefficient associated with the percent of births among US-born women, $\%USborn_{ij}$; $\beta_{<HS}$ is the coefficient associated with the percent of births among women with a less than high school education, $\% < HS_{ij}$; β_{BA} is the coefficient associated with the percent of births among women with a college degree, $\%BA_{ij}$; $\beta_{tobacco}$ is the coefficient associated with the percent of births among women who used tobacco while pregnant, $\%tobacco_{ij}$; $\beta_{diabetes}$ is the coefficient associated with the percent of births among women with diabetes, $\%diabetes_{ij}$; $\beta_{hypertension}$ is the coefficient associated with the percent of births among women with hypertension, $\%hypertension_{ij}$; β_{weight} is the coefficient associated with the percent of births among women with gestational weight gain greater than 40 pounds, $\%weight_{ij}$; $\beta_{cesarean}$ is the coefficient

associated with the percent of births delivered cesarean, $\%cesarean_{ij}$; $\beta_{preterm}$ is the coefficient associated with the percent of births delivered at gestational week < 37, $\%preterm_{ij}$; and $\beta_{postterm}$ is the coefficient associated with the percent of births delivered after gestational week 41, $\%postterm_{ij}$.

We then refitted the models to U.S. states' IOL rates among births to Black, Latina, and white women to include time-varying indicators of the demographic profiles and risk factors of the states' *other* race/ethnic childbearing populations. For example, Equation (4) regresses U.S. states' IOL rates among births to Black women on changes in the demographics and maternal risk factors of the states' *white* childbearing populations:

$$
\begin{aligned}
Y_{ij} = \beta_0 + \gamma_2 State_2 + \cdots + \gamma_n State_n + \delta_{1992}1991 + \cdots + \delta_{2017}2017 + \beta_{Wteen}\%Wteen_{ij} + \\
\beta_{WAMA}\%WAMA_{ij} + \beta_{Wmarried}\%Wmarried_{ij} + \beta_{WUSborn}\%WUSborn_{ij} + \\
\beta_{W<HS}\%W < HS_{ij} + \beta_{WBA}\%WBA_{ij} + \beta_{Wtobacco}\%Wtobacco_{ij} + \\
\beta_{Wdiabetes}\%Wdiabetes_{ij} + \beta_{Whypertension}\%Whypertension_{ij} + \\
\beta_{Wweight}\%Wweight_{ij} + \beta_{Wcesarean}\%Wcesarean_{ij} + \beta_{Wpreterm}\%Wpreterm_{ij} + \\
\beta_{Wpostterm}\%Wpostterm_{ij} + \mu_{ij} \qquad (4)
\end{aligned}
$$

After estimating Equation (2), Equation (3), and Equation (4), we plotted the model-based expected IOL rates across each year *j* holding all other covariates at their 1990 mean levels using the margins module in Stata 17. We contrasted the average trends in U.S. states' IOL rates among Black, Latina, and white women estimated from Equation (2) (i.e., the observed rates) with the adjusted trends estimated from Equation (3) to examine the extent to which changes in the demographics and risk factors among states' Black, Latina, and white childbearing

populations are associated with the observed trends in states' IOL rates among these populations. Then, we contrasted the average trends in U.S. states' IOL rates estimated from Equation (2) with the adjusted trends estimated from Equations (4) to examine the extent to which changes in the demographics and risk factors among states' *other* race/ethnic childbearing populations are associated with the changes in IOL rates among births to states' Black, Latina, and white childbearing populations.[8]

RESULTS

[Table 1 about here]

Table 1 contains state-level descriptive statistics of the Black, Latina, and white analytic samples in 1990, 2004, and 2017. We present the mean state IOL rates among singleton first-births across these years, as well as the demographic profiles and risk factors for high-risk pregnancy among U.S. states' Black, Latina, and white childbearing populations.

Average state IOL rates among births to U.S. Black women increased from about 11% in 1990 to 23% in 2004, and to 33% in 2017. Similar increases in IOL are observed among singleton first-births born to U.S. Latina (10%, 21%, 31%) and white women (14%, 28%, 36%). Across this time, we also see substantial changes in the demographic profiles of states' childbearing populations. Most noteworthy is the increasingly older age distributions of the states' childbearing populations, with large reductions in the proportion of births to teens (e.g., 43% to 17% among Black women) and concomitant increases among women with AMA (e.g., 5% to 10% among white women). We also see sizable decreases in the proportion of births to women with education levels less than high school (e.g., 37% to 23% among Latina women),

which are offset by large proportionate increases in births to women with college degrees (e.g., 9% to 20% among Black women and 24% to 44% among white women). The proportion of births to women who are married decreased substantially in the Latina (60% to 40%) and white (76% to 66%) childbearing populations. Finally, the proportion of births among immigrants increased in the Black childbearing population (7% to 21%), and the proportion of births among immigrants in the Latina childbearing population increased between 1990 and 2004 (47% to 62%) and then decreased from 2004 to 2017 (62% to 40%).

