An Examination of Opioid Use Disorder Outcomes among Pregnant Women in Medicaid from 2007-2012: Trends, Disparities and Association with Punitive Child Welfare Policies

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Dedication

I wish to dedicate my dissertation to my husband, Eric, and our daughters, Mary Belle and Violet Lucille. Your unwavering love and support have made this dream a reality.

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I owe this accomplishment to several people and institutions. I would like to acknowledge the RAND Corporation, where I worked as an adjunct researcher and through which I obtained access to the MAX data used in my analyses, specifically via the National Institute on Drug Abuse under Grant R01DA045800 with Bradley Stein. This work was supported by the George Washington University Milken Institute of Public Health and by a pilot project award through the RAND Opioid Policy Tools and Information Center for Research Excellence (OPTIC). I wish to thank my committee members, Leighton Ku, Laura Faherty, Anne Markus, and Brendan Saloner, for their invaluable mentorship, advocacy and support during this process. I also thank Burt Barnow, Joe Cordes, and Mishka Terplan for serving as chair and examiners at my final defense. I also wish to thank Bradley Stein, Beth Ann Griffin, Andrew Dick and Flora Sheng for their guidance with methods development and model specification, and Lauryn King for her help with developing the theoretical context from a sociology and criminal justice perspective. I would also like to thank Jonathan Levin for his helpful edits and suggestions along the way.

Abstract of Dissertation

An Examination of Opioid Use Disorder Outcomes among Pregnant Women in Medicaid from 2007-2012: Trends, Disparities and Association with Punitive Child Welfare Policies

This study examined trends and disparities in opioid use disorder (OUD) outcomes among pregnant women and analyzed the association of these outcomes with punitive child welfare policies. We examined the association between sociodemographic and clinical characteristics and receipt of any OUD treatment, medication for OUD (MOUD), and counseling alone among pregnant women with an OUD diagnosis. We also examined the association between OUD status and perinatal and emergency care utilization, and between sociodemographic and clinical characteristics and perinatal and emergency care utilization among pregnant women with OUD. We also examined the association between child welfare policies and changes in the probability of OUD diagnosis, any OUD treatment, MOUD and adequate prenatal care. Compared to White women, Black and American Indian/Alaskan Native (AI/AN) women were less likely to receive any OUD treatment and MOUD. Pregnant women with OUD were less likely to receive adequate prenatal care and attend the postpartum visit and more likely to have perinatal emergency visits than pregnant women without OUD. Among pregnant women with OUD, Black, Hispanic and AI/AN women were less likely to receive adequate prenatal care and attend the postpartum visit relative to White women. Black and AI/AN women were also more likely to receive emergency care. Child welfare policies were associated with a decrease in the probability of OUD diagnosis but an increase in the probability of MOUD given OUD diagnosis. Our results have public health and policy implications, especially in the context of state-level efforts to reduce maternal opioid use.

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Chapter One: Introduction.

Problem Statement.

Pregnant women represent an increasingly large and uniquely vulnerable population affected by opioid use disorder (OUD) and its associated harms. Researchers have documented disparities in OUD treatment and perinatal health care utilization, but national data for the Medicaid population is lacking. Policymakers have enacted a range of policies at the state and federal levels in an effort to deter prenatal opioid use and reduce the incidence of withdrawal among newborns exposed to opioids during pregnancy. Despite consensus from the medical and public health communities in support of treatment-supportive policy approaches and in opposition to punitive policy approaches, limited empirical, quantitative research examines the impact of punitive child welfare policies on OUD outcomes among pregnant women who use opioids in Medicaid.

Purpose Statement.

I describe the population of pregnant women with opioid use disorder (OUD) in Medicaid over the period 2007-2012, describe trends and disparities in receipt and type of OUD treatment and perinatal care utilization over time in this population, and analyze the relationship between the enactment of punitive child welfare policies and changes in perinatal OUD diagnosis, receipt and type of OUD treatment, and prenatal care utilization.

Dissertation Structure.

In this dissertation, I describe a three-paper approach that examines trends in OUD treatment and perinatal care utilization among pregnant women with OUD in Medicaid and explores the impact of child welfare policies on their health care utilization. In the first chapter, I provide a background on maternal opioid use and policy contexts and describe the significance and structure of my research. In the second chapter, I explore the theoretical context from which I approach my study, and I describe how this theoretical context fits into the policy context. In the third, fourth and fifth chapters, I present my three dissertation papers. In the sixth and final chapter, I provide a summary of my research and end with conclusions.

Introduction.

A Maternal Public Health Crisis

The opioid crisis in the United States continues to escalate; in 2019, 10.1 million people reported misusing opioids over the previous year,[2] and 49,860 individuals died from opioid overdose – an almost fivefold increase from 2000.[3] Preliminary research indicates that the COVID-19 pandemic has worsened the opioid crisis, bringing economic shock, increased social isolation and mental health distress, and significant disruptions in access to addiction support and medication that often require in-person visits with providers.[4,5]

Opioid misuse has also increased among pregnant women, exacerbating the already substantial risks of maternal morbidity and mortality in the U.S.[5] Between 2010 and 2017, the rate of maternal opioid-related diagnoses (MOD) increased from 3.5 to 8.2

per 1,000 hospital births, representing a 134% increase over the eight-year period.[6] Rates of MOD at delivery vary widely across states, from 1.7 per 1,000 hospital births in Nebraska to 47.3 per 1,000 in Vermont in 2017.[6] Untreated opioid use disorder during pregnancy is associated with significant health risks for mother and infant, including increased risk of maternal depression and anxiety, maternal mortality, low birth weight, preterm birth, and neonatal opioid withdrawal syndrome (NOWS), a condition characterized by a variety of symptoms, including increased irritability, muscle rigidity, tremors, feeding difficulty and vomiting, seizures, and respiratory problems.[7-10] Between 60% and 80% of newborns exposed to heroin or methadone in utero exhibit symptoms of NOWS, and infants with symptoms severe enough to warrant pharmacologic intervention are treated with first-line opioid medications such as morphine, methadone or buprenorphine, and secondary medications like clonidine and phenobarbital, and are then weaned off over a period of days to weeks.[7,11] The long-term effects of intrauterine opioid exposure on pediatric and adolescent development are not well-understood,[12] but untreated maternal opioid use can have lasting and significant impacts for mothers, children and their families.[13-17]

Standard of Treatment for Pregnant Women with OUD

Medication for opioid use disorder (MOUD), previously called medication-assisted treatment (MAT), is recommended for pregnant women with OUD.[13,18-20] Medications recommended for use in pregnant women with OUD include methadone and buprenorphine. MOUD prevents complications of continued nonmedical opioid use by reducing the risk of return to use and subsequent overdose.[13,21] The recurrence rate of

medically-supervised withdrawal ranges from fifty-nine to more than ninety percent, and relapse following complete abstinence can be fatal for mothers; furthermore, complete withdrawal may trigger a contraction of the uterus, which can result in miscarriage or preterm delivery.[13,22-24] MOUD also improves adherence to prenatal care and addiction treatment programs, and reduces the risk of obstetric complications and adverse birth outcomes for mothers and infants.[13,21]

Although NOWS is an expected condition following prenatal exposure to opioids (both nonmedical use and MOUD use),[25] it is a treatable condition, and the risks of continued nonmedical opioid use are far greater for mothers and infants compared to supervised use of opioids via MOUD.[13] A variety of state- and federal-level policies have been enacted to address the opioid crisis, and some of these have been specifically designed to reduce prenatal opioid use and its associated harms for women and their infants. All of these policies have the potential to affect both access to MOUD and other OUD treatment, as well as prenatal care for pregnant women with OUD in Medicaid, and these policies are discussed in the following section.

Policy Context.

In this section, I describe two types of relevant policies: (1) state-level policies specifically addressing prenatal substance use, and (2) more general state Medicaid policies that affect health care access and continuity of care for the population of pregnant women using opioids, including Medicaid expansion, coverage of MOUD medications and the inmate exclusion policy. Within this policy discussion, I present two policy frameworks that help to contextualize policies relating to prenatal substance use:

(1) the traditional American framework for prenatal substance use policy and (2) an alternative framework via the Swiss Four Pillars Policy.[26]

I will note here that multiple federal policies and initiatives either directly or indirectly affect access to treatment for pregnant women with OUD, including the Comprehensive Addiction and Recovery Act of 2016 (CARA); the Centers for Medicare and Medicaid Services' (CMS) Maternal Opioid Misuse (MOM) model announced in 2019; the CMS's two informational bulletins released in July 2019, *Caring Recovery for Infants and Babies (CRIB)* and *Help for Moms and Babies (HMB)*; the Substance Use Disorder Prevention that Promotes Opioid Recovery and Treatment for Patients and Communities (SUPPORT) Act of 2018; the American Family Rescue Plan (including the temporary state option to expand Medicaid postpartum coverage up to 12 months)[27]; and the Build Back Better Act (which died in the Senate in December 2021 but may be revived via a smaller spending package), but these initiatives are not discussed in this dissertation.

State Policies addressing Prenatal Substance Use

Numerous states have enacted a range of policies in an effort to reduce prenatal opioid use and the incidence of NOWS, both of which impose enormous health care costs, the majority of which are shouldered by public financing systems. For decades, state policymakers have grappled with the complex and growing problem of substance use during pregnancy, and the policies they have enacted reflect the breadth of possible policy approaches to solve a complicated public health issue. In the following section, I describe how these policies fit into the traditional framework for prenatal substance use

policy in the United States, before moving to an alternative and more cohesive framework embodied by the Swiss Four Pillars Policy.[26]

Traditional Framework: Supportive versus Punitive

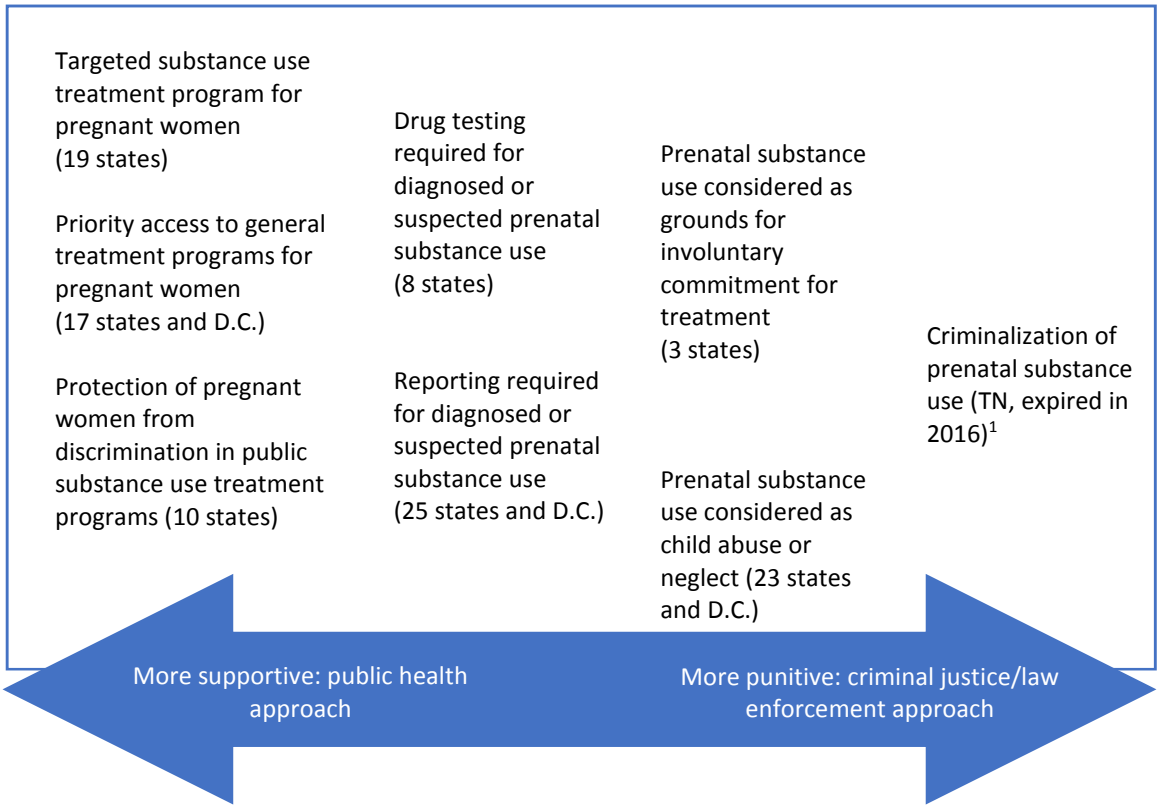
In the United States, policies addressing prenatal substance use have traditionally been articulated by the extent to which they are supportive or punitive. Supportive policies generally reflect a public health approach to illicit substance use, conceptualizing prenatal substance use as a chronic medical condition[28] and focusing on efforts to increase and protect the access of pregnant women and new mothers to appropriate health care and substance use disorder treatment. Broadly speaking, punitive policies reflect a criminal justice or law enforcement approach, using the (at least implicit) threat of detection and punishment to deter pregnant women and new mothers from using illicit substances. Whereas some policies can be viewed as potentially punitive, including mandated testing for and reporting of suspected prenatal drug use by health care providers, others are more clearly punitive. Some states allow for the testing of newborns for suspected prenatal drug exposure without parental consent, and others have designated prenatal substance use as grounds for involuntary commitment to an inpatient mental health or substance abuse treatment facility.[29,30] Some states have labelled prenatal substance use as child abuse and/or neglect under civil child-welfare statutes, such that substance abuse during pregnancy constitutes grounds for the loss of parental rights due to child abuse or neglect.[29] For the remainder of this dissertation, I will refer to this last set of policies as "child welfare policies." As of 2000, only 12 states had enacted child welfare policies, compared to 26 states and D.C. as of 2021.[5]

It is important to note that the intent of punitive policies may not be to punish a mother for using illicit substances during pregnancy, but rather to protect her child from a home environment that lacks a competent and able-bodied parent, especially in the case of reporting and child welfare policies. Notably, child welfare cases involving caregiver substance use disorders (SUDs) are highly complex and unfortunately common: SUDs affect 50-80% of families within the child welfare system.[31] Further, children and families affected by SUDs in the child welfare system experience disproportionately poor outcomes relative to families not affected by SUDs.[31] Caregivers with SUDs are more likely to engage in maladaptive parenting practices, including increased hostility, over-reactivity and disengagement from children.[31] Certainly, the involvement of the child welfare system is sometimes necessary for the health and well-being of parents and children affected by prenatal substance use, but relationship-focused interventions[31] bolstered by existing institutional structures fostering prevention and treatment for parents struggling with OUD represent the best strategy for keeping families together during recovery and maximizing child welfare outcomes.[31]

Other punitive policies may not be necessarily punishment-seeking in nature. Civil commitment policies may compel an otherwise unwilling pregnant women struggling with OUD to enter into treatment, and testing policies have the potential to help health care providers tailor their treatment to maximize the likelihood of positive maternal and birth health outcomes. Further, these policies and their advocates may not categorically conceptualize prenatal substance use as a moral failure, but rather view it as a chronic disease requiring treatment and compassion. Thus, policy approaches are best conceptualized by their relative placement on a continuum: some policies are framed as

more punitive, and some policies are framed as more supportive. They are not necessarily antagonistic toward, nor do they necessarily work against, one another (though they often do). Many punitive and supportive policies often operate simultaneously: multiple states have enacted a range of both punitive and supportive policies over time in their efforts to address prenatal substance use from multiple approaches. More detailed information on these policies and their traditional framing in the United States, based on the prenatal substance use policy data set produced by the Guttmacher Institute,[29] is provided in Figure 1.

Figure 1. Traditional Framework for Policies Addressing Prenatal Substance Use[29]



Source: Guttmacher Institute. Substance Use During Pregnancy: State Laws and Policies. 2021.[29]

Despite the intention of punitive policy approaches, research has shown that the perception of these policies on the part of the women they directly affect is often adversarial, jeopardizing the relationship between pregnant women and their health care providers and causing them to delay or avoid prenatal care and substance abuse treatment for fear of being reported to the police or child protective services (CPS).[8,30,32-37] Because regular prenatal care improves the likelihood of a healthy pregnancy and birth, and because untreated OUD during pregnancy is associated with multiple adverse health outcomes for mothers and infants, punitive approaches to substance use in the prenatal period may have unintended and adverse effects on maternal and child health.[30,37,38] Additionally, data suggest that the use of MOUD – the recommended treatment for pregnant women with OUD – is less likely in states that permit child abuse charges for illicit prenatal drug use.[39] More than 20 national medical and public health organizations have spoken against punitive policy approaches, including the American Medical Association, the American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, the American Public Health Association, the American Psychiatric Association, the National Perinatal Association, the American Society of Addiction Medicine, and the March of Dimes.[40] Despite these concerns, states continue to propose, enact, and enforce punitive policies surrounding prenatal substance use; these policies stem from long-standing American drug campaigns like the 1970s War on Drugs and the 1994 crime bill, as well as reproductive health policy. At least some of the rationale for this approach is grounded in deterrence theory, which is discussed in greater detail in a later section of this dissertation.

Alternative Framework: The Swiss four pillars policy

Although the traditional American framework for prenatal substance use policy generally describes policies by the degree to which they are supportive or punitive, the Swiss Four Pillars Policy (shown below in Figure 2) integrates multiple approaches within a cohesive national drug strategy.[26] This progressive policy approach, ratified in 2008, articulates four approaches or "pillars" that work together within a broader policy framework: prevention, treatment, law enforcement (or repression/ criminalization), and risk reduction.[26] The innovation of this policy was twofold. First, it politically and institutionally incorporated the more controversial strategy of risk reduction (or harm reduction) within a more conventional and broadly accepted policy strategy consisting of prevention, treatment and law enforcement.[26] Second, it presented previously juxtaposed strategies (like treatment and law enforcement) as complementary and mutually reinforcing within a broader, multidimensional policy approach.[26] Although the use of risk reduction strategies had been increasing at local levels for decades, the Four Pillars Policy formalized their role in a comprehensive and historic national drug policy, intent on continuous and open communication between the various stakeholders of each pillar.[26]

Importantly, the Four Pillars Policy led to a significant reduction in heroin use and deaths both directly and indirectly attributable to substance use.[26] For those individuals who wanted treatment but were unable or unwilling to engage in abstinence-based programs, the new policy embraced a more pragmatic and humanist approach of reducing harm and protecting life. Savary, Hallam and Bewley-Taylor wrote in their 2009 brief for the Beckley Foundation Drug Policy Programme that the Four Pillars Policy incorporated "the principle that drug users who are unable to break the cycle of

compulsive consumption continue nonetheless to have rights which address their specifically marginalized status. The first of these is to stay alive."[26]

In the U.S., there are policy strategies that reflect each of the four pillars, but they are not integrated with one another, and their legislation and implementation vary widely across states and even localities. Lacking a national cohesive substance abuse policy, the U.S. has instead largely delegated the responsibility of addressing substance abuse to states and communities, and sometimes community-level programs contradict federal legislation. Despite a federal funding ban on needle exchange programs beginning in 1988 through section 300ee-5 of the Public Health and Welfare Act,[41] which reflected the ideological perspective that substance use was both morally wrong and illegal,[42,43] some localities have implemented harm reduction strategies like syringe services programs and safe injection sites in an effort to reduce risk among persons who inject drugs. Even within states, different policy strategies are generally described and perceived as counteracting, and in fact they often work that way in practice, including among the maternal population. For example, in Kentucky, substance use during pregnancy is considered child abuse as of 2018, and health care providers are required to test for and report diagnose or suspected drug use during pregnancy, but the state has also created targeted treatment programs for pregnant women, prioritized access for pregnant women in treatment programs, and prohibited public treatment programs from discriminating against pregnant patients.[26] Despite the complexity of the issue, prenatal substance use policy is generally framed (and construed) as either supportive or punitive, and policies often (either explicitly or implicitly) take on a more supportive or punitive approach.

Importantly, the Swiss Four Pillars Policy demonstrates that all of these policy

strategies can (and do elsewhere) exist together in a cohesive and multidimensional drug strategy, and players operating from a variety of perspectives – public health, medical, child welfare, criminal justice and law enforcement, and harm reduction – need not be opponents in the endeavor to improve the health and well-being of pregnant women struggling with OUD. Importantly, Switzerland does not have federal anti-drug campaigns like the American War on Drugs, which by definition places different perspectives for addressing substance use at odds with one another. The U.S. could learn from this approach as it continues to battle the opioid crisis.

Figure 2. Swiss Four Pillars Policy Framework for Substance Abuse[26]

Medicaid Policy: Early expansion, coverage of MOUD, and the Inmate exclusion policy.

Medicaid represents the largest single payer of pregnancy-related health care services and paid for 43% of all U.S. births in 2018.[44,45] Medicaid is the primary payer

for 75% of substance use-related maternal hospitalizations, covering roughly 80% of annual hospital costs related to NOWS.[46] Because Medicaid-insured mothers and infants are disproportionately impacted by prenatal opioid misuse and its associated harms, any meaningful exploration of policy response must include a discussion of the role of Medicaid in expanding treatment access for this vulnerable population.

A provision of the Affordable Care Act (ACA) called for the expansion of Medicaid eligibility, with the goal of providing more low-income Americans with health insurance coverage. Under expansion, Medicaid eligibility was expanded to adults up to age 64 with incomes up to 138% of the federal poverty line (FPL). This 138% threshold included the federally-specified statute of 133% FPL plus a single income eligibility disregard of 5% FPL, using Internal Revenue Service definitions of modified adjusted gross income (MAGI). Coverage under Medicaid expansion became effective on January 1, 2014, but five states (California, Connecticut, Minnesota, New Jersey and Washington) and D.C. expanded Medicaid early, between March 2010 and August 2011. Federal law mandates pregnancy-related Medicaid coverage through 60 days postpartum; after this period, some women may qualify for Medicaid via another eligibility pathway, depending on expansion status in their state of residence.[47] A provision of the American Rescue Plan Act of 2021 offers states the option to extend Medicaid postpartum coverage up to one year via a state plan amendment (SPA); this option takes effect in April 2022 and is available for five years.[47] Importantly, women enrolled in the ACA Medicaid expansion could be parents already or could become pregnant after enrolling. For women who are eligible for Medicaid on the basis of pregnancy, most states provide Medicaid coverage up to 200% of the FPL, and some states are more generous.[48] Further, all state

Medicaid programs offer pregnant women that are Medicaid-eligible on the basis of pregnancy certain benefits including prenatal care and childbirth services, but states have discretion to define specific maternity care benefits under Medicaid, like treatment for substance use, home visiting services, doula care and home births.[49] For pregnant women who are eligible for Medicaid via expansion through the Affordable Care Act, states are required to cover all preventive services recommended by the U.S. Preventive Services Task Force (USPSTF).[49] Pregnancy-related health care services for pregnant women enrolled via any Medicaid coverage pathway are exempt from cost-sharing arrangements.[49]

When the 60-day postpartum period is over, mothers with incomes up to 138% FPL in Medicaid expansion states still qualify for coverage, and mothers with incomes above 138% FPL may qualify for coverage subsidies through the ACA Marketplace.[49] But in non-expansion states, many mothers become uninsured when pregnancy-related coverage ends 60 days postpartum, for at least one of several reasons. Their income may be too high to qualify for coverage as parents (because the income eligibility level for parents is much lower than that for pregnant women in non-Expansion states), but too low to qualify for subsidies through the ACA Marketplace (the "Medicaid gap").[49] It is also possible that the state in which a woman lives does not have a family planning waiver or state plan amendment extending coverages for family planning services after the 60-day postpartum period.[50] This gap in coverage is common for births financed by Medicaid: more than fifty percent of women who gain Medicaid coverage by the month of delivery lose all coverage after the 60-day postpartum period is over.[50] In expansion states, however, women can maintain their Medicaid coverage after delivery as long as

they are income eligible as an expansion adult, and this continuity in coverage allows improved access to care in the postpartum period, and indeed earlier prenatal care in the case of a subsequent pregnancy.[50] Due to the churn effect imposed by eligibility cutoffs at 60 days postpartum and the resulting disruptions in coverage and care in non-expansion states,[48] Medicaid coverage is higher and uninsurance rates are lower among women before and after pregnancy in expansion states relative to non-expansion states.[51,52]

In the context of maternal opioid use, Medicaid expansion increases the capacity and reach of the social safety net and can serve as an example of a more macro-level treatment-supportive policy, increasing access to affordable and consistent health care for women of reproductive age and improving health equity by supporting low-income Americans.[53-56] When prenatal care and OUD treatment for pregnant women are considered from the life course perspective, Medicaid expansion can be conceptualized as a stabilizer for affordable, accessible and effective health care for pregnant women struggling with OUD. More specifically, expansion could increase the role of Medicaid as a safety net via two possible pathways: (1) the woodwork or welcome mat effect, or (2) increased eligibility pathways.[50] The woodwork or welcome mat effect argues that program expansion or change (especially that which is well-communicated to the public) can encourage even previously eligible women to enroll in coverage. These women become aware of Medicaid coverage expansions and choose to enroll, even though they were eligible for benefits before the program change. The second possibility is that if women can gain access to coverage as expansion adults, they do not have to be pregnant to be eligible, and if they become pregnant later, their pre-existing coverage as an

expansion adult can translate to improved access to pre-conception care as well as earlier initiation of prenatal care.[50] When women enroll in the traditional Medicaid pregnancy program, their coverage of prenatal care in particular may start later than what is clinically recommended.[50,57] This disparity is troubling, because early prenatal care is associated with better pregnancy outcomes and fewer complications for mothers and babies.[58] Importantly, health insurance (through Medicaid or otherwise) does not equate to health care, and pregnant women struggling with OUD may still face substantial barriers to treatment, including difficulty finding providers that both accept Medicaid and are willing to treat pregnant patients.[34,59]

Finally, state Medicaid programs differ in their coverage for buprenorphine and methadone, the medications indicated for use during pregnancy. Medicaid coverage of these medications can certainly be described as a treatment-supportive policy approach in the context of prenatal substance use. As of 2019, 44 state Medicaid programs covered methadone, and all 50 states and D.C. covered buprenorphine,[60] but increases in coverage have been gradual. In addition, some states have placed restrictions on buprenorphine access, including quantity limits and prior authorization requirements.

Although Medicaid coverage generally represents increased access to appropriate health care for pregnant women with OUD, not all aspects of Medicaid are treatment-supportive. The Medicaid inmate exclusion policy (MIEP), established in 1965, significantly limits Medicaid's role for incarcerated people, stipulating that Medicaid cannot cover health care services for people in jail or prison, except in the case of inpatient hospitalizations outside of jail or prison settings.[61] This policy creates gaps in care for Medicaid beneficiaries as the move from Medicaid coverage prior to

incarceration, into the criminal justice system, and during reentry from jail or prison.[61] Health care providers in the criminal justice system and community systems have generally poor coordination, such that individuals released from carceral settings face major disruptions in continuity of care, and this is especially problematic given the relatively high incidence of morbidity and mortality among justice-involved individuals.[61] Over the last decade, many states have implemented Medicaid suspension rather than termination policies for incarcerated individuals, such that upon release, they do not have to reapply for Medicaid coverage; as of 2019, 43 states established these suspension policies for some prisons, and 42 states did so for some jails.[61] In August 2021, the Senate announced the bipartisan Due Process Continuity of Care Act, which would amend the federal MIEP to stipulate that pre-trial detainees can retain their Medicaid benefits.[62] This legislation would distinguish between individuals who have been convicted with a crime and those who have not been convicted of a crime (and presumed innocent), whereas current federal law provides no distinction between individuals being held pending adjudication and those serving jail time post-conviction.[62] Although these suspension policies and other state initiatives to facilitate continuity of coverage for justice-involved people occur after my study period, they are important for considering the range of policies within Medicaid that are relevant for the population of pregnant women with OUD.

Significance.

Multiple studies[32,33,36,37,63-65] have found a negative association between punitive policy approaches and health care utilization of or birth outcomes for pregnant women

with OUD. However, this research has important limitations: three of the papers that explored the effects of punitive policies on health-seeking behaviors of pregnant women with OUD were qualitative,[32,33,63] and another used one year of data (2012) in the Treatment Episode Dataset – Admissions (TEDS-A) to examine the relationship between child abuse laws and patterns in the use of MOUD among pregnant women with OUD.[36] Another study[37] used a much longer period (2002-2014) from TEDS-A to explore the effect of punitive policies on the proportion of pregnant admissions, but the authors did not examine variation in policy effects by insurance status or type of insurance (Medicaid versus private). Another study [64] examined the effects of civil child abuse laws on prenatal health care behaviors and birth outcomes, but the policy dataset covered the period 1985 through 2000 and has not been published in a peer-reviewed journal. Another study[65] found that punitive policies were not associated with reduced odds of neonatal abstinence syndrome (NAS, also known as NOWS), but the authors did not examine the health care utilization of pregnant women with OUD nor whether the NAS was the result of maternal prescribed or nonprescribed opioid use. The significance of my work in relation to the existing body of research is described below.

In my analyses, I expand upon existing research by analyzing trends and disparities in OUD diagnosis, receipt and type of OUD treatment, and perinatal and emergency care utilization; and examining the impact of punitive child welfare policies on OUD diagnosis, OUD treatment and prenatal care utilization among pregnant women with OUD in Medicaid. My work adds to the existing literature on the health care utilization of publicly-insured pregnant women with OUD and the relationship of that utilization with state-level punitive child welfare policies in several important ways:

1. I build upon work[66-71] that has found evidence of ***racial and ethnic disparities in the use of MOUD and completion of OUD treatment*** among pregnant women with OUD. As a part of this work, I examine disparities in OUD treatment and perinatal and emergency care utilization for American Indian/Alaskan Native (AI/AN) women, a population that is normally not analyzed in racial and ethnic disparities analyses due to small sample size.
2. I describe the relationship between child welfare policies and changes in OUD diagnosis, receipt and type of OUD treatment, and receipt of prenatal care.
3. I examine the relationships described in (1) and (2) using a ***50-state, multi-year Medicaid population***. Because maternal opioid misuse disproportionately affects publicly-insured women and their children, focusing on this population is crucial for understanding the impact of policy strategies. I have access to a large (50 states plus the District of Columbia) set of Medicaid claims for all individuals with an OUD diagnosis over the period 2007-2012, which strengthens the statistical power and inferences of my analyses.

Three-Paper Structure.

In this dissertation, I describe a three-paper approach that examines trends in OUD treatment and perinatal and emergency care utilization among pregnant women with OUD in Medicaid and explores the impact of child welfare policies on OUD diagnosis, OUD treatment and prenatal health care utilization for these women. These papers build on one another, the third paper using the theoretical context, empirical results, policy implications and general lessons from the first two papers as a foundation

for exploring the complex relationship between policy and maternal health care utilization in the context of OUD in a more nuanced, analytically technical way.

Paper one is a descriptive analysis of OUD treatment among pregnant women with OUD in Medicaid over time; paper 2 is a descriptive analysis of perinatal and emergency health care utilization for these women; and paper 3 examines the impact of child welfare policies on OUD diagnosis, OUD treatment and prenatal care utilization of pregnant women with OUD.

Chapter Two: Theoretical Context.

In this chapter, I explore the theoretical contexts from which I approach my dissertation work. These theoretical foundations not only serve as a conceptual basis for how I frame my research, but also illustrate a variety of mechanisms for and beliefs about behavior change in the wake of state-level policy change. These theoretical contexts include the well-established Andersen and Newman Behavioral Model of Health Service Use,[72,73] social constructions from the fields of sociology and public policy,[74] and deterrence theory from the field of criminal justice.[75]

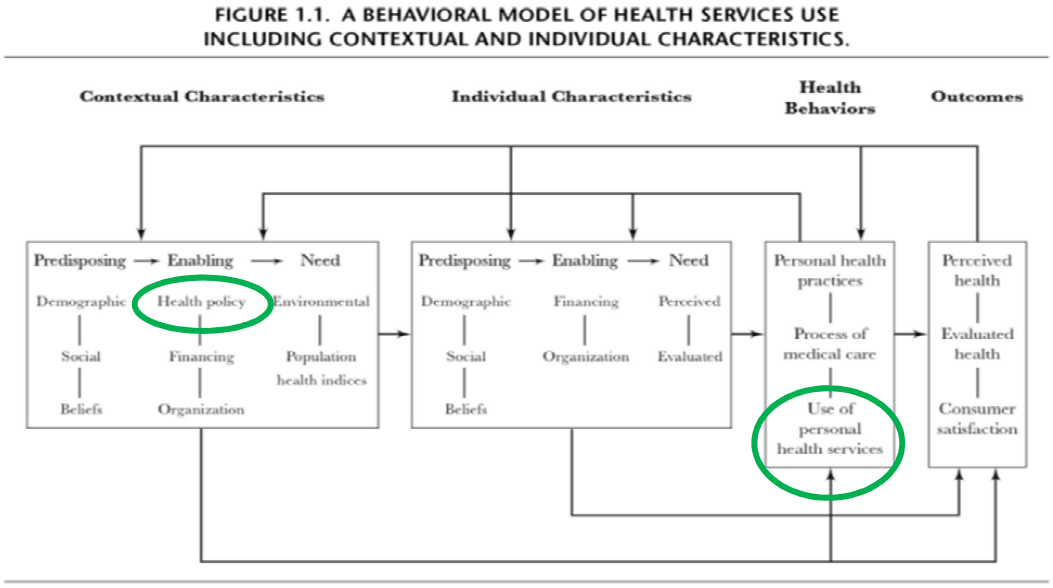
The Andersen and Newman Behavioral Model of Health Service Use[72,73] describes state-level policy change as one of multiple determinants of health care utilization, including maternal health care utilization. Essentially, individuals modify their behavior in response to a variety of individual and contextual characteristics – one of which is health policy. Social constructions,[74] or ideas or perceptions of people or groups of people that exist within a society, describe the complex relationship between

social norms, policy design and policy impacts on the populations addressed by policy change, and deterrence theory[75] illuminates the basic rationale behind law enforcement/criminal justice approach to substance use generally, and prenatal substance use specifically. Put more simply, social constructions help to illustrate the way that people or groups of people are viewed within society, and these views help to shape the policy process. And deterrence theory embodies the concept that people respond to the threat of punishment by reducing behavior that could result in that punishment. The following section of this dissertation is not a complete analysis of the theoretical contexts that are relevant for the issue of policy relating to prenatal substance use, but it describes several important theoretical frameworks and concepts that are crucial for a more nuanced understanding of how policy affects individuals, and how rationale for these policies can evolve over time and place.

Andersen and Newman Behavioral Model of Health Service Use.[72,73]

Andersen and Newman's conceptual model of health service use (shown in Figure 3 below) illustrates the causal mechanism between state-level policy change and changes in maternal health care utilization, including OUD treatment and prenatal care utilization. The original (1973[72]) and expanded (1995[73]) versions of the model describe health service use as a function of predisposing factors (including gender, age and health beliefs), enabling factors (including income level, social support and community characteristics), and need factors (including self-perceived health, chronic conditions, and restricted mobility), and later adaptations situated these characteristics among contextual and individual characteristics.[76,77]

Figure 3. Andersen & Newman Behavioral Model of Health Service Use[73]



In this framework, health care policy change (circled in green in Figure 3) represents an upstream contextual characteristic and enabling factor, which influences downstream changes in individual health behaviors. This causal link between upstream state-level health policy change and downstream change in health care utilization (operationalized here as changes in OUD treatment and prenatal care utilization, circled in green in Figure 3) presented in the Andersen model describes the causal mechanism underlying paper three of my dissertation. When a state-level policy increases access to affordable and effective health care (e.g., Medicaid expansion, expanded Medicaid coverage of MOUD medications recommended for use in pregnancy), we might expect a resulting increase in the use of personal health services among pregnant women with OUD, including increases in prenatal care utilization and OUD treatment. When a state-level policy decreases access to health care, either directly or via a negative externality

(in the case of punitive child welfare policies relating to prenatal opioid use), we might expect a resulting decrease in the use of personal health services among pregnant women with OUD, including decreases in prenatal care utilization and OUD treatment. It is also possible that these policies produce effects that work in the opposite direction or affect one another. For example, child welfare policies in a given state may deter women from care, but treatment-supportive policies in the same state may encourage women to seek appropriate treatment, such that the effects of each policy become entangled. It is also possible that the presence of a punitive policy makes it more politically and administratively difficult to establish and implement a treatment-supportive policy. Empirical work is necessary to improve our understanding of the complex and likely countervailing impacts of policy change in this area.

Sociology and Public Policy: Social Constructions.

I. Schneider and Ingram's Social Construction of Target Populations[i]

Schneider and Ingram's 1993 typology[74] (and 2007 adaptation[78]) provide a policy framework for understanding how the social construction of target populations influences the policy agenda and becomes embedded in policy messaging and design. The framework captures the social construction of women who use opioids during pregnancy, articulates how public policy serves to create, perpetuate and respond to that social construction, and explains how punitive policies – including child welfare policies – are designed (on some level) to punish the behavior of "deviant" groups, or at least deter

[i] This section of the dissertation is largely drawn from a course paper that I wrote for PUBH 8404 in February 2020: "The Social Construction of Target Populations Applied to the Design of Punitive Policies Surrounding Prenatal Substance Use."

their "deviant" behavior. Further, the framework describes the role that policy design plays in shaping individuals' perceptions of themselves and their interactions with the policy process.

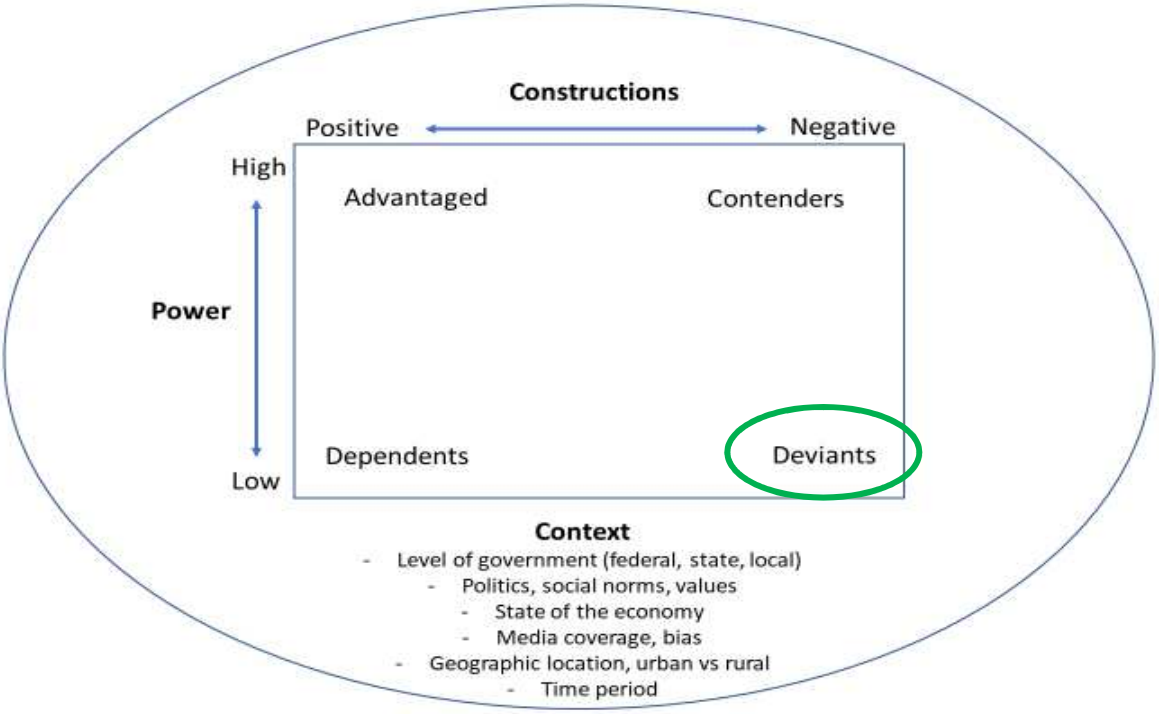
The 2x2 policy typology has two dimensions: (1) power in the policy process, defined as the use of votes, wealth, or mobilization for political action, and (2) social construction or deservedness of target populations, defined as the extent to which society generally approves or disapproves of the direction of a policy toward particular individuals or groups.[74] The "advantaged" group appears in the upper left quadrant of the typology; this group holds significant power in the policy process as well as a positive social construction of deservedness, resulting in the over-allocation of benefits and the under-allocation of burdens in the design of public policy. The "contenders" group appears in the upper right quadrant of the typology; this group also holds significant power but a negative social construction of undeserving, resulting in the generally secretive allocation of benefits and burdens that are largely symbolic and covert. The "dependents" group appears in the lower left quadrant of the typology; this group is weak but positively construed and generally perceived as deserving, resulting in the under-allocation of benefits and the over-allocation of burdens. Examples of dependents include children, (most) mothers, and the disabled. Finally, the "deviants" group appears in the lower right quadrant of the typology; this group is weak and negatively construed as undeserving, resulting in the allocation of very undersubscribed benefits and very oversubscribed burdens. Examples of deviants include people who commit crimes, people addicted to drugs, and gang members.

According to this framework, constructions of individuals and groups influence

the policy agenda, the selection of policy tools, and the logic behind policy design and implementation decisions. Further, these social constructions attach powerful labels to groups of people that tend to persist over time, such that they become embedded not only in public policy but in the broader social lexicon as messages that are internalized by the populace and affect their political and social orientations and participation in the policy process. Deviants, for example, are sent powerful messages through policy design that they are bad people, that their problems are their own personal responsibility, and that the government should treat them with contempt and disrespect until they change their behavior or avoid contact with the government.[74] They are more likely to engage in disruptive forms of mobilization, they tend to avoid interactions with agency officials, and they tend to view the policy process as not only outside of their reach, but abusive of power and fixed.[74] Dependents, on the other hand, are sent more positive messages through policy design that describe them as weak but deserving of government assistance, and this position empowers individuals in this group to seek and accept assistance and view authority structures as supportive of and responsive to their needs.

In Figure 4 below, I propose an adaptation to the modified 2007 framework[78] that increases its applicability and usefulness in the design of punitive policies aiming to reduce substance use during pregnancy. My adaptation consists of two key adjustments: (1) the addition of context to the basic framework; and (2) better articulation of the mechanisms underlying the transition from one space in the framework to another, as well as movement within these spaces.

Figure 4. Proposed Adaptation of Schneider & Ingram's Social Construction of Target Populations[78]



Although the 2007 framework[78] does not exclude the importance of context in the interplay of policy design and social construction, it does not explicitly include this context, and the inclusion of context helps to formalize the role of external factors in affecting the position and movement of target populations within the framework. For example, the level of government in which a given policy is designed, in combination with local politics and regionalized social norms, can shift the social construction of populations affected by that policy.

Further, the 2007 framework[78] incompletely describes the mechanisms underlying transitions from one space in the framework to another, as well as movement within spaces. Just as this movement is influenced by context, I would also argue that it is influenced by specific "triggers" – and this is especially true in the case of policy design

surrounding prenatal substance use. I imagine triggers to be social labels or symbols that can affect framework placement – for example, parenthood (including fatherhood but especially motherhood) – and often serve to combine constructs from different spaces of the framework. For example, "mothers" are firmly in the space of "dependents" – relatively weak in terms of political power but deserving from a social perspective.

"Welfare mothers," on the other hand, have less power than mothers more generally, and are positioned toward the "deviant" space; their inability (or unwillingness, as the label "welfare mothers" heavily implies) to provide for their children demotes them to the role of "bad mothers" who are undeserving of policy benefits – and instead possibly deserving of punishment. But if "substance-using" is added to "welfare mothers," the result is "very bad mothers" who have exposed their unborn children to the potential harms of substance use, blatantly defying the powerful and enduring social norm that mothers should be the best protectors of and advocates for their children. They are (often) shoved to the furthest corner of the framework – armed with minimal political power and saddled with exceptionally negative social construction and oversubscribed burdens, including threats of the loss of parental rights, child abuse charges and civil commitment (in the case of punitive policies). Motherhood, then, especially when that mother is pregnant, serves as a powerful trigger for relatively large movements or shifts within and across spaces in this framework.

Another trigger that is especially relevant for the policy space around prenatal substance use is race/ethnicity. Systemic racism has resulted in widely different social constructions of Black versus White mothers struggling with substance use during pregnancy, and these different social constructions have resulted in major variations in

policy design and troubling inequities in treatment.[22] When policymakers waged their War on Drugs in the 1980s, the policies and rhetoric – even in popular media – were focused on the demonization and punishment of Black women who used substances during pregnancy.[22] The policy environment, characterized by punitive policies criminalizing prenatal substance use, reflected the weak and starkly negative social construction of the population at risk: Black mothers pathologically using crack cocaine.[22] As prenatal substance use shifted to affect more White suburban women, so too did the rhetoric and policy design: the crack cocaine scare became the opioid crisis, and criminalization policies gave way to the development of more supportive policies emphasizing treatment.[22]

I would argue that it is possible – though challenging[79] – for thoughtful and evidence-informed policy design to minimize or even overturn this harmful dynamic between pregnant women who use substances and the policy process. Punitive policies perpetuate a narrative of stigma, blame and deservingness,[79] but treatment-supportive policies that promote and protect access to affordable and effective health care coverage have the power to shift the social construction and eventually the self-perceptions and individual behavior of women who use substances during pregnancy. They can move from "very bad" mothers in the furthest bottom-right corner of the framework to a more positive and deserving position on the "dependents" side, and potentially even move closer to the "contenders" space through the dignity and empowerment allowed to them via treatment-supportive policy approaches, or even via more cohesive, multidimensional policy strategies such as that embodied in the Swiss Four Pillars Policy.[26] When institutionally and administratively linked with initiatives promoting prevention,

treatment, and harm reduction, even "punitive" policies can lose some of their sting, and be incorporated in a patient-centered policy strategy. Over time, policy design can help to shape social constructions, and vice versa, such that policies that take or incorporate a public health or treatment-supportive approach to combatting prenatal substance use can fundamentally reshape our understanding and treatment of this vulnerable group.