Changes in risk factors for high-risk pregnancy are also observed in all three childbearing populations. The proportion of births to women who used tobacco while pregnant dropped (e.g., 10% to 4% among Black women and 18% to 8% among white women), and the proportion of singleton first-births born in late term or postterm gestations also declined (e.g., 23% to 15% among Black women and 28% to 18% among Latina women). Yet, across this same time, in all three populations we see increasing rates of gestational diabetes (2% in 1990 to 5-7% in 2017), hypertension (4-5% in 1990 to 8-13% in 2017), and high gestational weight gain (e.g., 24% to 28% among Black women). Among the white childbearing population, we also see a small increase in the proportion of births born at premature gestations (8% to 10% to 9%).[9]

To see the full year-over-year changes in U.S. states' IOL rates among births to Black, Latina, and white women, we plot IOL rates in each state in Figure 1 (gray lines) and indicate the yearly mean rate among all states (black lines).

[Figure 1]

In 1990, the mean IOL rate among states' singleton first-births born to Black, Latina, and white women were 10.8%, 9.6%, and 13.5%, respectively. The rates varied considerably across states. For example, among pregnancies to Black women, IOL rates ranged from 4.9% in Mississippi to 21.9% in Kentucky, and among white women, rates ranged from 8.0% in California to 21.5% in Oregon (see Appendix B for each state's IOL rate among Black, Latina, and white women in 1990, 2004, and 2017). Yet, IOL rates increased among all states' childbearing populations between 1990 and 2017. The trends exhibit similar monotonic increases in all states' IOL rates among the three populations, although trends among white women exhibit some nonlinearity during the 2000s and 2010s. In 2017, the average IOL rate among U.S. states' Black, Latina, and white women were 33.4%, 31.0%, and 35.9%, respectively. As was the case in 1990, state-based variation in these 2017 rates is high, ranging from 19.3% among Black and Latina women in California to 54.0% among white women in West Virginia.

[Table 2]

Table 2 presents results from growth curve models fitted to U.S. states' IOL rates among singleton first-births born to Black, Latina, and white women for all years 1990 through 2017. Results from the Unconditional Means Model (UMM) (Panel A) suggest that only 14% (Latina), 17% (Black), and 23% (white) of variation in U.S. IOL rates between 1990 and 2017 occurred between states $\left(\text{i.e., } {\sigma_0^2}/{(\sigma_\varepsilon^2 + \sigma_0^2)}\right)$. Thus, 77% (white) to 86% (Latina) of variation in U.S. IOL rates occurred within-states over time $\left(\text{i.e., } {\sigma_\varepsilon^2}/{(\sigma_\varepsilon^2 + \sigma_0^2)}\right)$, reflecting the large increases in IOL rates observed in Figure 1. Results from the Random Slope Model (RSM) (Panel B) indicate that 77% (Black),

78% (Latina), and 79% (white) of the within-state variation is accounted for by a linear approximation of changes in states' IOL rates $\left(\text{i.e., } {\left(\sigma^2_{\varepsilon_{RSM}} - \sigma^2_{\varepsilon_{UMM}}\right)}\Big/{\sigma^2_{\varepsilon_{UMM}}}\right)$. Indeed, when linear OLS models are fitted separately to each state's IOL rates in these childbearing populations, the median R^2 is about .85 (Appendix C). Results also indicate that estimates of the slope do not substantively differ for Black (.039), Latina (.034), and white women (.036), suggesting that states' IOL rates increased among these childbearing populations in similar ways (i.e., about 3.4% to 3.9% every five years). Taken together, the findings from the generalized mixed models suggest near-linear increases in U.S. states' IOL rates among white, Black, and Latina childbearing populations that occurred across U.S. states in similar ways. The similarity in these trends is evident by the very small slope variances in Table 1 (σ_1^2) and is also observed in Figure 2, which plots predicted Bayes estimates of IOL rates among states' Black, Latina, and white childbearing populations.

[Figure 2]

In Figure 3, we plot the mean state IOL rates estimated from Equation (2), Equation (3), and Equation (4) in order to contrast the observed mean IOL rates among states' Black, Latina, and white women (i.e., "Observed") with the estimated mean IOL rates among states' Black, Latina, and white women while controlling for changes in these populations' demographics and risk factors (i.e., "Control Own Characteristics"), and the estimated mean IOL rates among states' Black, Latina, and white women while controlling for the demographics and risk factors of the states' *other* race/ethnic childbearing populations. For the latter, we plot mean IOL rates for Black and Latina women while controlling for the demographics and risk factors of states' white

childbearing populations (i.e., "Control White Characteristics"), and we plot mean IOL rates for white women while controlling for the demographics and risk factors of states' Black childbearing populations. (Appendix F, Appendix G, and Appendix H provide detailed results)

[Figure 3]