II. Social Construction of Motherhood: "Good" and "Bad" Mothers[ii]

As the Schneider and Ingram framework illustrates,[78] policy approaches designed for pregnant women with OUD are greatly affected by the lens through which these women are viewed. Differences in perception, often the result of social constructs, can directly or indirectly result in differential treatment and impact. In this case, the social constructs of 'good' and 'bad' mothers are especially influential; they tend to evolve with society, shaping to fit the norms and customs of time and place. The most recent characterization of the 'good' mother is that of professionalized motherhood, wherein mothers are expected to become experts on and advocates for their children, their children's lives, and their children's individual needs.[80,81]

'Bad' mothers have most recently been defined and criminalized by the War on Drugs, beginning in the 1970s and perpetuated by the 1994 crime bill. A study conducted in 2005[82] found that 35 states criminally prosecuted women found to be using alcohol or drugs during pregnancy, including states that did not have laws specifically criminalizing drug or alcohol use during pregnancy at the time. This strategy endures, as

[ii] This section of the dissertation is adapted from a course paper that Lauryn King and I wrote for PPPA 8091 in December 2019: "How Can the Philosophy of Social Science Help Us to Understand and Address Substance Abuse During Pregnancy?"

criminal justice and medical establishments across the U.S. legislate the punishment of 'bad' mothers by loosely interpreting and applying other laws on the books, such as those against child endangerment, child abuse or delivery of drugs to a minor.[83,84] By identifying and threatening to sanction mothers suspected of using illicit substances during pregnancy, the criminal justice system seeks to criminalize, confine, detain, or incarcerate 'bad' and 'unfit' mothers.[84] The use of substances during pregnancy is treated as a moral failing, rather than a chronic medical condition.[28]

In fact, female substance users are punished twice: first for breaking the law and second for violating the accepted norms of femininity, especially the formidable expectations of motherhood.[85] This conceptualization creates and perpetuates the 'good' and 'bad' mother dichotomy, ignoring the political, socioeconomic, and structural contexts that are inextricably linked to prenatal substance use. The most punitive policies addressing prenatal substance use can be used to legitimize this dichotomy and attach the identities of 'addict' and 'bad' motherhood. This is especially problematic, because treatment programs often encourage women to view their motherhood as both a starting point and rationale for their recovery. In the case of relapse, her identity is reduced to maternal failure and addict.[85] Once again, a policy approach that incorporates a variety of mutually-reinforcing strategies for addressing prenatal substance use (like that exemplified in the Swiss Four Pillars Policy[26]) has the potential to soften and even remove the harmful depiction of mothers who use substances, replacing it with a practical and empathetic construction of a mother struggling with a challenging but treatable chronic disease.

Criminal Justice and Law Enforcement: Deterrence Theory.[75,iii]

Deterrence theory illuminates the rationale behind punitive policies addressing prenatal opioid use. Historically, the American criminal justice system has relied on four justifications for criminal punishment: rehabilitation, incapacitation, retribution, and deterrence.[83] Rehabilitation and incapacitation, which focus on reforming the offender or removing the offender from the general population, have become less relevant in the U.S. over time. Retribution, which punishes the offender for their offense, and deterrence, which attempts to dissuade potential offenders before they commit a crime, has grown more popular in its place.

For more than four decades, policymakers have largely relied on the tenets of classical deterrence theory in their efforts to reduce substance use through the criminal justice system's enforcement of fetal protection laws. According to this theory, (1) individuals make decisions based on what will bring them pleasure and help them avoid pain, and in the absence of deterrence, they will pursue these desires, even by committing crimes; (2) punishments should be swift, certain and proportionate to the crime in order to appropriately deter individuals from violating the law, and (3) laws should be clearly written and publicized so that individuals are educated about the consequences of their behavior.[75,86] Potential offenders will respond either to (a) a law that increases the punishment for a particular behavior (increased severity of punishment) or to (b) changes in local prosecutorial policy (increased certainty) by adjusting their behavior to reduce the risk of apprehension and conviction.[87] The central concept of classical deterrence

iii This section of the dissertation is adapted from a course paper that Lauryn King and I wrote for PPPA 8091 in December 2019: "How Can the Philosophy of Social Science Help Us to Understand and Address Substance Abuse During Pregnancy?"

theory is that in some circumstances, sticks rather than carrots may be necessary to shift the balance of incentives and change behavior, such that policy efforts to modify behavior must employ the use of sticks.

However, research has demonstrated that individuals with substance use disorders are unlikely to respond to threats of punishment as classical deterrence theory would anticipate, and women using substances during pregnancy are even less likely to do so.[83,87] Pregnant women with substance use disorders are disproportionately lower-income, socially isolated, and have lower educational attainment, and they often have co-occurring mental health conditions, which can exacerbate feelings of isolation.[87] In some situations, substance use becomes a way of self-medicating,[88] coping with unmet mental health needs,[89] or adapting to painful or seemingly inescapable personal circumstances, such that the decision (or series of decisions) to misuse substances is neither rational or irrational.

Importantly, a small but growing literature suggests that punitive policies may have the opposite and unintended effect of deterring these women from any governmental authorities, even those offering help, and this deterrence is exacerbated by the lack of trust that these women have in health care providers.[87] It is also possible that the fear and lack of trust perpetuated by punitive policies may be longer-lasting than the policies themselves, and may dampen the benefits of treatment-supportive efforts. In other words, even if the policy is repealed and replaced with a better one, the damage to trust and utilization among pregnant women with OUD may be slower to repair.

In the case of punitive policies relating to toward pregnant women with OUD, some of which require health care providers to report suspicions of prenatal drug use and

go so far as to threaten to remove infants from the custody mothers who do not comply with mandatory and often logistically complicated treatment protocols, this reluctance to enter into care seems very likely and is supported by empirical research. Multiple studies[32,33,36,37,63-65] (the limitations of which are described in the significance portion of this dissertation) have found negative associations of punitive policies on the health-seeking behaviors of and birth outcomes for pregnant women with substance abuse disorders, lending credence to the theory that punitive policies act as a deterrent to appropriate prenatal care and substance abuse treatment, pushing these women into the shadows of a complex and powerful health care system. However, national evidence for the Medicaid population is lacking.

Women seeking prenatal care or substance use treatment often face different realities, which are heavily influenced by their socioeconomic status and possibly by race/ethnicity. As a result of their disproportionate use of Medicaid and other publicly-funded services, low-income Black women are far more likely than white or middle-income women to already be under surveillance.[90] In fact, multiple studies have found that Black women and their newborns were significantly more likely to be tested for illicit substance use compared to their non-Black counterparts.[91,92] This increased surveillance represents a driving factor for the entrance of many pregnant women into the criminal justice system, and because low-income Black women are more likely to be observed engaging in prenatal opioid use, they are also more likely to suffer the impacts of punitive policies than their wealthier or white counterparts.

These theoretical foundations form the conceptual basis of my dissertation. They illustrate a variety of mechanisms for and beliefs about behavior change in the wake of

state-level policy change, and they also help to explain why disparities in OUD treatment and perinatal care utilization may exist. In the following chapters, I build upon these frameworks to empirically examine opioid use disorder outcomes among pregnant women in Medicaid, exploring trends and disparities over time and analyzing their association with punitive child welfare policies.

Chapter Three: Trends and Disparities in Opioid Use Disorder Treatment Among Pregnant Women in Medicaid: 2007-2012

Highlights

- There is limited evidence on the association between race/ethnicity and OUD treatment during pregnancy.
- Black and American Indian/Alaskan Native (AI/AN) women were less likely to receive any perinatal OUD treatment and MOUD relative to non-Hispanic White women.
- The disparity in any perinatal OUD treatment between Black and Non-Hispanic White women increased between 2007 and 2012.

Abstract

Background. Pregnant women represent a vulnerable population affected by opioid misuse, but the degree to which sociodemographic and clinical characteristics are associated with receipt and type of OUD treatment is not well-understood.

Methods. Using Medicaid Analytic eXtract (MAX) data from 50 states and the District of Columbia from 2007 to 2012, we identified 74,570 deliveries among women with OUD aged 18-44 years. Logistic regressions modeled the association between sociodemographic and clinical characteristics and receipt of any OUD treatment, medication for OUD (MOUD), and counseling alone during the perinatal period. Interacted logistic regression models were used to examine differential

associations between race/ethnicity and treatment over time.

Results. Rates of any OUD treatment and MOUD for women with OUD-affected deliveries increased over time, but trends differed for subgroups.

Compared to non-Hispanic White women, Black and American Indian/Alaskan Native (AI/AN) women were less likely to receive any OUD treatment (aOR=0.55, 95%CI 0.52 to 0.59; aOR=0.60, 95%CI 0.53 to 0.67, respectively) and MOUD (aOR=0.39, 95%CI 0.36 to 0.43; aOR=0.87, 95%CI 0.75 to 1.00, respectively). Over time, the disparity in receipt of any OUD treatment between Black and White women increased, with Black women becoming progressively less likely to receive any OUD treatment relative to White women.

Conclusions: Although the overall rate of OUD treatment increased during the study period, this trend was driven by improvements in perinatal OUD care for White women and obscured disparities for Black and AI/AN women. These results underscore the importance of addressing disparities in perinatal OUD treatment.

Acknowledgements: I would like to acknowledge coauthors on this study: Brendan Saloner, Beth Ann Griffin, Bradley Stein, Mishka Terplan and Laura Faherty.

1. Introduction

Opioid misuse has increased among pregnant women in recent decades, exacerbating the already substantial risks of maternal morbidity and mortality in the United States.[5] Between 2010 and 2017, the rate of maternal opioid-related diagnoses increased from 3.5 to 8.2 per 1,000 hospital births, representing a 134% increase over an eight-year period.[6] Untreated opioid use disorder during pregnancy is associated with poor health outcomes for the mother-infant dyad.[7-10] Medicaid-insured women are disproportionately impacted by prenatal opioid misuse and its associated harms. Medicaid is the primary payer for 75% of substance use-related maternal hospitalizations and covers roughly 80% of annual hospital costs related to neonatal opioid withdrawal syndrome (NOWS),[46] a clinical condition affecting some infants exposed to opioids *in utero*.

Medication for opioid use disorder (MOUD, e.g., methadone and buprenorphine) is the standard of care for pregnant women with OUD,[13] reducing the risk of relapse and subsequent overdose.[13,21] MOUD also improves adherence to prenatal care and substance use disorder treatment programs, and reduces the risk of obstetric complications and adverse birth outcomes.[13,21] Although MOUD is recommended for pregnant women with OUD, many receive counseling alone, if they receive OUD treatment at all.[36,46] This gap in evidence-based care is likely influenced by a myriad of factors, including misinformation and stigma surrounding OUD generally and the use of MOUD specifically, especially during pregnancy;[34,46,93-99] fear of punitive responses, including reporting of suspected or confirmed prenatal substance use to Child Protective Services (CPS) or health officials;[93,94,100] and difficulty accessing substance use treatment

providers that both accept Medicaid and treat pregnant women with OUD.[46,101,102] Researchers have found racial and ethnic disparities in receipt of perinatal OUD treatment in Medicaid,[66-71] but national evidence is lacking, especially for American Indian/Alaskan Native women.

The degree to which sociodemographic and clinical characteristics, in particular, race/ethnicity and pre-existing chronic conditions, are associated with OUD treatment receipt and type of treatment (i.e., MOUD or counseling alone) is not well-understood. Our study addresses this gap in the literature by leveraging a national, multi-year Medicaid claims database to (1) describe characteristics of women who do and do not receive treatment for OUD in the perinatal period and (2) describe trends and disparities in perinatal OUD treatment receipt among women in Medicaid. By better understanding disparities in perinatal OUD treatment, we can develop appropriate strategies to address the inequitable burden of perinatal OUD.

2. Methods

2.1 Data and Sample

We used 2006-2014 Medicaid Analytic eXtract (MAX) files for 50 states and the District of Columbia, which contain information on inpatient and outpatient services, eligibility, and prescription drug utilization, to identify women 18 to 44 years of age who had a delivery hospitalization[103] from January 1, 2007, to December 31, 2012. We included deliveries for women who were Medicaid-enrolled during the month of delivery and at least one month in either the prenatal or postpartum period. We excluded deliveries that occurred before or after the study period to allow for sufficient observation

during the prenatal and postpartum periods. Medicaid MAX data were not available for all states in each year we examined. Appendix Table A1 shows the states and years of data availability.

The MAX dataset contains all Medicaid claims for all individuals with Internal Classification of Disease-Ninth Revision (ICD-9) codes for OUD in any diagnosis field over the period 2006-2014, plus all claims for a random sample of control individuals without an OUD diagnosis. We identified OUD-affected deliveries that occurred during our study period; ICD-9 codes used to identify OUD are provided in Appendix Table A2.

2.2 Outcome Variables

We used *Current Procedural Technology* (CPT) codes, *Healthcare Common Procedure Coding System* (HCPCS) codes, and National Drug Codes (NDCs) to identify OUD treatment, including counseling and/or MOUD (including buprenorphine and methadone maintenance treatment), for inpatient and outpatient claims during the prenatal period, defined as 260 days prior to delivery, and 365 days postpartum. We identified patients receiving buprenorphine formulations approved by the Food and Drug Administration (FDA) for OUD treatment, excluding buprenorphine formulations only approved for pain management. A list of CPT and HCPCS codes used to identify methadone maintenance treatment are provided in Appendix Table A3.

2.3 Independent Variables

ICD-9 codes were used to identify woman with a concurrent mental health condition, other pre-existing chronic condition, or pregnancy-specific comorbidity (see

Appendix Table A4 for the ICD-9 codes included)[104,105]. Women were categorized by age (18-25 years, 26-35 years, and 36-44) and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Non-Hispanic American Indian or Native Alaskan [AI/AN], or other/unknown). We defined the delivery year and state as the calendar year and state in which the delivery hospitalization occurred. We identified county-level urbanicity (categorized as metropolitan, non-metropolitan adjacent to a metropolitan area, and non-metropolitan not adjacent to a metropolitan area) using 2013 Rural-Urban Continuum Codes.[106]

2.4 Analytic Approach

We conducted univariate and bivariate analyses to describe characteristics of Medicaid-enrollees with treated and untreated OUD during the perinatal period. Multivariable logistic regressions were conducted to examine the extent to which sociodemographic and clinical factors such as age, race/ethnicity, mental health comorbidities, chronic conditions, and pregnancy complications, and county-level urbanicity were associated with (1) any OUD treatment, (MOUD and/or counseling) versus no treatment, and (2) conditional on receipt of OUD treatment, receipt of MOUD versus counseling alone. Additional models included interactions between non-Hispanic Black race and year indicators to test for differential associations between race and treatment receipt over time. We structured the analysis as a pooled cross-sectional analysis, allowing women to contribute multiple deliveries, and clustering standard errors at the individual level. We included year and state fixed effects to account for state- and time-invariant characteristics.

To examine whether shorter periods of Medicaid eligibility affected the likelihood of OUD treatment, we conducted a sensitivity analysis in which we restricted our analytic sample to deliveries with more consistent eligibility: eligibility for the month of delivery plus at least two months during the prenatal period and at least two months during the postpartum period. The findings were generally consistent with those from our main analyses and are presented in the Appendix (Tables A5-A6). Analyses were conducted using STATA 16.0 (College Station, TX). The RAND institutional review board approved the research with a waiver of informed consent.

3. Results

3.1 Descriptive Results

3.1.1 Any OUD Treatment

Of 74,570 OUD-affected deliveries, 50,950 (68%) received any OUD treatment (Table 1). Overall unadjusted rates of OUD treatment increased from 58% to 72% from 2007 to 2012. Compared to non-Hispanic White women, Black and AI/AN women were consistently less likely to receive any OUD treatment, and the gap between Black and White women appeared to widen over time: in 2007, non-Hispanic Black and AI/AN women were 6 and 7 percentage points less likely to receive any OUD treatment compared to non-Hispanic White women, respectively, but by 2012, the gap between Black and White women had grown to 14 percentage points (Figure 1).

3.1.2 MOUD Conditional on Any OUD Treatment

Of 50,950 OUD-affected deliveries receiving any OUD treatment, 32,409 (63.6%) received MOUD (Table 1). The unadjusted rate of MOUD among women receiving OUD treatment increased from 57% to 66% between 2007 and 2012. Relative to non-Hispanic White women, Black women were roughly 20 to 30 percentage points less likely to receive MOUD in each year, and beginning in 2009, AI/AN women were roughly 10 to 15 percentage points less likely to receive MOUD (Figure 2). Appendix Figure A1 shows the corresponding trends in receipt of counseling alone by race/ethnicity.

3.2 Multivariable Logistic Regression Results

3.2.1 Any OUD Treatment

In adjusted models, women ages 26-35 were more likely to receive any OUD treatment relative to younger women (70% vs 66%, aOR = 1.18, 95% CI 1.14 to 1.22). Non-Hispanic Black (56.1%, aOR = 0.55, 95% CI 0.52 to 0.59) and AI/AN (64.5%, aOR = 0.60, 95% CI 0.53 to 0.67) women were less likely to receive OUD treatment relative to non-Hispanic White women (70.2%). Women living in rural areas (71.5%, aOR = 1.26, 95% CI 1.17 to 1.36) were more likely to receive OUD treatment than those in metro areas (68.2%) or non-metro adjacent areas (67.1%). Women with mental health conditions (79.1%, aOR = 2.80, 95% CI 2.70 to 2.90) and other pre-existing chronic conditions (72.0%, aOR = 1.09, 95% CI 1.04 to 1.13) were more likely to receive OUD treatment.

In models with interactions between non-Hispanic Black and year indicators,

Black women were consistently and significantly less likely to receive any OUD treatment relative to non-Hispanic White women in each year of the study period (Table 2). The odds of non-Hispanic Black women receiving any OUD treatment relative to non-Hispanic White women decreased over time, from aOR = 0.79 (95% CI 0.68 to 0.92) in 2007 to 0.62 in 2012 (95% CI 0.51 to 0.75).

3.2.2 Type of Treatment: MOUD versus counseling alone

In adjusted models conditional on receiving any OUD treatment, women ages 26-35 were more likely to receive MOUD relative to younger women (66.2% vs 60.3%, aOR =1.32, 95% CI 1.27 to 1.38) (Table 1). Non-Hispanic Black (40.7%, aOR = 0.39, 95% CI 0.36 to 0.43) and AI/AN women (57.2%, aOR = 0.87, 95% CI 0.75 to 1.00) were less likely to receive MOUD relative to non-Hispanic White women (65.8%), although the odds ratio was only marginally significant for AI/AN women. Women living in rural areas were more likely to receive MOUD than those in metro areas or non-metro adjacent areas. Women with mental health conditions (59.7%, aOR= 0.65, 95% CI 0.62 to 0.68), pre-existing chronic conditions (60.7%, aOR= 0.94, 95% CI 0.90 to 0.99) and pregnancy complications (61.3%, aOR= 0.93, 95% CI 0.89 to 0.97) were less likely to receive MOUD than those without.

In adjusted models with interactions, non-Hispanic Black women were consistently less likely to receive MOUD relative to non-Hispanic White women, but the gap between these two groups fluctuated over time (Table 2). Overall, conditional on receiving treatment, non-Hispanic Black women had higher odds of receiving counseling alone, (aOR=2.55, 95% CI 2.35 to 2.78) (Table 1) and in interacted models, the gap

between these two groups also fluctuated over the study period (Table 2).

4. Discussion

In our analysis of trends and disparities in OUD treatment among Medicaid-insured pregnant women with OUD, we found that compared to non-Hispanic White women, Black and AI/AN women were less likely to be treated for OUD and if treated, were less likely to receive the standard of care with MOUD. Because MOUD is associated with improved outcomes for women and infants,[13] these disparities in OUD treatment may be exacerbating well-described racial inequities in perinatal outcomes, including reduced prenatal care engagement, increased risk of maternal morbidity and mortality, and increased risk of preterm birth.[66,107-109] Although overall rates of any OUD treatment and MOUD for perinatal OUD increased over the study period, differing trends for Black and AI/AN women compared to White women underscore the inequitable gains in receipt of evidence-based perinatal OUD treatment.

Our findings for non-Hispanic Black and AI/AN women are consistent with research indicating racial disparities in OUD treatment generally[110-112] and perinatal OUD treatment specifically.[66-71,113,114] Black and AI/AN women face unique barriers to OUD treatment, both systemic and cultural, which may help to explain observed disparities. Structural racism[115] in the health care system combined with increased patient distrust of health care[116] contribute to inequitable access to appropriate OUD care. Research has documented inequitable distribution of buprenorphine and methadone treatment programs, with greater concentration in higher-income, predominantly White residential social areas.[117] Experiences of interpersonal racism have been linked to lower perceived

quality of care, medical mistrust and reduced adherence to prescribed treatment,[69,118] and medical mistrust and reluctance to engage in treatment among Black Americans is likely exacerbated by the history of punitive policy responses toward pregnant women who use drugs – especially Black women.[37,64,66,119,120] Racial bias among clinicians has been linked with poor patient-provider communication and lower patient satisfaction, especially among Black individuals.[69,121] Further, many Black individuals encounter substance abuse treatment through their contact with the criminal justice system,[122-124] and women with perinatal OUD referred by criminal justice agencies are less likely to receive MOUD relative to women referred through other settings.[125]

Similar to Black individuals, AI/AN individuals are more likely than White individuals to encounter substance abuse treatment via the criminal justice system.[126] For AI/AN individuals, a population for which overdose mortality is second only to White individuals,[114] the mismatch between Western medical versus holistic healing traditions often makes MOUD culturally unacceptable.[114,126,127] For many AI/AN women struggling with perinatal OUD, the implementation of a "two-eyed seeing" approach[114] that integrates both Indigenous and Western worldviews would likely improve patient engagement and OUD treatment acceptability.[114,128-133] Policy strategies for reducing disparities in perinatal OUD treatment must acknowledge the structural and cultural barriers and work to engage women in integrated, patient-centered decision-making. Of note, other research has documented disparities in OUD treatment and MOUD for Hispanic women,[66-69] but we did not observe the same differences in our data. One possible explanation for this discrepancy is that other studies used single-state Medicaid[66,68,69] or TEDS-Discharge data,[67] whereas we examined all OUD-affected

deliveries in a national Medicaid data set, and because significant diversity exists within the broader community of individuals with Hispanic ethnicity, important variation may exist across states and types of insurance.

We found that older pregnant women with OUD were significantly more likely to receive any OUD treatment and MOUD compared to their younger counterparts, consistent with research documenting higher rates of MOUD receipt among older adults.[111] It is possible that because women with more advanced maternal age face increased risk of adverse perinatal outcomes,[134] they may be followed more closely throughout pregnancy, providing more opportunities to engage in OUD treatment.

Pregnant women with a mental health condition were significantly more likely to receive any OUD treatment as well as MOUD, consistent with research documenting higher use of MOUD among individuals with dual mental health diagnoses, including pregnant women.[105,135] The higher likelihood of any OUD treatment receipt is not surprising, as presumably many of these women are receiving counseling for co-occurring OUD and mental health conditions. As for MOUD, pregnant women with mental health conditions often have higher utilization of health care, potentially facilitating access to appropriate OUD treatment.

Pregnant women with pre-existing chronic conditions and pregnancy complications face higher risk of adverse perinatal outcomes[136-139] and are therefore monitored more closely during the perinatal period. This increased engagement may affect their likelihood of receiving treatment for OUD, which is supported by our finding that pregnant women with pre-existing chronic conditions and pregnancy complications were more likely to receive any OUD treatment. Our finding that they were less likely to

receive MOUD should be explored in future work.

This study must be viewed within the context of its limitations. First, we do not have all states for all years in the study period. Second, our data were collected prior to 2015, but the study period marks a critical phase of the opioid crisis, during which the use of MOUD in the Medicaid population became increasingly common, including among pregnant women, [140-145] and our findings are consistent with more recent analyses of racial/ethnic disparities in perinatal OUD treatment.[66,146] In addition, the disparities we observed across sociodemographic and clinical groups during this period are likely useful in current efforts to grapple with ongoing structural racism in the treatment of pregnant women with OUD.[124] Women may lose Medicaid coverage during our study period and become unobservable in our data. While our sensitivity analysis requirement that women must be enrolled in Medicaid for at least 5 months during the perinatal period maximizes the likelihood of observing women with brief periods of Medicaid enrollment, we cannot completely capture patient churn over time. Finally, our findings may not be generalizable to commercially-insured populations or Medicaid-enrollees in states not included in our sample.

5. Conclusion

Despite these limitations, our study is among the first to use a national, multi-year Medicaid claims dataset to examine disparities by race/ethnicity, age and clinical comorbidities in OUD treatment among pregnant women with OUD. Since the end of our study period, perinatal opioid use has continued to increase: between 2010 and 2017, the number of women with opioid-related diagnoses at delivery increased by 131%.[6]

Pregnancy can represent an important window for OUD treatment, both because Medicaid has higher income eligibility thresholds for women during pregnancy and because many women are motivated to change their behavior to protect the health of their unborn child.[29,147,148] As opioid overdose deaths among Black Americans now outpace those for their White counterparts[149] and the rate of prescription opioid misuse and overdose in AI/AN populations remains higher than that for all other racial/ethnic groups, it is imperative that policymakers and health care providers consider culturally-sensitive, patient-centered approaches to address racial and ethnic disparities in perinatal OUD treatment.

Tables and Figures

Figure 1. Percent of OUD-Affected Deliveries with Any OUD Treatment, by Race/Ethnicity

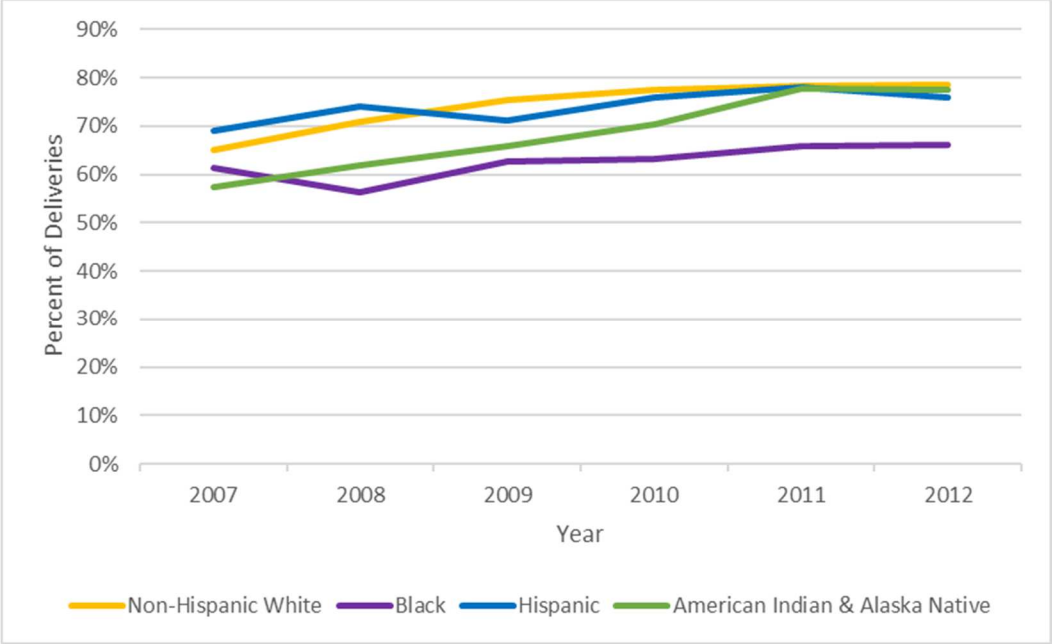


Figure 2. Percent of Treated OUD-Affected Deliveries with MOUD, by Race/Ethnicity

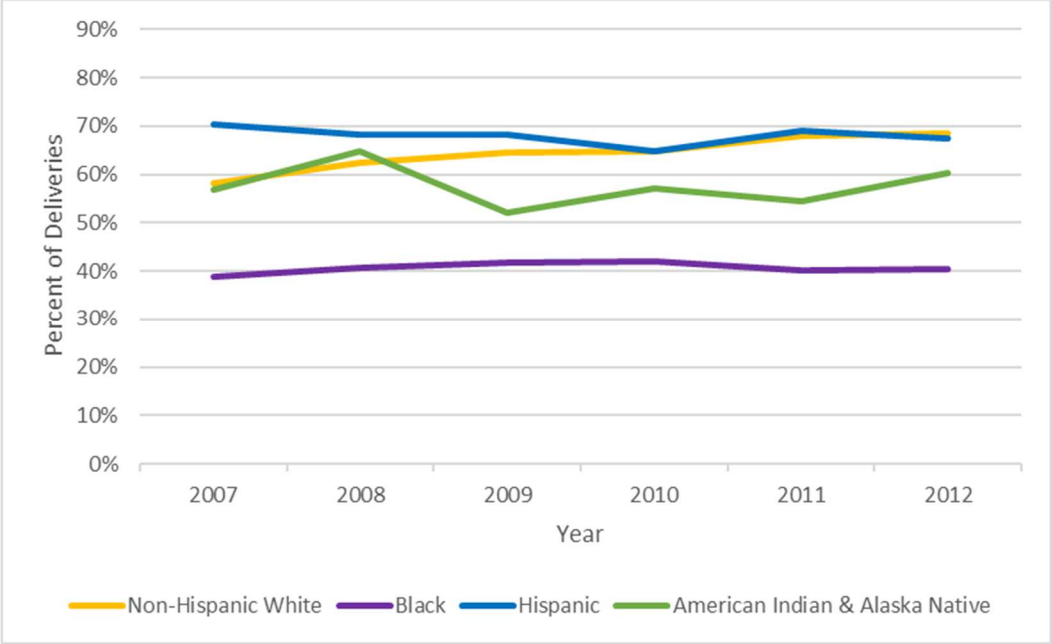


Table 1. Odds of Receipt and Type of OUD Treatment Among OUD-Affected Deliveries (50 states and the District of Columbia, 2007-2012)

	OUD-Affected Deliveries (N=74,570)		OUD-Affected Deliveries Receiving Treatment (N=50,950)			
	Any OUD Treatment N (%)	Any OUD Treatment aOR (95% CI)	MOUD N (%)	MOUD aOR (95% CI)	Counseling Only N (%)	Counseling Only aOR (95% CI)
Sociodemographic Characteristics	50,950 (68.3)	-	32,409 (63.6)	-	18,541 (36.4)	-
Age						
18-25 (omitted)	17,441 (65.5)	REF	10,512 (60.3)	REF	6,929 (39.7)	REF
26-35	28,984 (70.0)	1.18 (1.14, 1.22)	19,184 (66.2)	1.32 (1.27, 1.38)	9,800 (33.8)	0.75 (0.72, 0.79)
36-44	4,525 (69.1)	1.20 (1.13, 1.29)	2,713 (60)	1.16 (1.07, 1.25)	1,812 (40.0)	0.86 (0.80, 0.94)
Race/Ethnicity						
Non-Hispanic White (omitted)	40,876 (70.2)	REF	26,896 (65.8)	REF	13,980 (34.2)	REF
Non-Hispanic Black	3,542 (56.1)	0.55 (0.52, 0.59)	1,441 (40.7)	0.39 (0.36, 0.43)	2,101 (59.3)	2.55 (2.35, 2.78)
Hispanic	3,828 (66.4)	1.01 (0.94, 1.09)	2,596 (67.8)	1.06 (0.97, 1.17)	1,232 (32.2)	0.94 (0.86, 1.03)
American Indian & Alaska Native	1,386 (64.5)	0.60 (0.53, 0.67)	793 (57.2)	0.87 (0.75, 1.00)	593 (42.8)	1.15 (1.00, 1.33)
Other/Unknown Race/Ethnicity	1,318 (63.3)	0.73 (0.66, 0.82)	683 (51.8)	0.69 (0.6, 0.79)	635 (48.2)	1.45 (1.26, 1.66)
Urbanicity						
Metro (omitted)	39,695 (68.2)	REF	25,352 (63.9)	REF	14,343 (36.1)	REF
Non-metro, adjacent to urban area	6,766 (67.1)	0.92 (0.87, 0.97)	4,195 (62.0)	0.84 (0.79, 0.90)	2,571 (38.0)	1.19 (1.11, 1.26)
Non-metro, not adjacent to urban area	4,489 (71.5)	1.26 (1.17, 1.36)	2,862 (63.8)	1.22 (1.12, 1.33)	1,627 (36.2)	0.82 (0.75, 0.89)
Clinical Characteristics						
Mental Health Comorbidities	31,748 (79.1)	2.80 (2.70, 2.90)	18,946 (59.7)	0.65 (0.62, 0.68)	12,802 (40.3)	1.53 (1.47, 1.60)
Any Chronic Condition	12,943 (72.0)	1.09 (1.04, 1.13)	7,858 (60.7)	0.94 (0.90, 0.99)	5,085 (39.3)	1.06 (1.01, 1.12)
Any Pregnancy Complication	26,410 (70.3)	1.02 (0.98, 1.05)	16,192 (61.3)	0.93 (0.89, 0.97)	10,218 (38.7)	1.07 (1.03, 1.12)

Table 2. Odds of Receipt and Type of OUD Treatment Among OUD-Affected Deliveries with Black and Year Interactions (50 states and the District of Columbia, 2007-2012)

	OUD-Affected Deliveries (N=74,570)	OUD-Affected Deliveries Receiving Treatment (N=50,950)	
	Any OUD Treatment aOR (95% CI)	MOUD aOR (95% CI)	Counseling Only aOR (95% CI)
Sociodemographic Characteristics			
Age			
18-25 (omitted)	REF	REF	REF
26-35	1.18 (1.14, 1.22)	1.32 (1.27, 1.38)	0.76 (0.72, 0.79)
36-44	1.20 (1.12, 1.28)	1.15 (1.06, 1.24)	0.87 (0.80, 0.94)
Race/Ethnicity			
Non-Hispanic White (omitted)	REF	REF	REF
Non-Hispanic Black	0.79 (0.68, 0.92)	0.54 (0.44, 0.67)	1.84 (1.49, 2.28)
Hispanic	1.01 (0.94, 1.09)	1.07 (0.97, 1.17)	0.94 (0.86, 1.03)
American Indian & Alaska Native	0.60 (0.53, 0.67)	0.87 (0.75, 1.00)	1.15 (1.00, 1.33)
Other/Unknown Race/Ethnicity	0.73 (0.66, 0.81)	0.69 (0.60, 0.79)	1.45 (1.26, 1.66)
Interaction between Year & Non-Hispanic Black			
2007 & Non-Hispanic Black (omitted)	REF	REF	REF
2008 & Non-Hispanic Black	0.73 (0.59, 0.90)	0.85 (0.63, 1.15)	1.18 (0.87, 1.59)
2009 & Non-Hispanic Black	0.69 (0.56, 0.84)	0.78 (0.58, 1.04)	1.29 (0.96, 1.72)
2010 & Non-Hispanic Black	0.66 (0.54, 0.81)	0.80 (0.60, 1.06)	1.25 (0.94, 1.66)
2011 & Non-Hispanic Black	0.66 (0.54, 0.80)	0.63 (0.48, 0.83)	1.58 (1.21, 2.08)
2012 & Non-Hispanic Black	0.62 (0.51, 0.75)	0.58 (0.44, 0.75)	1.73 (1.33, 2.25)
Urbanicity			
Metro (omitted)	REF	REF	REF
Non-metro, adjacent to urban area	0.92 (0.87, 0.97)	0.84 (0.79, 0.90)	1.19 (1.11, 1.26)
Non-metro, not adjacent to urban area	1.26 (1.17, 1.36)	1.22 (1.12, 1.33)	0.82 (0.75, 0.89)
Clinical Characteristics			
Mental Health Comorbidities	2.80 (2.71, 2.90)	0.65 (0.63, 0.68)	1.53 (1.47, 1.60)
Any Chronic Condition	1.09 (1.04, 1.13)	0.94 (0.90, 0.99)	1.06 (1.01, 1.11)
Any Pregnancy Complication	1.02 (0.98, 1.05)	0.93 (0.90, 0.97)	1.07 (1.03, 1.12)

Appendix

Table A1. States and Years Available in the MAX Data

State	2006	2007	2008	2009	2010	2011	2012
AK	X	X	X	X	X	X	X
AL	X	X	X	X	X	X	X
AR	X	X	X	X	X	X	X
AZ	X	X	X	X	X	X	X
CA	X	X	X	X	X	X	X
CO	X	X	X	X	X	X	X
CT	X	X	X	X	X	X	X
DC	X	X	X	X	X	X	X
DE	X	X	X	X	X	X	X
FL	X	X	X	X	X	X	X
GA	X	X	X	X	X	X	X
HI	X	X	X	X	X	X	X
IA	X	X	X	X	X	X	X
ID	X	X	X	X	X		X
IL	X	X	X	X	X	X	X
IN	X	X	X	X	X	X	X
KS	X	X	X	X		X	X
KY	X	X	X	X	X	X	X
LA	X	X	X	X	X	X	X
MA	X	X	X	X	X	X	X
MD	X	X	X	X	X	X	X
ME						X	X
MI	X	X	X	X	X	X	X
MN	X	X	X	X	X	X	X
MO	X	X	X	X	X	X	X
MS	X	X	X	X		X	X
MT	X	X	X	X	X	X	X
NC	X	X	X	X	X	X	X
ND	X	X	X	X	X	X	X
NE	X	X	X	X	X	X	X
NH	X	X	X	X	X	X	X
NJ	X	X	X	X	X	X	X
NM	X	X	X	X	X	X	X
NV	X	X	X	X	X	X	X
NY	X	X	X	X	X	X	X
OH	X	X	X	X	X	X	X
OK	X	X	X	X	X	X	X
OR	X	X	X	X	X	X	X

PA	X	X	X	X	X	X	X
RI	X	X	X	X	X	X	X
SC	X	X	X	X	X	X	X
SD	X	X	X	X	X	X	X
TN	X	X	X	X	X	X	X
TX	X	X	X	X	X	X	X
UT	X	X	X	X	X	X	X
VA	X	X	X	X	X	X	X
VT	X	X	X	X	X	X	X
WA	X	X	X	X	X	X	X
WI	X	X	X	X	X	X	X
WV	X	X	X	X	X	X	X
WY	X	X	X	X	X	X	X

Appendix Table A2. OUD ICD-9 Codes

OUD[105]	304.00-304.03; 304.70-304.73, 305.50-305.53, 965.00, 965.01, 965.02, 962.09, E850.0, E935.0

Appendix Table A3. Methadone Maintenance CPT & HCPCS Codes

Methadone Maintenance Treatment	H0020, Z2006, Z3357, 02200, 2973, 1671, Z1856, 02206, 1564, 1543, Z1854, H0033, X0321, 02208, 02250, 02202, 02256, 02207, 1618, T1502, S0109

Appendix Table A4. Comorbidities ICD-9 Codes[104]

Mental Health Conditions[105]	**All**	295.X, 296.X, 311.XX,648.4X, 300.0X, 309.8X
Chronic Conditions[104]	**Chronic Respiratory Disease**	491.X – 496.X
	Chronic Hypertension	401.X-405.X, 642.0X, 642.1X, 642.2X, 6427.X
	Diabetes	249.X, 250.X, 648.0X
	Chronic Heart Disease	412.X-414.X, 394.X-397.X, 424.X, 428.22, 428.23, 428.32, 428.33, 428.42, 428.43, 745.0X-747.4X, 648.5X
	Chronic Renal Disease	581.X-583.X, 585.X, 587.X, 588.X, 646.2X
	Chronic Liver Disease	571.X, 572.X

	HIV	042.X, V08.X
Pregnancy Complications	**All**	641.0, 641.1, 641.8, 641.9, 642.3, 642.4, 642.5, 642.6, 642.9, 648.0, 648.1, 648.2, 648.8, 649.5, 648.6, 648.7, 648.9

Model Specification.

Basic Model. The multivariable logistic regression equation that we used in our analysis is provided below:

$$\text{logit}(Y) = \beta_0 + \beta_1 Race + \beta_2 Age + \beta_3 MHC + \beta_4 CC + \beta_5 PC + \beta_6 Urbanicity + \beta_7 State + \beta_8 Year + u_{ij}$$

In this model, $\text{logit}(Y)$ is the outcome variable of interest (natural log of the odds of OUD diagnosis, any OUD treatment, MOUD, and counseling alone). $Race$ is a vector of variables indicating individual-level race/ethnicity, Age is a vector of variables indicating individual-level age group, MHC is an indicator indicating individual-level mental health comorbidities, CC is an indicator indicating individual-level chronic conditions, PC is an indicator indicating individual-level pregnancy complications, $Urbanicity$ is a vector of variables indicating county-level urbanicity, $State$ is a state fixed effect, $Year$ is a year fixed effect, and $+ u_{ij}$ is the error term. Standard errors are clustered at the individual (patient) level to account for multiple deliveries for the same woman.

Interacted Model. The interacted model is the same as the basic model provided above, but with the addition of year & non-Hispanic Black interactions to allow for differential associations between race and OUD diagnosis and treatment over time.

$$\text{logit}(Y) = \beta_0 + \beta_1 Race + \beta_2 Age + \beta_3 MHC + \beta_4 CC + \beta_5 PC + \beta_6 Urbanicity + \beta_7 State + \beta_8 Year + \beta_9 Black * Year + u_{ij}$$

Appendix Table A5, Sensitivity Analysis: Odds of Receipt and Type of OUD Treatment Among OUD-Affected Deliveries (50 states and the District of Columbia, 2007-2012)

	OUD-Affected Deliveries (N=54,434)		OUD-Affected Deliveries Receiving Treatment (N=40,564)			
	Any OUD Treatment N (%)	Any OUD Treatment aOR (95% CI)	MOUD N (%)	MOUD aOR (95% CI)	Counseling Only N (%)	Counseling Only aOR (95% CI)
Sociodemographic Characteristics						
Age						
18-25 (omitted)	13,676 (71.8)	REF	8,724 (63.8)	REF	4,952 (36.2)	REF
26-35	23,296 (76.1)	1.20 (1.14, 1.25)	16,217 (69.6)	1.35 (1.28, 1.42)	7,079 (30.4)	0.74 (0.70, 0.78)
36-44	3,592 (75.6)	1.26 (1.16, 1.37)	2,282 (63.5)	1.17 (1.07, 1.28)	1,310 (36.5)	0.85 (0.78, 0.94)
Race/Ethnicity						
Non-Hispanic White (omitted)	32,651 (75.9)	REF	22,569 (69.1)	REF	10,082 (30.9)	REF
Non-Hispanic Black	2,738 (63.1)	0.55 (0.51, 0.59)	1,220 (44.6)	0.41 (0.37, 0.45)	1,518 (55.4)	2.46 (2.24, 2.71)
Hispanic	3,092 (74.6)	1.08 (0.99, 1.19)	2,220 (71.8)	1.10 (0.99, 1.22)	872 (28.2)	0.91 (0.82, 1.01)
American Indian & Alaska Native	1,100 (71.2)	0.62 (0.54, 0.72)	667 (60.6)	0.83 (0.71, 0.98)	433 (39.4)	1.20 (1.02, 1.41)
Other/Unknown Race/Ethnicity	983 (70.5)	0.78 (0.68, 0.89)	547 (55.6)	0.70 (0.59, 0.82)	436 (44.4)	1.43 (1.22, 1.68)
Urbanicity						
Metro (omitted)	31,745 (74.5)	REF	21,381 (67.4)	REF	10,364 (32.6)	REF
Non-metro, adjacent to urban area	5,360 (73.2)	0.91 (0.86, 0.98)	3,516 (65.6)	0.83 (0.77, 0.90)	1,844 (34.4)	1.20 (1.12, 1.29)
Non-metro, not adjacent to urban area	3,459 (76.6)	1.22 (1.12, 1.34)	2,326 (67.2)	1.24 (1.12, 1.37)	1,133 (32.8)	0.81 (0.73, 0.89)
Clinical Characteristics						
Mental Health Comorbidities	25,811 (82.7)	2.61 (2.50, 2.73)	16,468 (63.8)	0.68 (0.65, 0.72)	9,343 (36.2)	1.47 (1.4, 1.54)
Any Chronic Condition	10,730 (77)	1.07 (1.01, 1.12)	6,879 (64.1)	0.93 (0.88, 0.98)	3,851 (35.9)	1.07 (1.02, 1.13)
Any Pregnancy Complication	22,092 (75.3)	0.95 (0.91, 0.99)	14,275 (64.6)	0.89 (0.85, 0.93)	7,817 (35.4)	1.12 (1.07, 1.18)

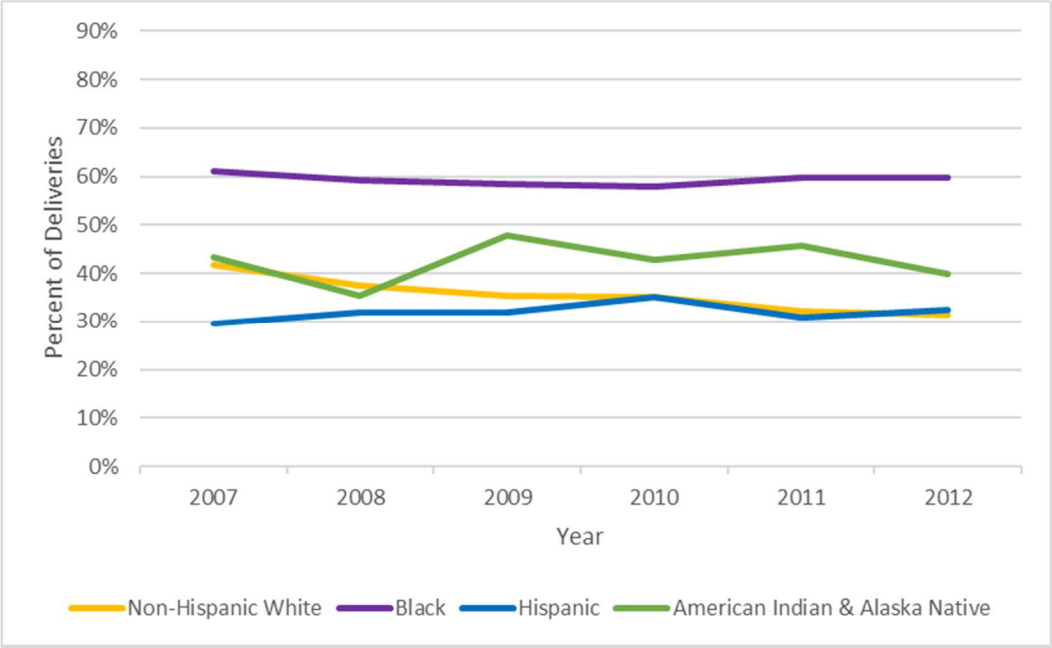
*Note: In the sensitivity analysis, the sample is restricted to women with eligibility during the month of delivery plus at least 2 months in the prenatal period and at least 2 months in the postpartum period.