Results from Equation (3) indicate that U.S. states' IOL rates among pregnancies to *Black women* are associated with both the demographic profiles and risk factors of states' Black childbearing populations (Appendix F). Yet, as seen in Figure 3 (Panel A), *changes* in these demographics and risk factors between 1990 and 2017 do not account for the upward trend in states' IOL rates among pregnancies to Black women. We see that the mean IOL rate indicated by the "Control Own Characteristics" line (dashed black) is nondifferent from the mean IOL rate indicated by "Observed" line (solid black). Thus, the increases in states' IOL rates among pregnancies to Black women are estimated to occur even while controlling for changes in demographic characteristics and risk factors among states' Black childbearing populations. Results from "Equation (4)-White" (Appendix F) indicate that changes in the demographics and risk factors of states' white childbearing populations are statistically and substantively associated with states' IOL rates among pregnancies to Black women. Further, changes in risk factors among states' white childbearing populations account for much of the rising IOL rates among states' Black childbearing populations. As seen in Figure 3 (Panel A), the rise in the mean IOL rate indicated by the "Control White Characteristics" line (solid gray) is much lower than the upward trend of the "Observed" line. This suggests that increases in IOL among states' Black women would have

been much smaller if the demographic and risk factors of states' white childbearing populations had not changed between 1990 and 2017.

We find similar results from models fitted to states' IOL rates among *Latina women*. In Figure 3 (Panel B), there are no significant differences between the "Observed" line (solid black) and "Control Own Characteristics" line (dashed black) during the time period 1990-2005, but the "Control Own Characteristics" line is significantly lower than the "Observed" rates for the time period 2005-2017. Although the differences are not substantively large, these findings suggest that a small fraction of the rising IOL rates among states' Latina women are associated with changes in the demographics and risk factors of the states' Latina childbearing populations. Yet, states' IOL rates among Latina women are also statistically and substantively associated with changes in demographic characteristics and risk factors among states' white childbearing populations ("Equation (4)-White", Appendix G). As seen in Figure 3 (Panel B), the "Control White Characteristics" line (solid gray) indicates that the average IOL rate among pregnancies to Latina women would not have substantively increased between 1990 and 2017 if states' white childbearing populations had not experienced changes in their demographic composition or maternal risk factors. Thus, the rising trends in states' IOL rates among pregnancies to Latina women are largely explained by changes in the demographic composition and risk factors of states' white childbearing populations.

Results from Equation (2) (Appendix H) suggest that U.S. states' IOL rates among pregnancies to *white women* are associated with both the demographic profiles and risk factors in states' white childbearing populations. Further, we find evidence suggesting that changes in these demographic characteristics and risk factors of states' white childbearing populations are strongly associated with the rising IOL rates among pregnancies to states' white women between 1990

and 2017. This is clearly seen in Figure 3 (Panel C), which suggests that states' IOL rates among pregnancies to white women ("Observed" line, solid black) would not have increased if the demographic profiles and risk factors of states' white childbearing populations had remained at 1990 levels ("Control Own Characteristics" line, dashed black). Also seen in Figure 3 is the lack of associations between states' IOL trends among pregnancies to white women and changes in demographics and risk factors of states' Black childbearing populations ("Control Black Characteristics" line, solid gray). We see that the average IOL rate among states' white childbearing populations is estimated to have increased between 1990 and 2017 even if the demographic characteristics and maternal risk factors of states' Black childbearing populations had not changed during this time.

Together, results presented in Figure 3 indicate that U.S. states' rising IOL rates among pregnancies to Black, Latina, and white women are strongly associated with changes in the demographic profiles and risk factors in states' white childbearing populations. In contrast, states' rising IOL rates among Black and Latina women are not strongly associated with changes in the demographic characteristics or risk factors in these populations. Nor are changes in the demographic characteristics or risk factors in Black and Latina childbearing populations associated with the rising state IOL rates among pregnancies to white women. Thus, the increasing use of IOL in the United States appears to be a national-level phenomenon occurring (a) in all states in similar ways, (b) among pregnancies to Black, Latina, and white women in similar ways, and (c) strongly responding to changes in the demographic profiles and risk factors in white childbearing populations.

DISCUSSION

Recent changes in U.S. obstetric practices provide a good case for identifying processes that might generate racial/ethnic inequities in U.S. healthcare more broadly. In many respects, obstetric care in the United States reflects the same policies, hospital systems, medical trainings and cultures, and interpersonal racism that often shape medical care of marginalized populations (Cogburn 2019; Smedley et al. 2003). In other respects, challenges unique to obstetric practice might amplify the racialized care for women of color in the United States. The guidelines for risk management of pregnancies and risk assessment for labor complications can be unclear, and in these environments, "neglect, lack of information, dismissiveness, disrespect, and interventions without explanation" can shape obstetric care for U.S. women of color (Davis 2019: 569). Indeed, at the individual level, Davis and others have documented many examples and forms of "obstetric racism" in Black women's maternal, prenatal, and labor care, including increased likelihood of receiving care without consent (Janevic et al. 2020; Logan et al. 2022). In this study, we sought to examine how obstetric racism and systemic racism more broadly may have shaped use of IOL at the population-level in the United States.