Table A6, Sensitivity Analysis: Odds of Receipt and Type of OUD Treatment Among OUD-Affected Deliveries with Black and Year Interactions (50 States and the District of Columbia, 2007-2012) (N=54,434)

	OUD-Affected Deliveries (N=54,434)	OUD-Affected Deliveries Receiving Treatment (N=40,564)	
	Any OUD Treatment aOR (95% CI)	MOUD aOR (95% CI)	Counseling Only aOR (95% CI)
Sociodemographic Characteristics			
Age			
18-25 (omitted)	REF	REF	REF
26-35	1.20 (1.14, 1.25)	1.35 (1.28, 1.42)	0.74 (0.70, 0.78)
36-44	1.25 (1.15, 1.36)	1.16 (1.06, 1.27)	0.86 (0.78, 0.94)
Race/Ethnicity			
Non-Hispanic White (omitted)	REF	REF	REF
Non-Hispanic Black	0.84 (0.70, 1.02)	0.55 (0.43, 0.7)	1.83 (1.43, 2.34)
Hispanic	1.09 (0.99, 1.19)	1.10 (0.99, 1.22)	0.91 (0.82, 1.01)
American Indian & Alaska Native	0.62 (0.54, 0.72)	0.83 (0.71, 0.98)	1.20 (1.02, 1.41)
Other/Unknown Race/Ethnicity	0.78 (0.68, 0.89)	0.70 (0.59, 0.82)	1.43 (1.22, 1.68)
Interaction between Year & Non-Hispanic Black			
2007 & Non-Hispanic Black (omitted)	REF	REF	REF
2008 & Non-Hispanic Black	0.63 (0.49, 0.82)	0.82 (0.58, 1.16)	1.22 (0.86, 1.73)
2009 & Non-Hispanic Black	0.69 (0.53, 0.89)	0.78 (0.56, 1.09)	1.28 (0.92, 1.78)
2010 & Non-Hispanic Black	0.57 (0.45, 0.74)	0.83 (0.60, 1.15)	1.20 (0.87, 1.66)
2011 & Non-Hispanic Black	0.60 (0.47, 0.76)	0.65 (0.47, 0.88)	1.55 (1.13, 2.11)
2012 & Non-Hispanic Black	0.59 (0.47, 0.75)	0.62 (0.46, 0.85)	1.60 (1.18, 2.17)
Urbanicity			
Metro (omitted)	REF	REF	REF
Non-metro, adjacent to urban area	0.91 (0.86, 0.98)	0.83 (0.77, 0.90)	1.20 (1.12, 1.29)
Non-metro, not adjacent to urban area	1.22 (1.12, 1.34)	1.24 (1.12, 1.37)	0.81 (0.73, 0.89)
Clinical Characteristics			
Mental Health Comorbidities	2.62 (2.51, 2.73)	0.68 (0.65, 0.72)	1.47 (1.40, 1.54)
Any Chronic Condition	1.07 (1.01, 1.12)	0.93 (0.88, 0.99)	1.07 (1.02, 1.13)
Any Pregnancy Complication	0.95 (0.91, 0.99)	0.89 (0.85, 0.93)	1.12 (1.07, 1.18)

*Note: In the sensitivity analysis, the sample is restricted to women with eligibility during the month of delivery plus at least 2 months in the prenatal period and at least 2 months in the postpartum period.

Figure A1. Percent of Treated OUD-Affected Deliveries with Counseling Alone, by Race/Ethnicity



Chapter Four: Disparities in Perinatal and Emergency Health Care Utilization Among Pregnant Women with OUD in Medicaid: 2007-2012

Abstract.

Research Objective: Untreated opioid use disorder (OUD) during pregnancy poses significant risks for mothers and their infants, but the utilization of perinatal and emergency care among pregnant women with OUD is not well understood. This study's objectives were to (1) examine the relationship between OUD status and perinatal and emergency visits, and (2) explore the extent to which utilization of perinatal and emergency care among pregnant women with OUD varied by sociodemographic and clinical characteristics.

Study Design: Retrospective, population-based cross-sectional study. Descriptive statistics were calculated to examine trends in perinatal and emergency visits over time and differences by OUD status and sociodemographic and clinical characteristics. Logistic regressions modeled the association between (1) OUD status and receipt of perinatal and emergency care, controlling for sociodemographic and clinical characteristics; and (2) sociodemographic and clinical characteristics and receipt of perinatal and emergency care, conditional on OUD diagnosis. We used robust standard errors, clustered at the individual level, and included state and year fixed effects.

Population Studied: Using Medicaid Analytic eXtract (MAX) data from all 50 states and D.C. from 2007 to 2012, we identified 6,823,471 delivery hospitalizations among

women 18-44 years old with and without an OUD diagnosis (N=74,570 and N= 6,748,901, respectively). We obtained demographic information and data on perinatal and emergency care received in the prenatal period and one-year postpartum. Rural-Urban Continuum Codes provided county-level urbanicity data.

Key Findings: After adjusting for age, race/ethnicity, comorbidities and urbanicity, women with OUD-affected deliveries were less likely to receive adequate prenatal care (aOR = 0.46, 95% CI 0.45 to 0.46) and attend the postpartum visit (aOR=0.47, 95% CI 0.46 to 0.48) and more likely to have perinatal emergency visits (aOR=1.44, 95% CI 1.42 to 1.47) than women without OUD-affected deliveries. Among women with OUD-affected deliveries, Black, Hispanic and American Indian and Alaskan Native (AI/AN) women were less likely to receive adequate prenatal care (aOR=0.68, 95% CI 0.64 to 0.72; aOR=0.86, 95% CI 0.80 to 0.92; aOR=0.71, 95% CI 0.64 to 0.79, respectively) and attend the postpartum visit (aOR=0.83, 95% CI 0.78 to 0.89; aOR=0.85, 95% CI 0.79 to 0.91; aOR=0.88, 95% CI 0.78 to 0.99, respectively) relative to non-Hispanic White women. Black and AI/AN women were also more likely to receive emergency care (aOR=1.13, 95% CI 1.05 to 1.20; aOR = 1.12, 95% CI 1.00 to 1.26, respectively).

Conclusions: Pregnant women with OUD were less likely to receive scheduled perinatal care but more likely to receive emergency care relative to pregnant women without OUD. Among women with OUD-affected deliveries, Black, Hispanic and AI/AN women were less likely to receive scheduled perinatal care relative to their White counterparts, and Black and AI/AN women were more likely to receive emergency

care. These findings suggest that Black, Hispanic and AI/AN women with OUD may be missing opportunities for preventive care and comprehensive management of their physical and behavioral health during pregnancy.

Implications for Policy or Practice: Our results highlight the importance of addressing disparities in perinatal and emergency care for women with OUD during pregnancy.

Acknowledgements: I would like to acknowledge coauthors on this study: Brendan Saloner, Beth Ann Griffin, Bradley Stein, Mishka Terplan and Laura Faherty.

Introduction.

Opioid use during the perinatal period has become increasingly common in recent years; between 2010 and 2017, the rate of maternal opioid-related diagnoses increased 134%.[6] Untreated maternal opioid use poses significant health risks for the mother-infant dyad, including increased risk of maternal morbidity and mortality and neonatal opioid withdrawal syndrome (NOWS) among exposed infants.[5-10,150-153]

Regular prenatal care is associated with improved obstetric and birth outcomes, lowering the risk of severe maternal morbidity and death, low birthweight, preterm birth, and infant mortality.[154-163] The postpartum visit represents an important opportunity to help women transition from obstetric to ongoing preventive care,[164] especially for women who experienced pregnancy complications like gestational diabetes or preeclampsia[165-168] or who gained excess weight during pregnancy.[169-171] The postpartum visit also facilitates appropriate care for postpartum depression and other medical conditions that are common during the postpartum period.[172] Regular perinatal health care for women with OUD is especially important given the high risk profile of this vulnerable population; increased utilization of regular perinatal care provides more opportunities for appropriate management of their physical and behavioral health.

Utilization of emergency care during the perinatal period is associated with worse health outcomes, including higher risk of preterm birth,[173,174] and higher comorbidity burden,[175] including chronic mental and physical illness.[173,176] Further, emergency care utilization suggests elevated or worsening unmet health needs during the perinatal period that are not being addressed via scheduled care.[160,162,163,177] Although emergency care may be a substitute for scheduled prenatal and postpartum care[163,173,178,179] – including for

women with limited transportation access that rely on emergency transport for health care,[180,181] high emergency care utilization can also describe the behavior of high utilizers of health care, or individuals that have increased health care utilization generally.[163,176,182] Research has documented differential utilization of perinatal and emergency care for women with versus without substance-related diagnoses (SRDs)[162,177], as well as racial and ethnic disparities in health care utilization during the perinatal period.[107,173,174,178,179] However, the degree to which these differences persist in a national, multi-year Medicaid population is not well-understood.

Our study addresses this gap in the literature by leveraging a national, multi-year administrative claims database to (1) examine the relationship between OUD status and perinatal and emergency visits, and (2) explore the extent to which utilization of perinatal and emergency care among pregnant women with OUD varied by sociodemographic and clinical characteristics. Given the large inequities in overdose rates for Black versus White populations[149] and high burden of OUD among AI/AN populations, [101] these results are important for identifying opportunities for better management of OUD-affected pregnancies among racial and ethnic minority women.

Methods.

Data and Sample.

We used 2006-2014 Medicaid Analytic eXtract (MAX) files for 50 states and the District of Columbia, which contain data on inpatient and outpatient services, eligibility, and prescription drug utilization. We identified women 18 to 44 years of age who had a delivery hospitalization[103] during the period January 1, 2007, through December 31,

2012, excluding deliveries that occurred before or after this period to allow for sufficient observation during the prenatal and postpartum periods. We included deliveries for women who were Medicaid-enrolled during the month of delivery and at least one month in either the prenatal or postpartum period. Medicaid MAX data were not available for all states in each year we examined; states and years of data availability are included in Appendix Table A1.

The MAX dataset contains all Medicaid claims for all individuals that had Internal Classification of Disease-Ninth Revision (ICD-9) ICD-9 codes for OUD in any diagnosis field over the study period, plus all claims for a random sample of control individuals that never had OUD in any diagnosis field. We identified OUD-affected deliveries, and the control sample was weighted to be representative of all Medicaid-enrolled women without OUD for all states in the study period. A table showing the ICD-9 codes for OUD is provided in Appendix Table A2.

Dependent Variables.

We used ICD-9 codes to identify prenatal care visits during the prenatal period (defined as 260 days prior to delivery) and postpartum visits during the twelve-week postpartum period, and we used revenue codes to identify emergency visits (emergency department or obstetrical triage) during the prenatal or twelve-week postpartum periods. We then created binary measures of (1) receipt of adequate prenatal care (defined as at least seven visits), consistent with the literature defining adequate prenatal care when gestational age at delivery is unavailable;[105,183] (2) attendance of a postpartum visit; and (3) at least one emergency visit to the emergency department (ED) or obstetric (labor and

delivery) triage[174] during the prenatal or postpartum visit. Because many women are routed to obstetric triage when they seek emergency care during pregnancy,[184] especially later in pregnancy, the use of revenue codes for obstetric triage is crucial for accurately measuring perinatal emergency care utilization. Our use of at least one visit as a threshold for emergency care utilization is consistent with most of the literature measuring emergency visits for the maternal population.[162,163,173,175,177,179] A list of ICD-9 and revenue codes used to identify prenatal, postpartum and emergency visits is provided in Appendix Table A3.

Independent Variables.

Using the MAX outpatient service files, we determined whether a woman had a concurrent mental health condition, other pre-existing chronic condition, or pregnancy-specific comorbidity (see Appendix Table A4 for the ICD-9 codes included)[104,105]. Using the MAX eligibility files, we determined a woman's age category (18-25 years, 26-35 years, and 36-44) and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Non-Hispanic American Indian or Native Alaskan [AI/AN], or other/unknown). We defined the delivery year and state as the calendar year and state in which the delivery hospitalization occurred. We identified county-level urbanicity (categorized as metropolitan, non-metropolitan adjacent to a metropolitan area, and non-metropolitan not adjacent to a metropolitan area) using 2013 Rural-Urban Continuum Codes.[106]

Analytic Approach.

We first conducted univariate and bivariate analyses, describing perinatal and

emergency health care utilization of Medicaid-enrolled women with and without OUD during the perinatal period. We then described characteristics of Medicaid-enrolled women with OUD during the perinatal period by each dichotomous outcome measure. Next, we conducted multivariable logistic regressions of our binary health care utilization measures, adjusting for age, race/ethnicity, mental health comorbidities, chronic conditions, pregnancy complications, and county-level urbanicity.

We structured the analysis as a pooled cross-sectional analysis but allowed women to contribute multiple deliveries. As such, we clustered standard errors at the individual level, which is the primary unit of analysis. Each observation in the analytic sample is a woman-delivery linked to state of residence and year of the data. More than 85% of OUD-affected deliveries were for women with a single delivery. We included year and state fixed effects to account for state- and time-invariant characteristics. Model specification is provided in the Appendix. Analyses were conducted using STATA 16.0 (College Station, TX). The RAND institutional review board approved the research with a waiver of informed consent.

To examine whether shorter periods of Medicaid eligibility affected the likelihood of receiving regular perinatal or emergency care, we conducted a sensitivity analysis in which we restricted our analytic sample to deliveries with more consistent eligibility: eligibility for the month of delivery plus at least two months during the prenatal period and at least two months during the postpartum period. The findings were generally consistent with those from our main analyses and are presented in the Appendix Tables A5-A7.

Results.

Descriptive Results.

Of the 6,823,471 deliveries in our sample, 74,570 (1.1%) were OUD-affected (Table 1). Disaggregated by race/ethnicity, we found that 2.0% of deliveries among non-Hispanic White women were OUD-affected, compared to 0.4% for non-Hispanic Black women, 0.3% for Hispanic women, and 1.4% for AI/AN women. Among OUD-affected deliveries, 38.1% received adequate prenatal care, 27.0% attended a postpartum visit, and 48.7% had any emergency visits. Among non-OUD-affected deliveries, 53.7% received adequate prenatal care, 42.9% attended a postpartum visit, and 33.2% had any emergency visits.

Adequate Prenatal Care.

Over the period 2007 to 2012, unadjusted rates of adequate prenatal care among women with OUD-affected deliveries were consistently lower compared to those for non-OUD-affected deliveries (Figure 1). Although rates of adequate prenatal care among non-OUD-affected deliveries were similar for Non-Hispanic Black and non-Hispanic White women, among OUD-affected deliveries, Black women were consistently less likely to receive adequate prenatal care relative to their White counterparts, though the gap between the two groups narrowed over time (gap of 12 percentage points in 2007 versus 7 percentage points in 2012). Rates of adequate prenatal care were lowest for AI/AN women for both OUD-affected and non-OUD-affected deliveries; notably, rates of adequate prenatal care for AI/AN women with non-OUD-affected deliveries closely tracked those for White women with OUD-affected deliveries.

Postpartum Care.

Over the period 2007 to 2012, unadjusted rates of postpartum visit attendance among women with OUD-affected deliveries were consistently lower compared to those for non-OUD-affected deliveries (Figure 2). Black women with OUD-affected deliveries were consistently less likely to attend a postpartum visit relative to their White counterparts, though the gap between the two groups appeared to narrow over time (gap of 5 percentage points in 2007 versus 3 percentage points in 2012). Rates of postpartum visit attendance were lowest for AI/AN women among non-OUD-affected deliveries, but differences among OUD-affected deliveries less consistent; rates of postpartum visit attendance dipped for AI/AN women relative to other racial/ethnic groups in 2011 and 2012.

Emergency Care.

Over the period 2007 to 2012, unadjusted rates of emergency visits among women with OUD-affected deliveries were consistently higher compared to those for non-OUD-affected deliveries (Figure 3). AI/AN and non-Hispanic White women with OUD-affected deliveries generally had the highest rates of perinatal emergency visits, though rates for Black women caught up to those for AI/AN and White women in 2011 and 2012. Notably, rates of emergency visits for Black women were very similar for both OUD-affected and non-OUD-affected deliveries, whereas the gap in emergency care between OUD-affected and non-OUD-affected deliveries was larger for all other racial/ethnic groups.

Multivariable Logistic Regression Results.

All Deliveries: OUD Status and Adequate Prenatal Care, Postpartum Visit and Emergency Care

In adjusted models, women with OUD-affected deliveries were less likely to receive adequate prenatal care (38.1% vs 53.7%, aOR= 0.46, 95% CI 0.45 to 0.46), less likely to attend a postpartum visit (27.0% vs 42.9%, aOR= 0.47, 95% CI 0.46 to 0.48), and more likely receive emergency care (48.7% vs 33.2%, aOR= 1.44, 95% CI 1.42 to 1.47) compared to women without perinatal OUD (Table 2).

OUD-Affected Deliveries: Adequate Prenatal Care

In adjusted models of OUD-affected deliveries, women ages 36-44 were less likely to receive adequate prenatal care relative to younger women (31.5%, aOR =0.71, 95% CI 0.66 to 0.75) (Table 3). Non-Hispanic Black (31.8%, aOR = 0.68, 95% CI 0.64 to 0.72), Hispanic (34.2%, aOR = 0.86, 95% CI 0.80 to 0.92) and AI/AN women (29.5%, aOR = 0.71, 95% CI 0.64 to 0.79) were less likely to receive adequate prenatal care relative to non-Hispanic White women (39.6%). Women living in non-metro areas were more likely to receive adequate prenatal care than those in metro areas. Women with mental health conditions (40.7%, aOR= 2.05, 95% CI 1.99 to 2.12), pre-existing chronic conditions (42.1%, aOR= 1.16, 95% CI 1.11 to 1.22) and pregnancy complications (46.0%, aOR= 1.20, 95% CI 1.13 to 1.28) were more likely to receive adequate prenatal care than those without these conditions.

OUD-Affected Deliveries: Postpartum Visit

In adjusted models of OUD-affected deliveries, women ages 36-44 were less likely to attend a postpartum visit relative to younger women (23.4%, aOR =0.75, 95% CI 0.70 to 0.80) (Table 3). Non-Hispanic Black (24.4%, aOR = 0.83, 95% CI 0.78 to 0.89), Hispanic (24.9%, aOR = 0.85, 95% CI 0.79 to 0.91) and AI/AN women (24.7%, aOR = 0.88, 95% CI 0.78 to 0.99) were less likely to attend a postpartum visit relative to non-Hispanic White women. Women living in non-metro areas were more likely to attend a postpartum visit than those in metro areas. Women with mental health conditions (28.9%, aOR= 1.23, 95% CI 1.19 to 1.27) were more likely to attend a postpartum visit, and women with pregnancy complications (29.5%, aOR= 0.85, 95% CI 0.79 to 0.91) were less likely to attend a postpartum visit relative those without these conditions.

OUD-Affected Deliveries: Emergency Visit

In adjusted models of OUD-affected deliveries, women ages 36-44 were less likely to receive emergency care relative to younger women (41.4%, aOR =0.71, 95% CI 0.66 to 0.76) (Table 3). Before adjustment, non-Hispanic Black women were less likely to receive emergency care relative to non-Hispanic White women (45.5% vs 50.1%), but after adjustment, non-Hispanic Black women (aOR = 1.13, 95% CI 1.05 to 1.20) were more likely to receive emergency care. AI/AN women (54.0%, aOR = 1.12, 95% CI 1.00 to 1.26) were also more likely to receive emergency care relative to non-Hispanic White women. Women living in non-metro areas were more likely to receive emergency care than those in metro areas. Women with mental health conditions (55.2%, aOR= 2.85,

95% CI 2.76 to 2.95) were more likely to receive emergency care, and women with pregnancy complications (61.2%, aOR= 0.90, 95% CI 0.84 to 0.96) were less likely to receive emergency care relative those without these conditions.

Discussion.

In our analysis of the relationship between OUD status and perinatal and emergency care utilization, we found that women with an OUD diagnosis were less likely to receive adequate prenatal care and less likely to attend a postpartum visit, but they were more likely to receive emergency care in the ED or obstetric triage setting. These findings are consistent with existing literature[162,177] describing lower utilization of scheduled care and higher utilization of emergency care among pregnant women with substance use disorders. Because prenatal and postpartum care are associated with improved obstetric and birth outcomes, and because perinatal opioid use poses significant risks to mothers and infants, our finding suggests that pregnant women with OUD are not receiving the care that they need. Further, increased utilization of emergency care suggests that these women may be substituting emergency care for unmet physical and mental health needs that are not being addressed in routine prenatal and postpartum care.

In our examination of racial and ethnic disparities in perinatal and emergency care utilization among women with OUD-affected deliveries, we found that compared to non-Hispanic White women, Black, Hispanic and AI/AN women were less likely to receive adequate prenatal care and attend a postpartum visit, and Black and AI/AN women were more likely to utilize emergency care. Our results are consistent with research documenting racial disparities in prenatal health care utilization, with lower use of

regular prenatal care and greater use of emergency care.[107,173,174,185-191] These patterns of care for Black, AI/AN and Hispanic women during the perinatal period suggest higher risk of maternal and infant morbidity and mortality, exacerbating well-known disparities in perinatal outcomes for racial/ethnic minority women outside the context of perinatal substance use.[66,107-109]

Observed disparities in perinatal care utilization for Black, Hispanic and AI/AN women with OUD may be partially explained by the unique barriers that they face in the American health care system. Structural racism in the health care and criminal justice systems exacerbates longstanding distrust of health care among minority women,[116,192] and this distrust is further magnified by experiences of interpersonal racism,[69,118] including racial bias among providers,[69,121] and a legacy of disproportionate impact of punitive policy responses to prenatal substance use among minority women.[37,64,66,119,120] As a result of their disproportionate use of Medicaid and other publicly-funded services, low-income Black and AI/AN women are far more likely than White or middle-income women to already be under surveillance, [90,193] and this increased surveillance represents a driving factor for the entrance of many pregnant women into the criminal justice system. Multiple studies have found that Black women and their newborns were significantly more likely to be tested for illicit substance use compared to their non-Black counterparts,[91,92] and the fear of detection and punishment that may result from positive drug tests for these women and their infants may deter them from utilizing regular perinatal care. Furthermore, higher utilization of emergency care among Black and AI/AN women with OUD may potentially reflect the substitution of scheduled care with unscheduled care, in an attempt to minimize the risk of detection and punishment.