We first documented trends in U.S. states' IOL rates among singleton first-birth pregnancies to Black, Latina, and white women. Results show that mean rates of IOL among states' Black, Latina, and white women (combined) nearly tripled between 1990 and 2017 (i.e., increased from 12.5% to 34.4%), and that the increases in IOL among these populations occurred across all states in similar ways. At first glance, the racial/ethnic *similarities* in (1) high IOL rates (i.e., 31-36% in 2017), (2) the rising use of IOL (i.e., increases of 3.4% to 3.9% per five years), and (3) the ubiquity of these trends throughout the United States, appear to provide evidence against "obstetric racism" shaping the increased use of IOL in the United States. How can one

implicate racism in a health outcome if that outcome does not substantively differ across racial/ethnic groups? Thus, we hypothesized that the mechanisms underlying the rising trends in IOL likely differ for U.S. racial/ethnic groups and devised a simple test. If IOL has been increasingly used among U.S. pregnancies to reduce risk of adverse birth and maternal health outcomes (Nicholson et al. 2009a), then the rising rates of IOL among U.S. pregnancies should be associated with changes in demographic profiles and risk factors for high-risk pregnancy. The evidence here suggests that this has, indeed, been the case for pregnancies among states' white childbearing populations. Among pregnancies to white women, low maternal education, gestational tobacco use, maternal diabetes, maternal hypertension, and high gestational weight gain were all estimated to be positively associated with risk of IOL. Changes in these and other risk factors among states' white childbearing populations accounted for all the increase in states' IOL rates among pregnancies to white women. In contrast, we did not find this to be the case for IOL use among pregnancies to Black or Latina women. The increases in states' IOL rates among pregnancies to Black and Latina women were not explained by changes in these populations' demographic profiles or risk factors. Rather, the rising use of IOL among states' Black and Latina women is strongly associated with the changes in demographics and risk factors of states' *white* childbearing populations. Thus, it appears that changes in U.S. states' IOL use are associated only with changes in the characteristics of states' white childbearing populations.

Taken together, evidence here suggests that the increasing use of IOL in the United States has not been centered on the needs of the Black and Latina childbearing populations, but instead is likely responding to the changing needs and/or preferences of the white childbearing population. While we did not identify the underlying reasons for these associations, we offer two potential explanations for future research to consider. One possible explanation is the way in

which standards of obstetric care are created for the majority or “normal” pregnant person (i.e., white women) and then applied to all patients. The processes underlying this explanation reflect healthcare providers' desires and efforts to reduce perceived risks associated with pregnancy and childbirth. That is, obstetric interventions such as IOL can be used to minimize the risk of adverse birth outcomes and adverse maternal outcomes from high-risk pregnancies (Nicholson et al. 2004, 2007, 2009a, 2009b). In their efforts to minimize risk among the majority white populations, hospitals, clinics, and care-providers in the United States may be shifting their practices to identify "high-risk" pregnancies and minimize poor outcomes of these pregnancies via IOL. Indeed, since 1990, the gestational age distribution of births in the United States has shifted from IOLs primarily occurring at later gestational ages (40 weeks or more) to occurring more frequently at earlier gestational ages (weeks 37-39) (Tilstra and Masters 2020). Evidence presented here suggests that this new normative practice of using obstetric interventions at earlier gestations likely arose in response to the (perceived) needs of white women, but that the normative practice may have come to shape care for all U.S. populations in similar ways. Thus, standards of pregnancy care are created and adjusted to meet the needs of the majority or “normal patient” (i.e., white women alone) and then applied to all racial/ethnic groups, regardless of patients' needs and preferences (Hardeman et al., 2016). Providers may also care more about minimizing harm and preventing adverse outcomes among white patients because the lives and children of white women are implicitly more valued in the United States (Harris and Wolfe 2014). In either case, obstetric racism has resulted in prioritizing care for white women.

A second possible explanation is that racist "risk perception" in U.S. clinical and obstetric practices have differentially affected the use of IOL for managing pregnancy and childbirth among U.S. racial/ethnic populations. Here, pregnancies among Black and Latina women may be

perceived and diagnosed as being riskier and less healthy than pregnancies to white women. Public attention to maternal and infant morbidity and mortality among U.S. communities of color, healthcare training and education, and implicit biases might influence providers' perceptions of the health and needs of patients from these communities (Feagin and Bennefield 2014; Horbar et al. 2019; Washington 2006). Thus, providers may perceive, assess, and treat patients based on their skin color and/or on racist perceptions of their familial background and communities, instead of their individual risk factors for carrying a healthy pregnancy to full term or engaging in person-centered care and listening to their needs and preferences, as providers are more likely to do with white patients (Altman et al. 2019; Logan et al. 2022; McLemore et al. 2018; Slaughter-Acey et al. 2016; Vedam et al. 2019). Additionally, misperceptions about pain sensitivity might influence providers' reception to Black and Latina women's desires and preferences in obstetric care settings. Foundational practices in obstetrics and gynecology were strongly influenced by the racist care of J. Marion Sims, who developed surgical procedures by operating without consent and without anesthesia on enslaved Black women (Washington 2006). Sims' experiments contributed to the persistent false belief that Black and white patients have biological differences in pain perception (Hoffman et al. 2016). Indeed, the expansive and pervasive history of unequal healthcare in the United States has fostered an environment ripe for obstetric racism. Thus, our findings might implicate racism in the assessment of patients' needs and in clinical decision-making, which are consistent with a large body of evidence identifying racial/ethnic inequities in delivery of medical care in the United States (Smedley et al. 2003).