Among AI/AN individuals, a population for which opioid overdose mortality is second only to that for White individuals,[114] dissimilar communication styles, discontinuity in care via multiple obstetric providers and a mismatch between Western medical approaches and culturally acceptable, holistic healing traditions pose distinct barriers to consistent prenatal and postpartum care engagement.[192] Strategies for reducing disparities in perinatal and emergency care among pregnant women with OUD should incorporate these structural and cultural barriers, emphasizing individualized and patient-centered decision-making and the role of consistent and confidential provider-patient relationships.

Our finding that older pregnant women with OUD had lower utilization of perinatal and emergency care relative to their younger counterparts is noteworthy, contradicting existing work[194] describing younger women as less likely to utilize prenatal care, and warrants further research. The result that pregnant women with a mental health condition had higher utilization of perinatal and emergency care is consistent with research documenting higher health care utilization among individuals with mental health disorders[195] and may be partially explained by increased risk profiles for these women during pregnancy.[196-198] Similarly, results indicating that among OUD-affected deliveries, pregnant women with pre-existing chronic conditions or pregnancy complications were more likely to receive adequate prenatal care are likely explained by higher health care utilization and prenatal care engagement among pregnant women with chronic conditions and pregnancy complications that may affect perinatal health outcomes. Women with gestational diabetes or chronic hypertension, for example, are at higher risk of adverse obstetric and birth outcomes[136-139] and thus may be more closely

monitored during pregnancy, especially in the context of perinatal OUD. Our finding that women with pregnancy complications were less likely to attend a postpartum visit and receive emergency care are surprising, as the postpartum visit is an important opportunity for women to meet with their providers after delivery, facilitating the management of lingering clinical conditions[165-172] and the transition to ongoing preventive care.[164] This result should be explored in future work.

Despite our contribution to the literature, there are limitations to our analysis. We do not have all states for all years in the study period, and our data are older; it is possible that some of the disparities documented during the study period were mitigated via Medicaid expansion.[124,199,200] However, disparities observed during this period can provide lessons for current social policy environments, as well as a basis of comparison for more recent analyses of racial and ethnic disparities in perinatal care among women with OUD. Women may lose Medicaid coverage during our study period and become unobservable in our data, and we cannot completely capture churn over time. Finally, our results may not be generalizable to other state Medicaid populations or to commercially-insured individuals.

Conclusion.

Our study is among the first to use a national, multi-year Medicaid claims dataset to examine both the relationship between OUD status and perinatal and emergency health care utilization, and the extent to which perinatal and emergency health care utilization differs by race/ethnicity and other sociodemographic and clinical characteristics among OUD-affected deliveries. Perinatal OUD poses significant risks for maternal and infant

health outcomes, but these risks can be managed via regular perinatal care. As racial and ethnic disparities in the burden of the opioid crisis continue to rise,[114,149] it is crucial for policymakers and providers to address differential utilization of perinatal care via individualized and culturally-sensitive approaches that prioritize patient-centered decision-making and the patient-provider relationship.

Tables and Figures

Table 1: Characteristics of Medicaid Deliveries by OUD Status (2007-2012, 50 states and the District of Columbia)

	Non-OUD-Affected Deliveries	OUD-Affected Deliveries	All Deliveries
	N (%)	N (%)	N (%)
Total	6,748,901 (100)	74,570 (100)	6,823,471 (100)
Adequate Prenatal Care			
Yes	3,621,963 (53.7)	28,421 (38.1)	3,650,384 (53.5)
No	3,126,938 (46.3)	46,149 (61.9)	3,173,087 (46.5)
Postpartum Care			
Yes	2,896,660 (42.9)	20,128 (27.0)	2,916,788 (42.7)
No	3,852,240 (57.1)	54,442 (73.0)	3,906,682 (57.3)
Emergency Care			
Yes	2,241,170 (33.2)	36,315 (48.7)	2,277,485 (33.4)
No	4,507,730 (66.8)	38,255 (51.3)	4,545,985 (66.6)

*Note: The weighted sample of 6,823,471 non-OUD-affected deliveries corresponds to 775,893 unweighted deliveries. OUD-affected deliveries are not weighted. This table shows percentages of weighted non-OUD-affected frequencies, which are rounded to the nearest integer and may not sum to 100%.

Figure 1. Percent of Deliveries with Adequate Prenatal Care, by OUD Status and Race/Ethnicity

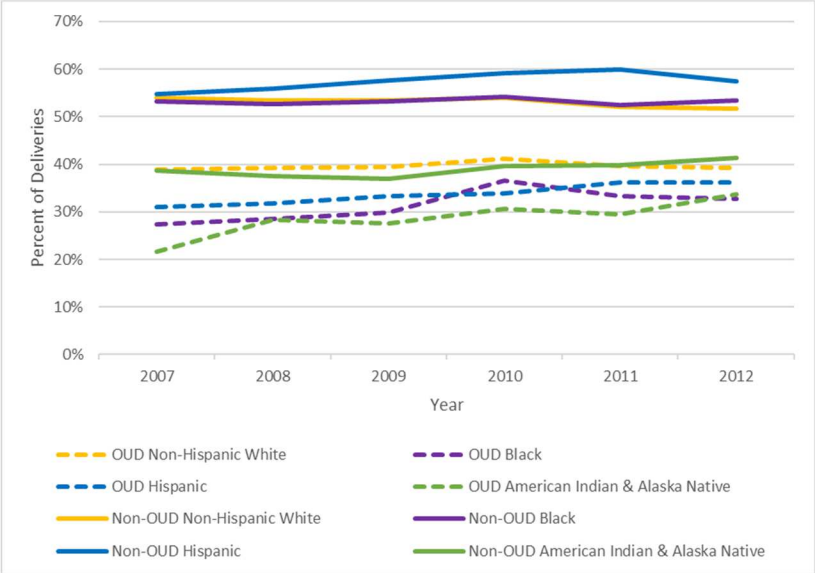


Figure 2. Percent of Deliveries with a Postpartum Visit, by OUD Status and Race/Ethnicity

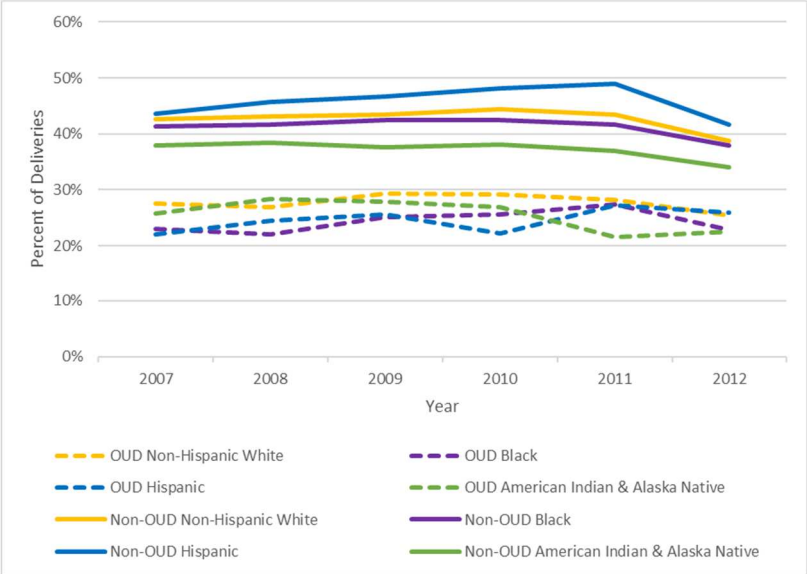


Figure 3. Percent of Deliveries with Emergency Care, by OUD Status and Race/Ethnicity

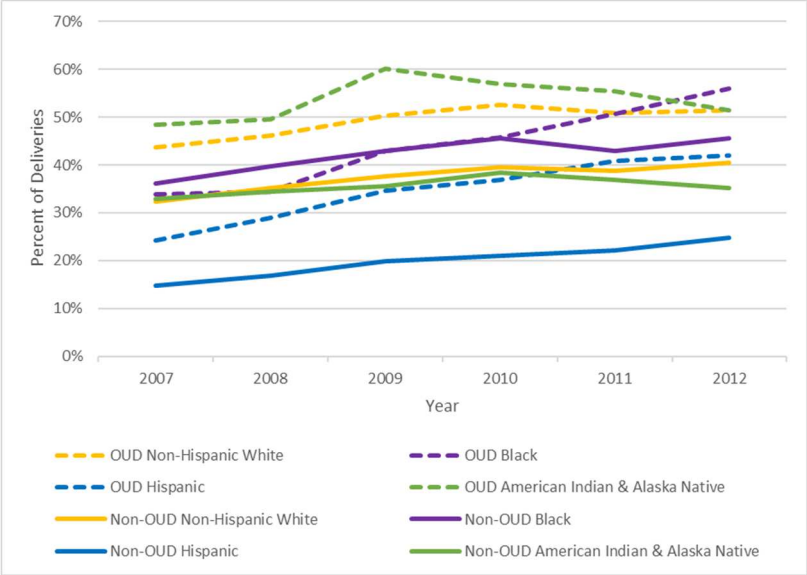


Table 2. Odds of Perinatal and Emergency Health Care Utilization Among All Deliveries (50 states and the District of Columbia, 2007-2012) (N=6,823,471)

	Adequate Prenatal Care N (%)	Adequate Prenatal Care aOR (95% CI)	Postpartum Care N (%)	Postpartum Care aOR (95% CI)	Emergency Care N (%)	Emergency Care aOR (95% CI)
Sociodemographic Characteristics	3,650,384 (53.5)	-	2,916,788 (42.7)	-	2,277,485 (33.4)	-
Age						
18-25 (omitted)	1,980,848 (54.8)	REF	1,541,144 (42.7)	REF	1,354,373 (37.5)	REF
26-35	1,431,801 (52.5)	0.90 (0.89, 0.90)	1,167,692 (42.8)	1.00 (0.99, 1.01)	812,188 (29.8)	0.72 (0.71, 0.73)
36-44	237,734 (49.3)	0.74 (0.73, 0.75)	207,953 (43.1)	0.97 (0.96, 0.99)	110,924 (23.0)	0.53 (0.51, 0.54)
Race/Ethnicity						
Non-Hispanic White (omitted)	1,542,896 (52.8)	REF	1,235,270 (42.3)	REF	1,101,896 (37.7)	REF
Non-Hispanic Black	889,825 (53.1)	0.84 (0.83, 0.85)	688,764 (41.1)	0.83 (0.82, 0.84)	707,678 (42.3)	1.36 (1.34, 1.38)
Hispanic	976,331 (57.4)	1.00 (0.99, 1.01)	777,695 (45.7)	0.95 (0.94, 0.97)	340,906 (20.0)	0.87 (0.86, 0.89)
American Indian & Alaska Native	58,348 (38.8)	0.84 (0.81, 0.87)	55,626 (37)	1.23 (1.19, 1.27)	53,829 (35.8)	0.76 (0.74, 0.79)
Other/Unknown Race/Ethnicity	182,984 (48.8)	0.93 (0.91, 0.95)	159,434 (42.5)	1.01 (0.99, 1.03)	73,176 (19.5)	0.66 (0.64, 0.68)
Urbanicity						
Metro (omitted)	2,977,926 (53.8)	REF	2,409,348 (43.5)	REF	1,776,653 (32.1)	REF
Non-metro, adjacent to urban area	440,298 (53.2)	1.16 (1.14, 1.18)	335,330 (40.5)	1.00 (0.98, 1.01)	323,017 (39.0)	0.95 (0.93, 0.96)
Non-metro, not adjacent to urban area	232,160 (50.7)	1.16 (1.14, 1.18)	172,110 (37.6)	1.00 (0.98, 1.02)	177,815 (38.8)	0.92 (0.90, 0.94)
Clinical Characteristics						
OUD Diagnosis	28,421 (38.1)	0.46 (0.45, 0.46)	20,128 (27.0)	0.47 (0.46, 0.48)	36,315 (48.7)	1.44 (1.42, 1.47)
Mental Health Comorbidities	522,346 (57.1)	1.20 (1.19, 1.22)	398,068 (43.5)	1.05 (1.03, 1.06)	457,846 (50.1)	1.96 (1.93, 1.99)
Any Chronic Condition	711,136 (59.5)	1.15 (1.14, 1.17)	555,942 (46.5)	1.11 (1.09, 1.12)	524,077 (43.9)	1.33 (1.31, 1.35)
Any Pregnancy Complication	1,988,614 (60.0)	1.74 (1.72, 1.76)	1,518,750 (45.8)	1.24 (1.23, 1.25)	1,547,879 (46.7)	3.40 (3.36, 3.43)

*Note: The weighted sample of 6,823,471 non-OUD-affected deliveries corresponds to 775,893 unweighted deliveries. OUD-affected deliveries are not weighted. This table shows percentages of weighted non-OUD-affected frequencies plus non-weighted OUD-affected deliveries, which are rounded to the nearest integer and may not sum to 100%.

Table 3. Odds of Perinatal and Emergency Health Care Utilization Among OUD-Affected Deliveries (50 states and the District of Columbia, 2007-2012) (N = 74,570)

	Adequate Prenatal Care N (%)	Adequate Prenatal Care aOR (95% CI)	Postpartum Care N (%)	Postpartum Care aOR (95% CI)	Emergency Care N (%)	Emergency Care aOR (95% CI)
Sociodemographic Characteristics	28,421 (38.1)	-	20,128 (27.0)	-	36,315 (48.7)	-
Age						
18-25 (omitted)	10,498 (39.4)	REF	7,558 (28.4)	REF	13,592 (51.1)	REF
26-35	15,859 (38.3)	0.94 (0.91, 0.97)	11,035 (26.6)	0.90 (0.87, 0.93)	20,014 (48.3)	0.85 (0.82, 0.88)
36-44	2,064 (31.5)	0.71 (0.66, 0.75)	1,535 (23.4)	0.75 (0.70, 0.80)	2,709 (41.4)	0.71 (0.66, 0.76)
Race/Ethnicity						
Non-Hispanic White (omitted)	23,097 (39.6)	REF	16,056 (27.6)		29,177 (50.1)	REF
Non-Hispanic Black	2,005 (31.8)	0.68 (0.64, 0.72)	1,542 (24.4)	0.83 (0.78, 0.89)	2,869 (45.5)	1.13 (1.05, 1.20)
Hispanic	1,972 (34.2)	0.86 (0.80, 0.92)	1,438 (24.9)	0.85 (0.79, 0.91)	2,075 (36.0)	1.05 (0.97, 1.14)
American Indian & Alaska Native	635 (29.5)	0.71 (0.64, 0.79)	531 (24.7)	0.88 (0.78, 0.99)	1161 (54.0)	1.12 (1.00, 1.26)
Other/Unknown Race/Ethnicity	712 (34.2)	0.92 (0.83, 1.02)	561 (27.0)	1.10 (0.99, 1.23)	1,033 (49.6)	0.81 (0.73, 0.9)
Urbanicity						
Metro (omitted)	21,587 (37.1)	REF	15,898 (27.3)		28,264 (48.6)	REF
Non-metro, adjacent to urban area	4,090 (40.6)	1.17 (1.14, 1.21)	2,736 (27.1)	1.18 (1.14, 1.22)	4,905 (48.7)	1.71 (1.65, 1.76)
Non-metro, not adjacent to urban area	2,744 (43.7)	1.11 (1.07, 1.15)	1,494 (23.8)	1.08 (1.04, 1.12)	3,146 (50.1)	1.45 (1.39, 1.51)
Clinical Characteristics						
Mental Health Comorbidities	16,361 (40.7)	2.05 (1.99, 2.12)	11,588 (28.9)	1.23 (1.19, 1.27)	22,177 (55.2)	2.85 (2.76, 2.95)
Any Chronic Condition	7,562 (42.1)	1.16 (1.11, 1.22)	5,170 (28.8)	0.99 (0.94, 1.04)	10,211 (56.8)	1.00 (0.95, 1.05)
Any Pregnancy Complication	17,298 (46.0)	1.20 (1.13, 1.28)	11,067 (29.5)	0.85 (0.79, 0.91)	22,991 (61.2)	0.90 (0.84, 0.96)

Appendix

Table A1. States and Years Available in the MAX Data

State	2006	2007	2008	2009	2010	2011	2012
AK	X	X	X	X	X	X	X
AL	X	X	X	X	X	X	X
AR	X	X	X	X	X	X	X
AZ	X	X	X	X	X	X	X
CA	X	X	X	X	X	X	X
CO	X	X	X	X	X	X	X
CT	X	X	X	X	X	X	X
DC	X	X	X	X	X	X	X
DE	X	X	X	X	X	X	X
FL	X	X	X	X	X	X	X
GA	X	X	X	X	X	X	X
HI	X	X	X	X	X	X	X
IA	X	X	X	X	X	X	X
ID	X	X	X	X	X		X
IL	X	X	X	X	X	X	X
IN	X	X	X	X	X	X	X
KS	X	X	X	X		X	X
KY	X	X	X	X	X	X	X
LA	X	X	X	X	X	X	X
MA	X	X	X	X	X	X	X
MD	X	X	X	X	X	X	X
ME						X	X
MI	X	X	X	X	X	X	X
MN	X	X	X	X	X	X	X
MO	X	X	X	X	X	X	X
MS	X	X	X	X		X	X
MT	X	X	X	X	X	X	X
NC	X	X	X	X	X	X	X
ND	X	X	X	X	X	X	X
NE	X	X	X	X	X	X	X
NH	X	X	X	X	X	X	X
NJ	X	X	X	X	X	X	X
NM	X	X	X	X	X	X	X
NV	X	X	X	X	X	X	X
NY	X	X	X	X	X	X	X
OH	X	X	X	X	X	X	X
OK	X	X	X	X	X	X	X
OR	X	X	X	X	X	X	X
PA	X	X	X	X	X	X	X
RI	X	X	X	X	X	X	X

SC	X	X	X	X	X	X	X
SD	X	X	X	X	X	X	X
TN	X	X	X	X	X	X	X
TX	X	X	X	X	X	X	X
UT	X	X	X	X	X	X	X
VA	X	X	X	X	X	X	X
VT	X	X	X	X	X	X	X
WA	X	X	X	X	X	X	X
WI	X	X	X	X	X	X	X
WV	X	X	X	X	X	X	X
WY	X	X	X	X	X	X	X

Appendix Table A2. OUD ICD-9 Codes

OUD[105]	304.00-304.03; 304.70-304.73, 305.50-305.53, 965.00, 965.01, 965.02, 962.09, E850.0, E935.0

Appendix Table A3. Perinatal Visits Codes

Visit Type	**Coding System**	**Codes**
Prenatal Visit[105]	ICD-9	V22.X, V23.X
Postpartum Visit[105]	ICD-9	V24.1, V24.2
Emergency Visit[174]	Revenue Codes	Emergency Department (450,451,456,459) or Obstetric Triage (720,729)

Appendix Table A4. Comorbidities ICD-9 Codes[104]

Mental Health Conditions[105]	**All**	295.X, 296.X, 311.XX,648.4X, 300.0X, 309.8X
Chronic Conditions[104]	**Chronic Respiratory Disease**	491.X – 496.X
	Chronic Hypertension	401.X-405.X, 642.0X, 642.1X, 642.2X, 6427.X
	Diabetes	249.X, 250.X, 648.0X
	Chronic Heart Disease	412.X-414.X, 394.X-397.X, 424.X, 428.22, 428.23, 428.32, 428.33, 428.42, 428.43, 745.0X-747.4X, 648.5X
	Chronic Renal Disease	581.X-583.X, 585.X, 587.X, 588.X, 646.2X

	Chronic Liver Disease	571.X, 572.X
	HIV	042.X, V08.X
Pregnancy Complications	**All**	641.0, 641.1, 641.8, 641.9, 642.3, 642.4, 642.5, 642.6, 642.9, 648.0, 648.1, 648.2, 648.8, 649.5, 648.6, 648.7, 648.9

Model Specification.

The multivariable logistic regression equation that we used in our analysis is provided below:

$$\text{logit}(Y) = \beta_0 + \beta_1 Race + \beta_2 Age + \beta_3 MHC + \beta_4 CC + \beta_5 PC + \beta_6 Urbanicity + \beta_7 State + \beta_8 Year + u_{ij}$$

In this model, $\text{logit}(Y)$ is the outcome variable of interest (natural log of the odds of OUD diagnosis, any OUD treatment, MOUD treatment, and counseling alone). $Race$ is a vector of variables indicating individual-level race/ethnicity, Age is a vector of variables indicating individual-level age group, MHC is an indicator indicating individual-level mental health comorbidities, CC is an indicator indicating individual-level chronic conditions, PC is an indicator indicating individual-level pregnancy complications, $Urbanicity$ is a vector of variables indicating county-level urbanicity, $State$ is a state fixed effect, $Year$ is a year fixed effect, and + u_{ij} is the error term. Standard errors are clustered at the individual (patient) level to account for multiple deliveries for the same woman.

Table A5: Characteristics of Deliveries by OUD Status (2007-2012, 50 states and the District of Columbia): Sensitivity Analysis

	Non-OUD-Affected Deliveries	OUD-Affected Deliveries	All Deliveries
	N (%)	N (%)	N (%)
Total	6,082,276 (100)	54,434 (100)	6,136,710 (100)
Adequate Prenatal Care			
Yes	3,371,671 (55.4)	23,275 (42.8)	3,394,946 (55.3)
No	2,710,605 (44.6)	31,159 (57.2)	2,741,764 (44.7)
Postpartum Care			
Yes	2,689,225 (44.2)	15,901 (29.2)	2,705,126 (44.1)
No	3,393,051 (55.8)	38,533 (70.8)	3,431,584 (55.9)
Emergency Care			
Yes	2,060,151 (33.9)	27,475 (50.5)	2,087,626 (34.0)
No	4,022,125 (66.1)	26,959 (49.5)	4,049,084 (66.0)

Table A6. Odds of Perinatal and Emergency Health Care Utilization Among All Deliveries (50 states and the District of Columbia, 2007-2012) (N=6,136,710)

	Adequate Prenatal Care N (%)	Adequate Prenatal Care aOR (95% CI)	Postpartum Care N (%)	Postpartum Care aOR (95% CI)	Emergency Care N (%)	Emergency Care aOR (95% CI)
Sociodemographic Characteristics	3,394,946 (55.3)	-	2,705,126 (44.1)	-	2,087,626 (34.0)	-
Age						
18-25 (omitted)	1,850,002 (56.5)	REF	1,435,433 (43.8)	REF	1,247,321 (38.1)	REF
26-35	1,324,770 (54.4)	0.90 (0.89, 0.91)	1,078,742 (44.3)	1.01 (1.00, 1.02)	740,873 (30.4)	0.73 (0.72, 0.74)
36-44	220,175 (51.6)	0.75 (0.73, 0.76)	190,951 (44.7)	0.99 (0.97, 1.01)	99,432 (23.3)	0.53 (0.51, 0.54)
Race/Ethnicity						
Non-Hispanic White (omitted)	1,439,488 (54.3)	REF	1,149,609 (43.4)	REF	1,012,692 (38.2)	REF
Non-Hispanic Black	841,570 (54.7)	0.84 (0.82, 0.85)	647,450 (42.1)	0.82 (0.80, 0.83)	657,466 (42.8)	1.37 (1.35, 1.39)
Hispanic	891,165 (60.1)	1.02 (1.00, 1.03)	710,125 (47.9)	0.98 (0.96, 0.99)	302,753 (20.4)	0.92 (0.91, 0.94)
American Indian & Alaska Native	54,275 (40.2)	0.86 (0.83, 0.90)	51,247 (38)	1.22 (1.17, 1.27)	49,454 (36.6)	0.76 (0.73, 0.80)
Other/Unknown Race/Ethnicity	168,449 (51.2)	0.94 (0.91, 0.96)	146,695 (44.6)	1.03 (1.00, 1.05)	65,261 (19.8)	0.67 (0.64, 0.69)
Urbanicity						
Metro (omitted)	2,769,635 (55.7)	REF	2,233,265 (44.9)	REF	1,626,109 (32.7)	REF
Non-metro, adjacent to urban area	411,153 (54.5)	1.14 (1.12, 1.16)	313,009 (41.5)	0.99 (0.97, 1.01)	299,156 (39.7)	0.93 (0.91, 0.94)
Non-metro, not adjacent to urban area	214,158 (52.3)	1.14 (1.12, 1.17)	158,852 (38.8)	0.98 (0.96, 1.00)	162,361 (39.6)	0.90 (0.88, 0.92)
Clinical Characteristics						
OUD Diagnosis	23,275 (42.8)	0.52 (0.51, 0.53)	15,901 (29.2)	0.50 (0.49, 0.51)	27,475 (50.5)	1.54 (1.51, 1.58)
Mental Health Comorbidities	500,655 (58.3)	1.18 (1.16, 1.20)	380,281 (44.3)	1.01 (1.00, 1.03)	430,918 (50.2)	1.91 (1.88, 1.94)
Any Chronic Condition	671,257 (60.5)	1.14 (1.12, 1.15)	523,998 (47.3)	1.09 (1.07, 1.10)	488,084 (44)	1.33 (1.31, 1.35)
Any Pregnancy Complication	1,854,337 (60.7)	1.56 (1.55, 1.58)	1,423,376 (46.6)	1.19 (1.17, 1.20)	1,427,706 (46.8)	3.20 (3.16, 3.24)

Table A7. Odds of Perinatal and Emergency Health Care Utilization Among OUD-Affected Deliveries (50 states and the District of Columbia, 2007-2012) (N = 54,434)

	Adequate Prenatal Care N (%)	Adequate Prenatal Care aOR (95% CI)	Postpartum Care N (%)	Postpartum Care aOR (95% CI)	Emergency Care N (%)	Emergency Care aOR (95% CI)
Sociodemographic Characteristics	23,275 (42.8)	-	15,901 (29.2)	-	27,475 (50.5)	-
Age						
18-25 (omitted)	8,446 (44.3)	REF	5,930 (31.1)	REF	10,084 (52.9)	REF
26-35	13,128 (42.9)	0.94 (0.90, 0.97)	8,755 (28.6)	0.87 (0.84, 0.91)	15,353 (50.1)	0.85 (0.81, 0.89)
36-44	1,701 (35.8)	0.70 (0.65, 0.75)	1,216 (25.6)	0.75 (0.69, 0.81)	2,038 (42.9)	0.71 (0.65, 0.77)
Race/Ethnicity						
Non-Hispanic White (omitted)	19,031 (44.2)	REF	12,784 (29.7)		22,302 (51.9)	REF
Non-Hispanic Black	1,546 (35.6)	0.65 (0.61, 0.70)	1,145 (26.4)	0.84 (0.77, 0.90)	2,063 (47.6)	1.16 (1.06, 1.26)
Hispanic	1,631 (39.3)	0.87 (0.80, 0.93)	1,132 (27.3)	0.88 (0.81, 0.95)	1,542 (37.2)	1.07 (0.96, 1.18)
American Indian & Alaska Native	520 (33.6)	0.73 (0.65, 0.83)	406 (26.3)	0.85 (0.75, 0.98)	848 (54.9)	1.05 (0.92, 1.21)
Other/Unknown Race/Ethnicity	547 (39.2)	0.95 (0.84, 1.07)	434 (31.1)	1.23 (1.08, 1.39)	720 (51.6)	0.79 (0.70, 0.900)
Urbanicity						
Metro (omitted)	17,774 (41.7)	REF	12,588 (29.6)		21,537 (50.6)	REF
Non-metro, adjacent to urban area	3,310 (45.2)	1.15 (1.11, 1.19)	2,143 (29.3)	1.1 (1.06, 1.14)	3,642 (49.7)	1.68 (1.61, 1.75)
Non-metro, not adjacent to urban area	2,191 (48.5)	1.12 (1.07, 1.16)	1,170 (25.9)	1.04 (0.99, 1.08)	2,296 (50.8)	1.44 (1.37, 1.51)
Clinical Characteristics						
Mental Health Comorbidities	13,928 (44.7)	1.65 (1.59, 1.72)	9,458 (30.3)	1.25 (1.20, 1.30)	17,543 (56.2)	2.70 (2.60, 2.82)
Any Chronic Condition	6,390 (45.9)	1.16 (1.09, 1.22)	4,209 (30.2)	0.98 (0.93, 1.04)	8,046 (57.7)	0.97 (0.91, 1.03)
Any Pregnancy Complication	14,086 (48)	1.20 (1.11, 1.29)	9,269 (31.6)	0.85 (0.78, 0.92)	18,061 (61.6)	0.84 (0.77, 0.91)

Chapter Five: Association Between Child Welfare Policies, OUD Diagnosis and Treatment, and Prenatal Care Utilization Among Medicaid-Insured Individuals: 2007-2012

Abstract

Importance. In an effort to deter prenatal opioid misuse, many states have enacted punitive child welfare policies designating prenatal opioid use as child abuse or neglect. The impact of these policies on perinatal opioid use disorder (OUD) diagnosis and treatment and prenatal care utilization is not well-understood.

Objective. To determine if child welfare policies were associated with OUD diagnosis, OUD treatment and prenatal care utilization.

Design, Setting and Participants. This repeated cross-sectional study used retrospective, two-way fixed effects event-time analysis of delivery hospitalizations in Medicaid Analytic eXtract (MAX) data for multiple states from 2007 to 2012. States without punitive child welfare policies were compared against states with policies before and after policy effective date using linear probability models adjusting for individual and county-level factors, early Medicaid expansion and state and month fixed effects. Analyses were conducted from November 1, 2021, to February 16, 2022.

Exposures. Time since effective date of punitive child welfare policies relating to prenatal opioid use, county-level rurality, and state-level early Medicaid expansion.

Main Outcome and Measures. Probability of OUD diagnosis, OUD treatment, MOUD (i.e., standard of care) and adequate prenatal care.

Results. After adjustment, we found that punitive child welfare policies were associated with a significant decrease in the probability of OUD diagnosis in the third full calendar year after policy effective date (average monthly adjusted probability, -0.01, p=0.02). Child welfare policies were also associated with a significant increase in the probability of MOUD in the first two years after policy effective date (average monthly adjusted probability in the first year, 0.09, p<0.01; second year, 0.09, p=0.04). These policies were not associated with changes in the probability of any OUD treatment or adequate prenatal care in the first three calendar years after policy effective date.

Conclusions and Relevance. Our results suggest that punitive child welfare policies are associated with lower probability of OUD diagnosis, but among women with diagnosed OUD, these policies are associated with a higher probability of MOUD. These policies are not associated with changes in adequate prenatal care. These findings highlight the importance of understanding the potentially harmful impacts of punitive policies addressing prenatal opioid use.

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Introduction.

Opioid use during the prenatal period poses significant health risks for women and their infants, including increased risk of maternal morbidity and mortality, preterm birth, low birth weight, and neonatal opioid withdrawal syndrome (NOWS), a clinical condition affecting some newborns exposed to opioids in utero.[7,9,10] The incidence of NOWS increased from 1.2 to 8.8 per 1,000 delivery hospitalizations from 2000 to 2016[7,150,201,202], with larger gains in rural and tribal communities and for infants with Medicaid coverage.[11,150,203]

Medication for opioid use disorder (MOUD, including methadone and buprenorphine) is the recommended treatment for perinatal OUD.[13] MOUD reduces the risk of relapse and subsequent overdose; improves utilization of prenatal care and addiction treatment services; and reduces the risk of adverse obstetric and birth outcomes.[13,21] Despite the benefits of MOUD, many pregnant women with OUD are treated with counseling alone, and many others are left untreated.[36,46] This gap in evidence-based care is influenced by misinformation and stigma surrounding MOUD during pregnancy,[34,46,93-99] difficulty accessing substance use treatment services,[46,101,102] lack of prescribing providers,[204] complex delivery models[204] and fear of punitive policy responses, including reporting of suspected or confirmed prenatal substance use to Child Protective Services (CPS) or health officials.[93,94,100]

Despite consensus from the medical and public health communities that treatment-supportive policy approaches to maternal opioid use are safer and more effective than punitive policy approaches,[40,205] states continue to propose, enact and enforce policies that classify prenatal substance use as child abuse or neglect under civil

child welfare statutes (hereafter referred to as "child welfare policies"). Largely qualitative work has shown that the perception of child welfare policies is often punitive, jeopardizing the relationship between pregnant women and their health care providers and causing them to delay or avoid prenatal care and substance abuse treatment for fear of involvement of the police or child protective services (CPS).[8,30,32-37,206] Because regular prenatal care improves the likelihood of a healthy pregnancy and birth, and because untreated OUD during pregnancy is associated with multiple adverse health outcomes for mothers and infants, punitive approaches to substance use in the prenatal period may have unintended and adverse effects on maternal and child health.[30,37,38]

Although several studies have analyzed the relationship between punitive policies addressing prenatal substance use and birth outcomes, including rates of NOWS,[35,64,65,100] research is limited on the association between child welfare policies and changes in OUD diagnosis, receipt and type of OUD treatment, and prenatal care utilization, especially for Medicaid-insured individuals. Medicaid is the primary payer for 75% of substance use-related maternal hospitalizations, covering roughly 80% of annual hospital costs related to NOWS.[46] Because individuals with Medicaid coverage are disproportionately impacted by opioid misuse and its associated harms,[46] it is important to understand the impacts of child welfare policies for pregnant women with OUD in this population. Our study aims to address this evidence gap by leveraging a national, multi-year Medicaid claims database to examine the association between punitive child welfare policies and changes in the probability of (1) OUD diagnosis, (2) any OUD treatment, (3) MOUD and (4) adequate prenatal care among publicly-insured pregnant women with OUD.

Methods.

Data Sources.

We used 2006-2014 Medicaid Analytic eXtract (MAX) files for 50 states and the District of Columbia; these data include information on inpatient and outpatient services, eligibility, and prescription drug utilization. We identified women 18 to 44 years of age who had a delivery hospitalization[103] from January 1, 2007, to December 31, 2012, excluding deliveries that occurred before or after this period to allow for sufficient observation during the prenatal and postpartum periods. We included deliveries for women who were Medicaid-enrolled during the month of delivery and eight months before the month of delivery. Medicaid MAX data were not available for all states in each year we examined; Appendix Table A1 shows the states and years of data availability.

We obtained punitive child welfare policy data from a targeted legal scan that expands upon the prenatal substance use policy data set produced by the Guttmacher Institute,[29] reviewing relevant statutes to identify policy effective dates for four states that enacted the policy within our time period: Arizona (September 2009), South Carolina (June 2008), Tennessee (2011) and Utah (2012). Eighteen states and the District of Columbia enacted punitive child welfare policies before the start of our study period; six states enacted these policies after our time period ends; and the remaining states never enacted these policies. Appendix Table A2 shows states that enacted punitive child welfare policies and the enactment dates of those policies.

Sample, Outcomes and Patient-Level Covariates.

The MAX dataset contains all Medicaid claims for all individuals that had Internal Classification of Disease-Ninth Revision (ICD-9) codes for OUD in any diagnosis field over the period 2006-2014, plus all claims for a random sample of control individuals that never had OUD in any diagnosis field. We identified OUD-affected deliveries using ICD-9 codes for OUD, and the control sample was weighted to be representative of all Medicaid-enrolled women without OUD for all states in the study period. A table showing the ICD-9 codes for OUD is provided in Appendix Table A3.

We used *Current Procedural Technology* (CPT) codes, *Healthcare Common Procedure Coding System* (HCPCS) codes, and National Drug Codes (NDCs) to identify OUD treatment, including counseling and/or MOUD (including buprenorphine and methadone maintenance treatment), for inpatient and outpatient claims during the prenatal period, defined as 260 days prior to delivery, and 365 days postpartum. For buprenorphine treatment, we included only buprenorphine formulations that the Food and Drug Administration (FDA) had approved for OUD treatment, and we excluded buprenorphine formulations only approved for pain management. A list of CPT and HCPCS codes used to identify methadone maintenance treatment are provided in Appendix Table A4. We used ICD-9 codes to identify OUD prenatal care visits during the prenatal period. We then created dichotomous measures of (1) OUD diagnosis (among all deliveries); and (2) any OUD treatment, (3) MOUD treatment; and (4) adequate prenatal care (defined as at least seven visits), consistent with the literature defining adequate prenatal care when gestational age at delivery is unavailable[105,183] (among OUD-affected deliveries). A list of ICD-9 codes used to identify prenatal visits

is provided in Appendix Table A5.

Using the MAX outpatient service files, we determined whether a woman had a concurrent mental health condition, other pre-existing chronic condition, or pregnancy-specific comorbidity (see Appendix Table A6 for the ICD-9 codes included)[104,105]. Using the MAX eligibility files, we determined a woman's age category (18-25 years, 26-35 years, and 36-44) and race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, Non-Hispanic American Indian or Native Alaskan [AI/AN], or other/unknown). We defined the delivery month and state as the calendar month and state in which the delivery hospitalization occurred.

State-Level and County-Level Covariates.

We identified county-level urbanicity (categorized as metropolitan, non-metropolitan adjacent to a metropolitan area, and non-metropolitan not adjacent to a metropolitan area) using 2013 Rural-Urban Continuum Codes.[106] Early Medicaid expansion dates are publicly available; states and effective dates are provided in Appendix Table A7.

Statistical Analysis.

We used 2-way fixed effects event-time models to examine the association between time since effective date of child welfare policies and changes in the probability of OUD diagnosis, any OUD treatment, MOUD and receipt of adequate prenatal care. We specified a linear probability model for ease of interpretation of the event study. The key independent variable was a vector of monthly indicators of the time-since policy

effective date until the month of delivery, which allows for heterogeneous policy impacts over time. We adjusted for individual-level sociodemographic and clinical characteristics; county-level urbanicity; state-level early Medicaid expansion; and state and month fixed effects. Policy effects were identified by pre-post variation within states that implemented the policy; variation in the timing of policy implementation across states; and comparison between states that did and did not enact the punitive policy.

We accounted for unobserved correlation structures across observations within state by calculating cluster robust standard errors at the state level.[207,208] We weighted all analyses such that effects represented the average policy effects across states that implemented the policy. Average calendar month effects for each full calendar year after policy effective date were calculated by averaging the monthly point estimates for that year; Wald tests were used to determine whether these average calendar month effects were statistically different from zero. Model specification is provided in the Appendix. Analyses were conducted using STATA 16.0 (College Station, TX). The RAND institutional review board approved the research with a waiver of informed consent.

We checked for evidence of parallel trends, which is an important assumption of 2-way fixed effects models, and we found that our results do not appear to violate that assumption (Appendix Table A8). We also tested for anticipatory effects of the policy (part of the common shocks assumption), and we found minimal evidence of anticipatory effects (Appendix Table A9).

Results.

Descriptive Results.

Of the 3,396,884 deliveries in our sample, 26,039 (0.8%) were OUD-affected (Table 1). Among OUD-affected deliveries, 79.8% received any OUD treatment, 57.6% received MOUD, and 51.7% received adequate prenatal care.

Pregnant women aged 26-35 years old were more likely to have an OUD diagnosis (1.1%) relative to younger (0.5%) and older (1.09%) women. Non-Hispanic White women were more likely to have an OUD diagnosis (1.4%) compared to all other race/ethnicity groups. Women with mental health comorbidities (2.8%), pre-existing chronic conditions (1.1%) and pregnancy complications (0.8%) were more likely to have an OUD diagnosis compared to women without these comorbidities. Women in rural areas (1.0%) were more likely to have an OUD diagnosis compared to women in metro (0.8%) and metro-adjacent (0.8%) areas. Women living in states without a child welfare policy were more likely to have an OUD diagnosis (0.9%) compared to women in states with policies effective for up to one year (0.8%) or with policies effective for more than one year (0.6%).

Among women with OUD-affected deliveries, pregnant women aged 36-44 years old were more likely to receive any OUD treatment (82.7%) relative to women aged 18-25 years (75.9%) and 26-35 years (81.5%). Hispanic (81.7%) and non-Hispanic White (81.1%) women were more likely to receive any OUD treatment than any other race/ethnicity groups. Women with mental health comorbidities (86.1%) or pre-existing chronic conditions (81.3%) were more likely to receive any OUD treatment compared to women without these comorbidities. Women without pregnancy complications (80.5%)

were more likely to receive any OUD treatment compared to women with pregnancy complications. Women in rural areas (80.6%) were more likely to receive any OUD treatment compared to women in metro (80.0%) and metro-adjacent (78.2%) areas. Women living in states without a child welfare policy were more likely to receive any OUD treatment (82.1%) compared to women in states with policies effective for up to one year (81.6%) or with policies effective for more than one year (75.5%).

Among women with OUD-affected deliveries, women aged 26-35 years were more likely to receive MOUD (61.1%) relative to younger (52.1%) and older (55.4%) women. Hispanic (62.7%) and non-Hispanic White (60.1%) women were more likely to receive MOUD than any other race/ethnicity groups. Women with mental health comorbidities (59.8%) were more likely to receive MOUD relative to women without these conditions, whereas women without chronic conditions (58.4%) or pregnancy complications (62.0%) were also more likely to receive MOUD. Women in rural areas (61.1%) were more likely to receive MOUD compared to women in metro (57.4%) and metro-adjacent (56.7%) areas. Women living in states without a child welfare policy were more likely to receive MOUD (64.6%) compared to women in states with policies effective for up to one year (54.0%) or with policies effective for more than one year (45.2%).

Among women with OUD-affected deliveries, women aged 18-25 years were more likely to receive adequate prenatal care (54.7%) relative to older women. Non-Hispanic White (53.2%) women were more likely to receive adequate prenatal care than any other race/ethnicity groups. Women with mental health comorbidities (52.4%), chronic conditions (52.2%) or pregnancy complications (56.5%) were more likely to

receive adequate prenatal care relative to women without these conditions. Women in rural areas (56.0%) were more likely to receive adequate prenatal care compared to women in metro (50.6%) and metro-adjacent (54.9%) areas. Women living in states with a child welfare policy effective for more than one year were more likely to receive adequate prenatal care (53.7%) compared to women in states without policies (51.0%) or with policies effective for up to one year (37.9%).

Regression Results.

OUD Diagnosis.

After adjustment, punitive child welfare policies were associated with a significant decrease in the probability of OUD diagnosis in the third full calendar year after policy effective date (average monthly adjusted probability, -0.01, p=0.02) (Table 1, Figure 1).

Any OUD Treatment.

In adjusted models, punitive child welfare policies were not associated with a significant change in the probability of any OUD treatment in the first three calendar years after policy effective date (Table 1, Figure 2).

MOUD.

After adjustment, child welfare policies were associated with a significant increase in the probability of MOUD in the first two years after policy effective date

(average monthly adjusted probability in the first year, 0.09, p<0.01; second year, 0.09, p=0.04) (Table 1, Figure 3). Early Medicaid expansion was associated with a significant decrease in the probability of MOUD (aCoef = -0.13, p<0.01).

Adequate Prenatal Care.

In adjusted models, child welfare policies were not associated with a change in the probability of adequate prenatal care in the first three years after policy effective date (Table 1, Figure 4).

Discussion.

In our analysis of the association between child welfare policies and changes in the probability of OUD diagnosis, any OUD treatment, MOUD and adequate prenatal care among Medicaid-insured pregnant women with OUD, we found that child welfare policies were associated with a significant decrease in the probability of OUD diagnosis, but among pregnant women with OUD, the policy was associated with a significant increase in the probability of MOUD.

Our finding that child welfare policies were associated with a decrease in the probability of OUD diagnosis is noteworthy, suggesting that these policies and the stigma that they perpetuate may act as a deterrent from contact with the health care system during pregnancy. In states with these policies in place, OUD diagnoses may fall for several reasons. First, pregnant women struggling with opioid misuse may choose not to come into their OB-GYN's or primary care provider's office for fear of judgment, detection or punishment, or they may attend their appointment but choose not to disclose

their opioid use. Providers cannot treat what they do not know about, and because appropriate treatment of perinatal OUD is essential for maximizing the health outcomes of mothers and their infants, this failure to diagnose a treatable medical condition exacerbates the risks of adverse obstetric and birth outcomes.[34,38,209,210] Second, it is possible that providers are reluctant to diagnose OUD among their pregnant patients for fear of exposing them to the punitive consequences of these policies. Our finding that child welfare policies are associated with lower probability of OUD diagnosis is consistent with qualitative work by Roberts and Pies (2011),[33] Crawford et al. (2022),[206] and Stone (2015)[34] documenting fear of detection and punishment as an important barrier to appropriate care in the context of perinatal OUD. Another possibility is that punitive policies reduce the probability of OUD diagnosis by reducing the amount of illicit drug use among pregnant women (a true deterrent effect), but this is unlikely given a plethora of research documenting increasing rates of OUD at delivery and NOWS in recent years[211-215] as well as research describing punitive policies directed toward pregnant women who use illicit substances as ineffective.[83,87]

Our finding that child welfare policies are associated with increased probability of MOUD is also noteworthy, contradicting findings of Angelotta et al. (2016),[36] and Gressler et al. (2019),[216] and Choi et al. (2021)[217] that such policies were associated with lower utilization of MOUD, but the discrepancy may be explained by our analysis of Medicaid-insured individuals versus individuals in national datasets. Angelotta et al. (2016)[36] examined 2012 Treatment Episode Dataset – Admissions (TEDS-A) and found that child welfare policies were associated with lower rates of MOUD. Gressler et al. (2019)[216] examined commercial claims database IQVA PharMetrics Plus over the period

2007-2015 and found that criminal statutes were associated with lower prevalence of MAT, but their findings were insignificant; the authors noted that this was likely due to the fact that the population included only commercially-insured women, whereas maternal OUD is much more common – and treatment more likely to be covered – among Medicaid-insured pregnant women.[216] Choi et al. (2021)[217] found that punitive policies dampened the positive effects of Medicaid expansion on uptake of MOUD among pregnant women using 2010-2018 TEDS-D data. When paired with our finding that child welfare policies are associated with lower probability of OUD diagnosis, the result that pregnant women diagnosed with OUD were more likely to receive MOUD suggests that child welfare policies may increase utilization of evidence-based treatment via a compulsory mechanism of fear of punishment, involvement of CPS, and the loss of child custody if an infant is diagnosed with NOWS. Although MOUD is the standard of care for the treatment of perinatal OUD, this potentially coercive versus elective treatment pathway threatens provider-patient trust and may erode confidence in the health care system.[218]

Our findings that child welfare policies were not associated with changes in the probability of any OUD treatment or receipt of adequate prenatal care conflicts with findings by Roberts and Pies (2011),[33] and Coyer (2015),[64] and Kozhimannil et al. (2019)[37], which found that punitive policies were associated with lower probability of any OUD treatment and adequate prenatal care, and warrant further research. Again, it is possible that discrepancies arise from the fact that our analysis focuses on the population of Medicaid-insured individuals, rather than national datasets. The result that early Medicaid expansion was not significantly associated with the probability of OUD

diagnosis, any OUD treatment or adequate prenatal care, but was significantly associated with a decrease in the probability of MOUD, is somewhat surprising, given existing research[199,219-221] showing that the Affordable Care Act (ACA) and Medicaid expansion increased the use of MOUD. Furthermore, because the ACA and Medicaid expansion increased continuous enrollment among Medicaid-insured pregnant women[222,223], it follows that the policies would also be associated with increased use of MOUD for that population[224]. However, because our time period only allowed for the analysis of Medicaid expansion in early expansion states, it seems plausible that the effect was different for the broader policy change in 2014. It is also important to note that insurance coverage via Medicaid expansion does not equate to health care, especially in the case of safety-net provider systems serving low-income, immigrant and minority communities, where capacity is often limited by resource constraints.[225]

Limitations.