Findings here provide complementary, structural-level evidence that align with individual-level studies of obstetric racism (Davis 2018, 2019; Janevic et al. 2020; Logan et al. 2022). We demonstrate that the pattern of adjusting obstetric care to meet the changing

composition and risk factors of the white population exists at the state-level, thus showing that the patterns of obstetric racism persist at a population-level in the United States. This contributes to an ever-growing body of literature implicating the pervasiveness of racism across U.S. institutions. Examples of institutions outside healthcare not centering at the margins include how systemic racism infiltrates the education system through segregation and standardizing white children as the norm in testing (Knoester and Au 2017; McGee 2020; Vaught and Castagno 2008) and how practices such as redlining and the behaviors of housing market professionals discriminate against communities of color and contribute to racial segregation by viewing white homeowners and tenants living arrangements and practices as “normal” (Korver-Glenn 2021; Rothstein 2017). These and other institutions continue to engage in and teach racist behaviors that perpetuate racial differences in several economic, social, and health outcomes. Here, we provide further evidence that the field of obstetrics also likely engages in behavior and practices that prioritizes the (perceived) needs and desires of the white childbearing population.

This study has several limitations. First, data are composed at the state-level and might fail to measure how changes in risk factors and IOL move together at other spatial levels within states (e.g., county or hospital). For example, hospitals that disproportionately serve Black and Latina populations might be changing obstetric practices for reasons not observed in these data, but which are correlated with changes in demographics and risk factors among states' white childbearing populations. Second, the NVSS data contain a limited set of measures for "high-risk" pregnancy. The rising use of IOL among states' Black and Latina women may be responding to changes in these childbearing populations that we are not observing in these data. Yet, our findings were robust to sensitivity analyses that controlled for a number of possible economic-related confounders.[7,8] Third, we are not measuring or directly observing "obstetric

racism" or forms of systemic racism. Rather, we are implicating differences in determinants of IOL trends as evidence for racism in the use of IOL. This limitation, however, can be perceived as a strength of the study. One need not document differences in outcomes by race/ethnicity or directly measure exposures to racism to suggest that the processes generating those outcomes might be shaped by racial/ethnic differences in the mechanisms. Indeed, in this case, if researchers had documented only the racial/ethnic similarities in U.S. IOL rates and trends, they would have concluded that there are no racial/ethnic inequities in IOL practices.

While results from this study must be interpreted with these limitations in mind, our findings are consistent with an extensive literature documenting healthcare inequity in the United States, and provide strong evidence that U.S. obstetric care has not been centered on the needs of Black and Latina childbearing populations. Results here indicate that rising use of IOL among pregnancies to Latina and Black women are likely responding to characteristics in white childbearing populations, not characteristics in these populations themselves. These findings provide population-level evidence to support claims of "obstetric racism" documented in individual-level data, and, therefore, provide an empirical foundation on which researchers can study the underlying mechanisms for racial/ethnic inequities in U.S. obstetric care.

NOTES

1. For parsimony and consistency, we use “maternal” and “women” when referring to birthing people. However, the identities of birthing people include all gender identities.

2. "High-risk" pregnancy has no definition, but pregnancy risks are higher for women older than age 35, for women with pre-existing health conditions (e.g., high blood pressure, obesity, diabetes), for people who engage in certain health behaviors while pregnant (e.g., smoking cigarettes, using alcohol), and for multiple pregnancies (e.g., carrying twins or higher order multitudes). (NICHD 2018)

3. Results from models fitted to pregnancies among white and Latina women in reduced analytic samples composed of the same 44 states are nondifferent from results in the paper and can be found in Appendix J.

4. See Appendix E for details about imputed values.

5. Records of IOL in Wisconsin during the 1990s and early 2000s were prone to error. We adjusted IOL rates in Wisconsin for all years 1990 through 2002. See Appendix D.

6. Advanced maternal age itself designates a pregnancy as "high risk", but we include it as a measure of states' childbearing "demographics" alongside maternal age less than 20 years.

7. We included measures of states' economic indicators and inequality such as the Gini index, child poverty rate, unemployment rate, housing price index (in 1990 dollars), and rates of Supplemental Nutrition Assistance Program (SNAP) benefits. Results from models that these controls are in Appendix I.

8. Appendix K presents results from several sensitivity analyses such as combining Equation (3) and Equation (4) and using three-year lagged effects of predictors.

9. Correlations between characteristics and risk factors among states' white, Latina, and Black populations in 1990, 2004, and 2017 are in Appendix L.

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FIGURE HEADINGS

Figure 1. U.S. States' Labor Induction Rates among Pregnancies to Black Women, Latina Women, and White Women, 1990-2017.

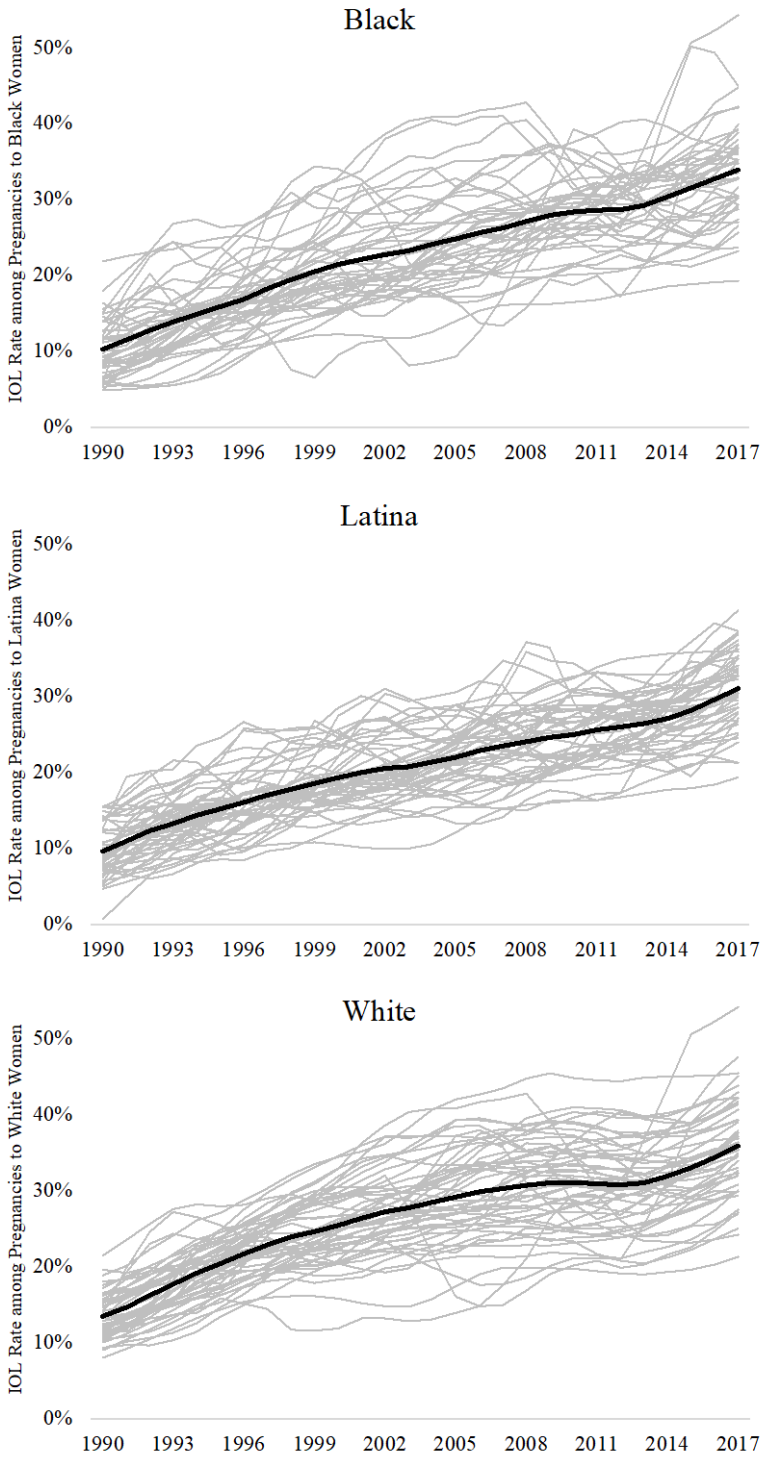


Figure 2. Predicted Bayes Estimates of U.S. States' Labor Induction Rates among Pregnancies to Black Women, Latina Women, and White Women, 1990-2017.

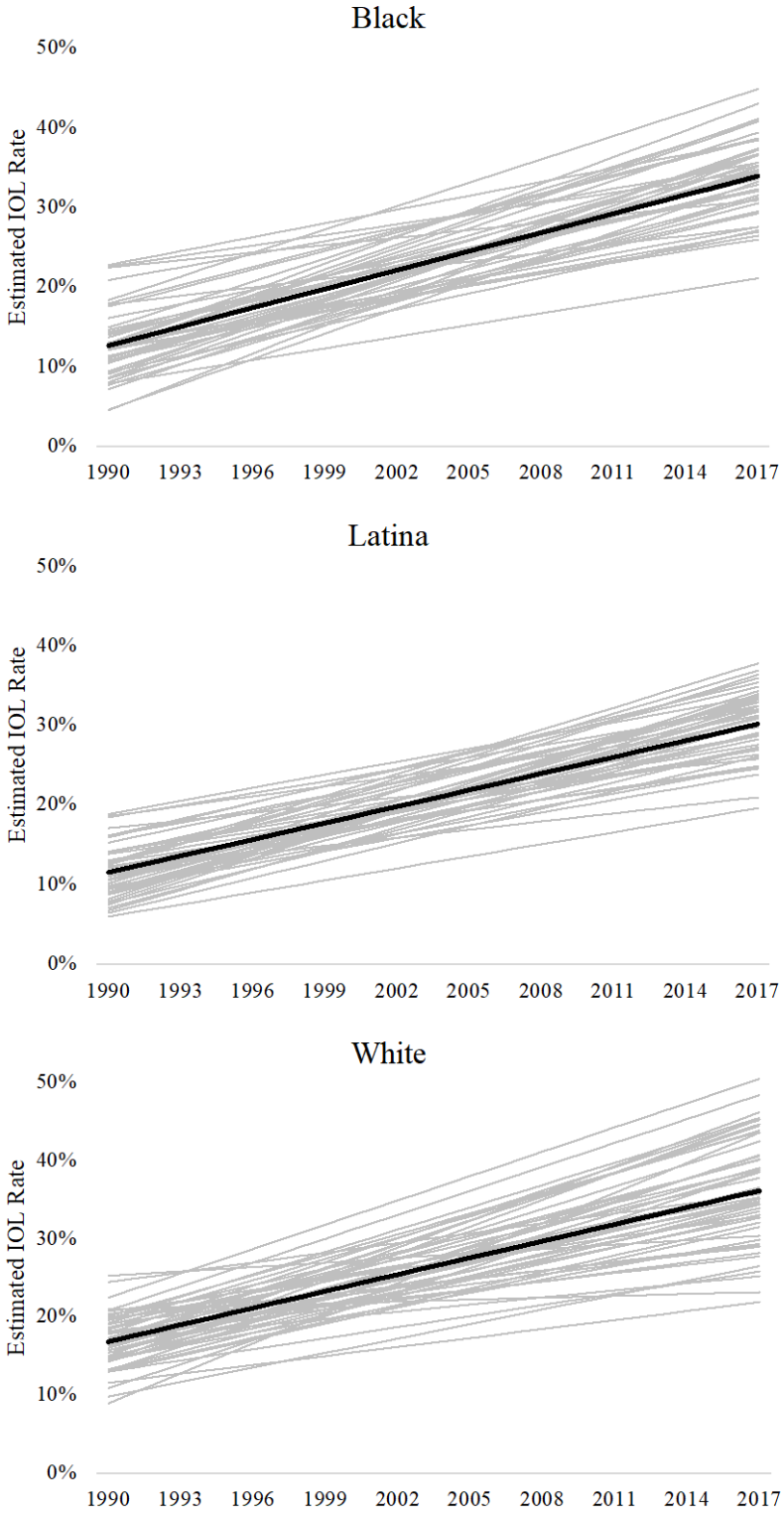
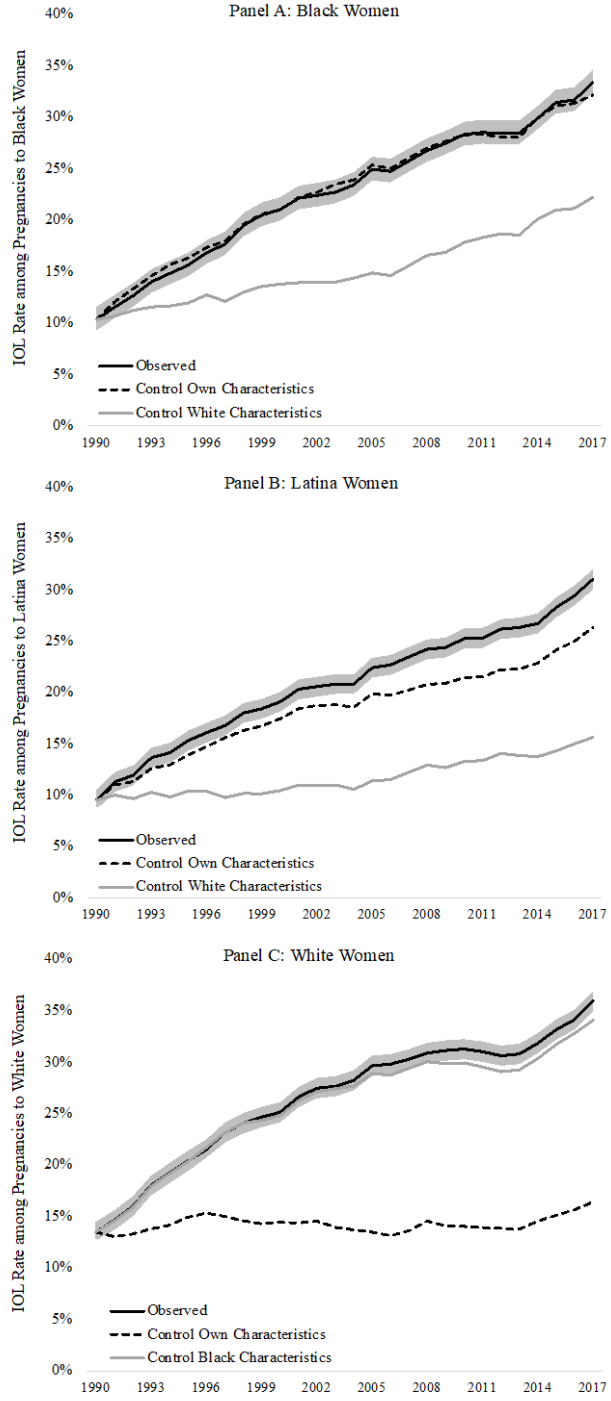


Figure 3. Estimates of Mean Labor Induction Rates among U.S. States' Black, Latina, and White Childbearing Populations, 1990-2017.



Note: "Observed" lines are mean IOL rates estimated from Equation 1, the "Control Own Characteristics" lines are mean IOL rates while holding constant states' 1990 levels of demographic characteristics and risk factors, and "Control White Characteristics" lines are mean IOL rates while holding constant states' 1990 levels of demographic characteristics and risk factors.

Table 1. Descriptive Statistics of Analytic Samples of Singleton First-births among U.S. States' Black, Latina, and White Childbearing Populations in 1990, 2004, and 2017.

	Black			**Latina**			**White**		
	1990	2004	2017	1990	2004	2017	1990	2004	2017
Characteristics of Labor/Delivery									
Labor Induction	0.10	0.23	0.33	0.10	0.21	0.31	0.14	0.28	0.36
Cesarean Delivery	0.23	0.30	0.32	0.24	0.25	0.25	0.24	0.28	0.28
Maternal Demographics									
Teen Maternal Age	0.43	0.35	0.17	0.32	0.31	0.21	0.20	0.16	0.08
Advanced Maternal Age	0.02	0.05	0.07	0.02	0.04	0.06	0.05	0.09	0.10
Education < HS	0.31	0.25	0.13	0.37	0.44	0.23	0.15	0.12	0.06
Education BA +	0.09	0.14	0.20	0.11	0.11	0.17	0.24	0.37	0.44
Married	0.28	0.25	0.29	0.60	0.42	0.40	0.76	0.67	0.66
U.S.-born	0.93	0.85	0.79	0.53	0.38	0.60	0.96	0.95	0.94
Pregnancy Risk Factors									
Gestational Tobacco Use	0.10	0.07	0.04	0.09	0.04	0.03	0.18	0.13	0.08
Diabetes	0.02	0.03	0.05	0.02	0.03	0.07	0.02	0.03	0.06
Hypertension	0.05	0.07	0.13	0.04	0.05	0.08	0.05	0.07	0.11
Weight Gain 40+ lbs.	0.24	0.29	0.28	0.24	0.26	0.25	0.27	0.34	0.30
Pre-Term Gestation	0.16	0.15	0.14	0.11	0.11	0.10	0.08	0.10	0.09
Post-Term Gestation	0.23	0.17	0.15	0.28	0.20	0.18	0.31	0.20	0.19
States	44	44	44	48	48	48	51	51	51

Source: National Vital Statistics System Restricted Natality Data

Table 2. Results from Unconditional Growth Curve Models Fitted to States' Labor Induction Rates among Pregnancies to Black, Latina, and White Childbearing Populations, 1990-2017.

Panel A: Unconditional Means Model

	Black		**Latina**		**White**	
	b	SE	b	SE	b	SE
Intercept	0.227	0.006	0.208	0.004	0.265	0.006
Variance Components						
σ_0^2	0.0012	0.0003	0.0007	0.0002	0.0015	0.0003
σ_ε^2	0.0060	0.0002	0.0044	0.0002	0.0050	0.0002

Panel B: Random Slope Model, Unstructured Error-Covariance Matrix

	Black		**Latina**		**White**	
	b	SE	b	SE	b	SE
5-Year Time	0.039	0.002	0.034	0.001	0.036	0.002
Intercept	0.121	0.007	0.116	0.005	0.168	0.005
Variance Components						
σ_1^2	0.0001	0.0000	0.0001	0.0000	0.0002	0.0000
σ_0^2	0.0021	0.0005	0.0011	0.0003	0.0013	0.0003
σ_{01}	-0.0003	0.0001	-0.0002	0.0001	-0.0002	0.0001
σ_ε^2	0.0014	0.0001	0.0010	0.0000	0.0010	0.0000
N states	44		48		51	
State-years	1232		1344		1428	

Source: National Vital Statistics System Restricted Natality Data