This study must be viewed within the context of its limitations. First, our data are older, but because states continue to propose, enact and enforce both treatment-supportive and punitive policies specific to prenatal substance use, these results are relevant for current policy discussions. As recently as 2018, Arizona and Kentucky passed laws designating prenatal substance use as grounds for the termination of parental rights,[35] and many states have never enacted treatment-supportive policies specific to prenatal substance use. Second, we have limited policy variation: only four states (Arizona, South Carolina, Tennessee and Utah) enacted punitive child welfare policies within our study period, such that we have pre-post data, and only two of these states

(Arizona and South Carolina) had substantial follow-up, reducing our statistical power. Another limitation is that common to all two-way fixed effects models, which have been demonstrated to have high type 1 error rates.[226] This is a potential limitation that we plan to address in future work by running the specification using placebo policies and checking for significant results in simulations. If the type 1 error rate is high enough to warrant concern, we can adjust our standard errors to account for this.

Another potential limitation is the argument that pregnant women struggling with OUD might not be aware of state-level policy change and how it may directly or indirectly affect them. These women tend to have fewer social support resources[227] and are likely more disengaged from political discourse and policy processes relative to individuals without OUD. However, even if pregnant women with OUD are unaware in real-time of state-level policy change that is relevant for them, we would argue that (1) they become aware over time as they or their friends encounter the downstream effects of policy change in their own lives (and our models allow for gradual or delayed policy effects); and (2) they are acutely aware of the social context and policy environment that produce the policy change, and that they alter their behavior because of these more macro-level shifts surrounding policy enactment. Policies do not happen in a vacuum, but rather are products of social and political context, sifting through the community in a myriad of ways. In this case, policy change could be thought of as a proxy for time- and geography-specific social and political shifts in the way we think about and respond to maternal substance use.

Another limitation is that we do not know how these policies are implemented or the extent to which each of these policies is enforced. Further, our findings are subject to

threats to external validity and generalizability: the effects of child welfare policies on OUD diagnosis and treatment and prenatal health care utilization among pregnant women insured by Medicaid might not be generalizable to the population of privately-insured individuals. Another important issue is that there are limitations to the consistency, level of detail, and documentation of existing policy data sets for analyses like this one, with significant subjectivity and interpretation with regard to how these policies are defined and dates are identified. Emerging work[228] will help to clarify some of these issues and streamline approaches for policy identification in future research. Finally, a potential limitation of our analysis is the designation of child welfare policies as punitive. We recognize that although the traditional framing of prenatal substance use policy in the U.S. uses a dichotomy of punitive versus treatment-supportive, this dichotomy is imperfect and obscures important nuances with regard to the intent, interpretation, and implementation of policies addressing prenatal substance use, and also glosses over the dynamic, time- and location-specific policy environments within which policies are created and operationalized.

Conclusion.

Despite these limitations, our study is among the first to use a fifty-state, multi-year pooled cross-sectional Medicaid claims dataset to examine the association between child welfare policies and changes in the probability of OUD diagnosis, receipt and type of OUD treatment, and adequate prenatal care among pregnant women with OUD. Pregnant women with OUD face multiple and substantial barriers to OUD treatment, including transportation challenges, lack of child care, and difficulty finding and

enrolling in treatment;[34] our study suggests that child welfare policies represent yet another barrier to appropriate perinatal OUD care. As perinatal opioid use continues to increase in the U.S.,[6] it is crucial that policymakers understand the potentially harmful impacts of punitive policies addressing prenatal substance use and focus on evidence-based, treatment-supportive policy strategies that promote and protect access to perinatal OUD treatment.

Tables and Figures

Table 1. Sample Characteristics: OUD-Affected Deliveries (2007-2012) (N=26,039)

	All Deliveries (N = 3,396,884)	OUD-Affected Deliveries (N = 26,039)		
	OUD Diagnosis	Any OUD Treatment	MOUD	Adequate Prenatal Care
	N (%)	N (%)	N (%)	N (%)
Total	26,039 (0.77)	20,774 (79.8)	15,005 (57.6)	13,459 (51.7)
Age Cohort (years)				
18-25	8,460 (0.47)	6,418 (75.9)	4,406 (52.1)	4,625 (54.7)
26-35	15,138 (1.11)	12,338 (81.5)	9,246 (61.1)	7,811 (51.6)
36-44	2,441 (1.09)	2,018 (82.7)	1,353 (55.4)	1,023 (41.9)
Race/Ethnicity				
Non-Hispanic White	20,569 (1.36)	16,673 (81.1)	12,362 (60.1)	10,938 (53.2)
Non-Hispanic Black	2,141 (0.23)	1,466 (68.5)	710 (33.2)	973 (45.4)
Hispanic	2,055 (0.28)	1,678 (81.7)	1,289 (62.7)	973 (47.3)
American Indian & Alaska Native	708 (0.96)	538 (76)	367 (51.8)	309 (43.6)
Other/Unknown Race/Ethnicity	566 (0.34)	419 (74)	277 (48.9)	266 (47)
Mental Health Comorbidity				
Yes	15,847 (2.77)	13,648 (86.1)	9,472 (59.8)	8,306 (52.4)
No	10,192 (0.36)	7,126 (69.9)	5,533 (54.3)	5,153 (50.6)
Any Chronic Condition (excluding mental health)				
Yes	7,163 (1.07)	5,823 (81.3)	3,982 (55.6)	3,741 (52.2)
No	18,876 (0.69)	14,951 (79.2)	11,023 (58.4)	9,718 (51.5)
Any Pregnancy Complication				
Yes	15,231 (0.84)	12,072 (79.3)	8,308 (54.5)	8,601 (56.5)
No	10,808 (0.69)	8,702 (80.5)	6,697 (62)	4,858 (44.9)
Urbanicity				
Metro	20,249 (0.75)	16,193 (80)	11,623 (57.4)	10,255 (50.6)
Non-metro, adjacent to urban area	3,560 (0.79)	2,784 (78.2)	2,020 (56.7)	1,955 (54.9)
Non-metro, not adjacent to urban area	2,230 (0.95)	1,797 (80.6)	1,362 (61.1)	1,249 (56)
Child Welfare Policy status				
No policy	16,479 (0.91)	13,527 (82.1)	10,646 (64.6)	8,402 (51)
≤ 1 year	457 (0.84)	373 (81.6)	247 (54)	173 (37.9)
> 1 year	9,103 (0.6)	6,874 (75.5)	4,112 (45.2)	4,884 (53.7)

Figure 1. Association Between Child Welfare Policy and Probability of OUD Diagnosis in First 3 Years Post-Effective Date

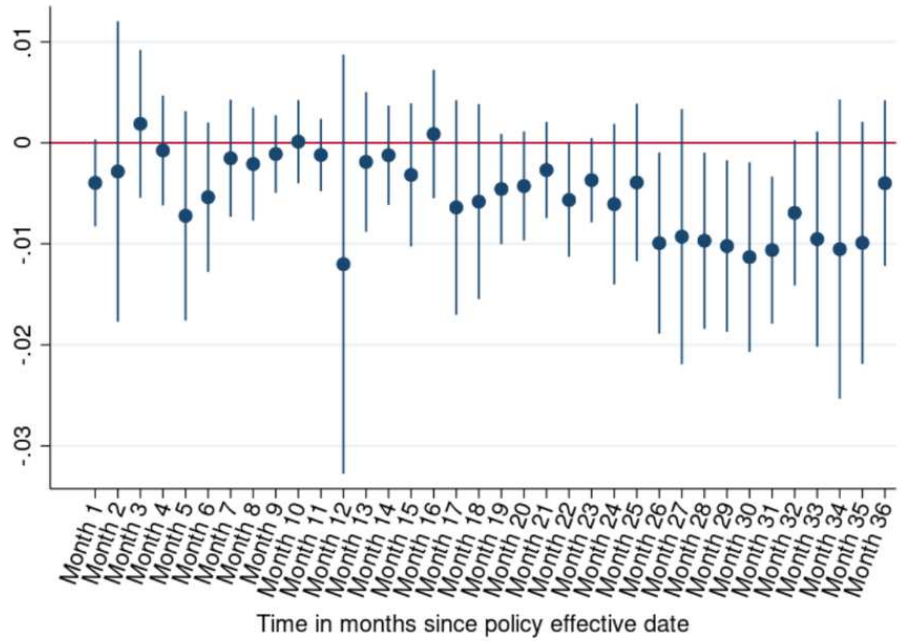

Figure 2. Association Between Child Welfare Policy and Probability of Any OUD Treatment in First 3 Years Post-Effective Date

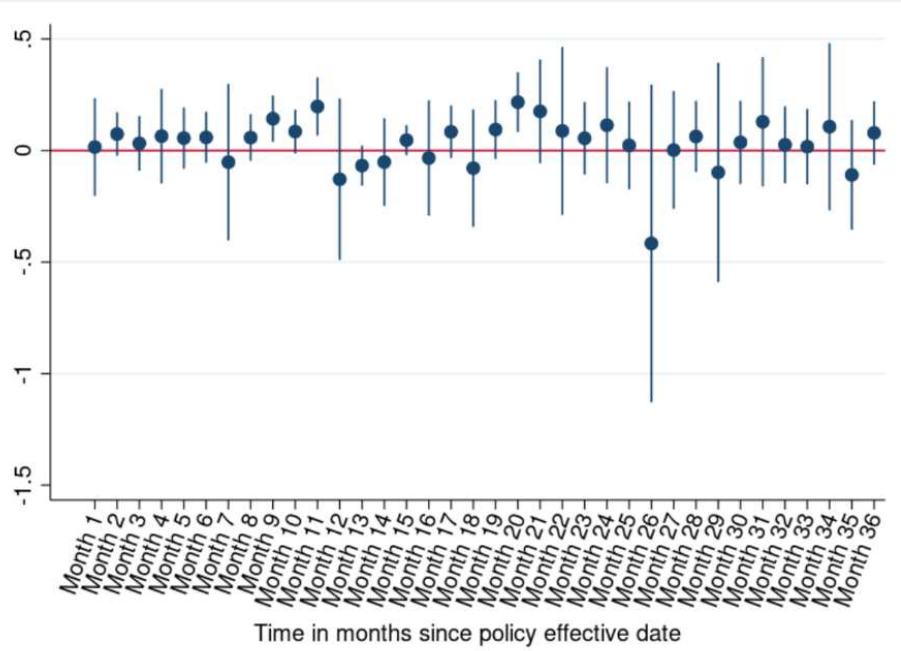

Figure 3. Association Between Child Welfare Policy and Probability of MOUD in First 3 Years Post-Effective Date

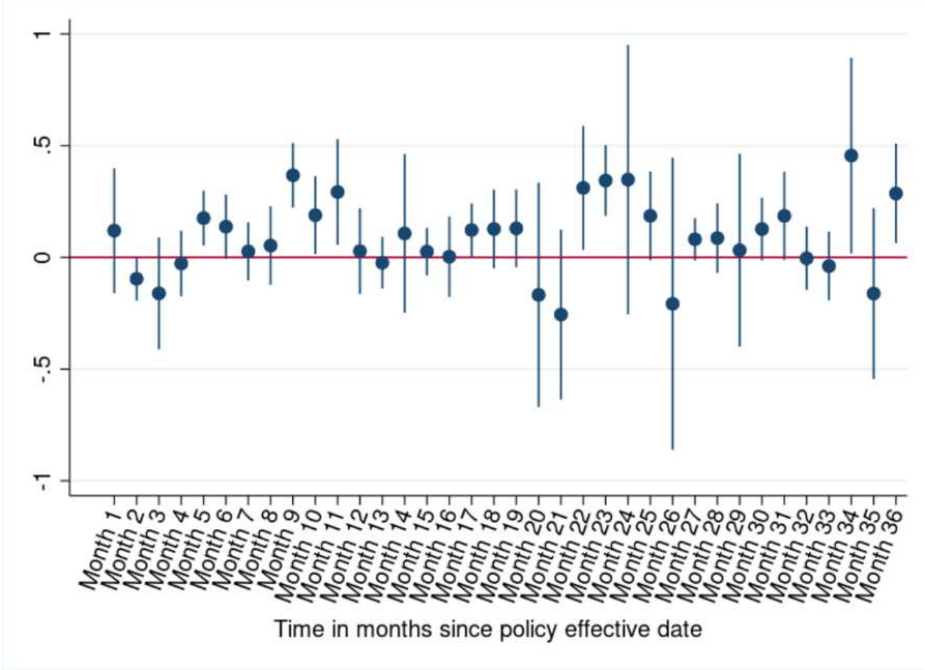

Figure 4. Association Between Child Welfare Policy and Probability of Adequate Prenatal Care in First 3 Years Post-Effective Date

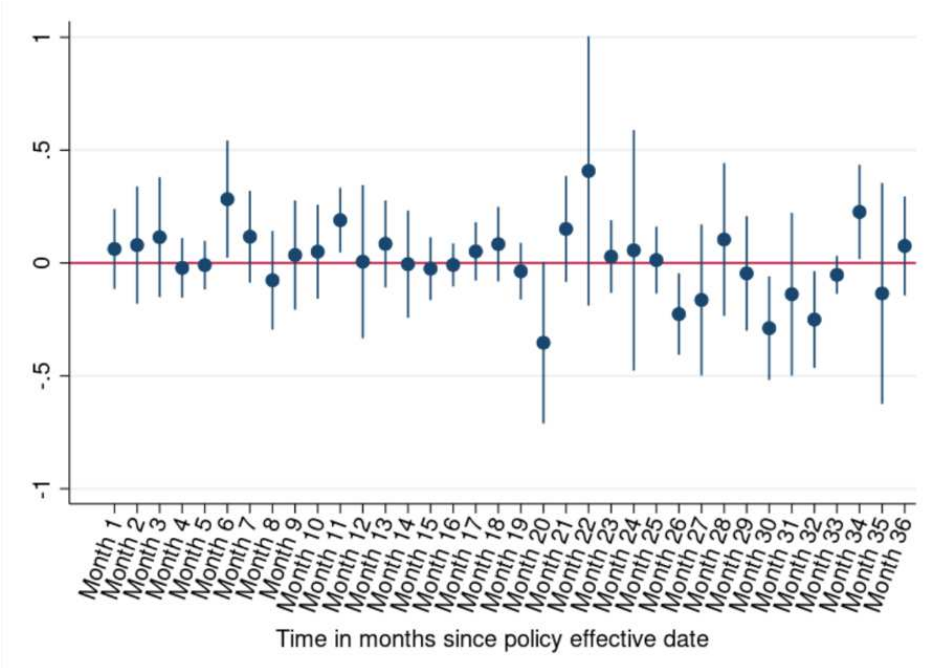

Table 2. Association Between Child Welfare Policies and Probability of OUD Diagnosis and Treatment and Prenatal Health Care Utilization (2007-2012)

	All Deliveries (N = 3,396,884)	OUD-Affected Deliveries (N = 26,039)		
	OUD Diagnosis	Any OUD Treatment	MOUD Treatment	Adequate Prenatal Care
Sociodemographic Characteristics				
Age				
18-25 (omitted)	REF	REF	REF	REF
26-35	0.009***	0.014	0.03**	-0.013
36-44	0.008**	0.006	0.002	-0.133***
Race/Ethnicity				
Non-Hispanic White (omitted)	REF	REF	REF	REF
Non-Hispanic Black	-0.014***	-0.082***	-0.202***	-0.055**
Hispanic	-0.013***	-0.024	0.011	-0.043
American Indian & Alaska Native	-0.001	-0.085**	-0.053	-0.086*
Other/Unknown Race/Ethnicity	-0.015***	0.001	-0.012	-0.068**
Urbanicity				
Metro (omitted)	REF	REF	REF	REF
Non-metro, adjacent to urban area	-0.004***	0.004	-0.016	-0.004
Non-metro, not adjacent to urban area	-0.005	-0.007	-0.009	-0.032
Clinical Characteristics				
Mental Health Comorbidities	0.026***	0.128***	0.043***	0.023
Any Chronic Condition	0.001	0.016	-0.002	0.001
Any Pregnancy Complication	-0.002**	-0.011	-0.039***	0.093***
Early Medicaid Expansion	0.003	-0.039	-0.132***	0.115
Child Welfare Policy				
Average Monthly Effect Year 1	-0.003	0.050	0.092***	0.069
Average Monthly Effect Year 2	-0.004	0.054	0.089**	0.036
Average Monthly Effect Year 3	-0.009**	-0.012	0.086*	-0.074

Appendix

Table A1. States and Years Available in the MAX Data

State	2006	2007	2008	2009	2010	2011	2012
AK	X	X	X	X	X	X	X
AL	X	X	X	X	X	X	X
AR	X	X	X	X	X	X	X
AZ	X	X	X	X	X	X	X
CA	X	X	X	X	X	X	X
CO	X	X	X	X	X	X	X
CT	X	X	X	X	X	X	X
DC	X	X	X	X	X	X	X
DE	X	X	X	X	X	X	X
FL	X	X	X	X	X	X	X
GA	X	X	X	X	X	X	X
HI	X	X	X	X	X	X	X
IA	X	X	X	X	X	X	X
ID	X	X	X	X	X		X
IL	X	X	X	X	X	X	X
IN	X	X	X	X	X	X	X
KS	X	X	X	X		X	X
KY	X	X	X	X	X	X	X
LA	X	X	X	X	X	X	X
MA	X	X	X	X	X	X	X
MD	X	X	X	X	X	X	X
ME						X	X
MI	X	X	X	X	X	X	X
MN	X	X	X	X	X	X	X
MO	X	X	X	X	X	X	X
MS	X	X	X	X		X	X
MT	X	X	X	X	X	X	X
NC	X	X	X	X	X	X	X
ND	X	X	X	X	X	X	X
NE	X	X	X	X	X	X	X
NH	X	X	X	X	X	X	X
NJ	X	X	X	X	X	X	X
NM	X	X	X	X	X	X	X
NV	X	X	X	X	X	X	X
NY	X	X	X	X	X	X	X
OH	X	X	X	X	X	X	X
OK	X	X	X	X	X	X	X
OR	X	X	X	X	X	X	X
PA	X	X	X	X	X	X	X
RI	X	X	X	X	X	X	X

SC	X	X	X	X	X	X	X
SD	X	X	X	X	X	X	X
TN	X	X	X	X	X	X	X
TX	X	X	X	X	X	X	X
UT	X	X	X	X	X	X	X
VA	X	X	X	X	X	X	X
VT	X	X	X	X	X	X	X
WA	X	X	X	X	X	X	X
WI	X	X	X	X	X	X	X
WV	X	X	X	X	X	X	X
WY	X	X	X	X	X	X	X

Table A2. Child Welfare Policies: States & Enactment Years

State	Enactment Year	Statute for AZ, SC, TN & UT
AL	2006	
AK	.	
AZ	2009	A.R.S. § 8-201(25)
AR	2005	
CA	.	
CO	2005	
CT	2017	
DC	2002	
DE	.	
FL	1987	
GA	.	
HI	.	
ID	.	
IL	1989	
IN	1987	
IA	1984	
KS	.	
KY	2015	
LA	2005	
ME	.	
MD	1997	
MA	.	
MI	.	
MN	1989	
MS	.	
MO	2014	
MT	.	
NE	.	

NV	2005	
NH	.	
NJ	.	
NM	.	
NY	.	
NC	.	
ND	2003	
OH	.	
OK	2000	
OR	.	
PA	.	
RI	2014	
SC	2008	S.C. Code Ann. § 63–7–1660(D)
SD	1998	
TN	2011	TENN. CODE ANN. § 39-13-107(a)
TX	1997	
UT	2012	Rule R512-80
VT	.	
VA	1998	
WA	1997	
WV	.	
WI	1998	
WY	.	

*Note: We have effective year and month for Arizona, South Carolina, Tennessee and Utah based on a targeted legal scan. For all other states, we use July 1 of the enactment year as the effective month.

Appendix Table A3. OUD ICD-9 Codes

OUD[105]	304.00-304.03; 304.70-304.73, 305.50-305.53, 965.00, 965.01, 965.02, 962.09, E850.0, E935.0

Appendix Table A4. Methadone Maintenance CPT & HCPCS Codes

Methadone Maintenance Treatment	H0020, Z2006, Z3357, 02200, 2973, 1671, Z1856, 02206, 1564, 1543, Z1854, H0033, X0321, 02208, 02250, 02202, 02256, 02207, 1618, T1502, S0109

Appendix Table A5. Comorbidities ICD-9 Codes[104]

Mental Health Conditions[105]	**All**	295.X, 296.X, 311.XX,648.4X, 300.0X, 309.8X
Chronic Conditions[104]	**Chronic Respiratory Disease**	491.X – 496.X
	Chronic Hypertension	401.X-405.X, 642.0X, 642.1X, 642.2X, 6427.X
	Diabetes	249.X, 250.X, 648.0X
	Chronic Heart Disease	412.X-414.X, 394.X-397.X, 424.X, 428.22, 428.23, 428.32, 428.33, 428.42, 428.43, 745.0X-747.4X, 648.5X
	Chronic Renal Disease	581.X-583.X, 585.X, 587.X, 588.X, 646.2X
	Chronic Liver Disease	571.X, 572.X
	HIV	042.X, V08.X
Pregnancy Complications	**All**	641.0, 641.1, 641.8, 641.9, 642.3, 642.4, 642.5, 642.6, 642.9, 648.0, 648.1, 648.2, 648.8, 649.5, 648.6, 648.7, 648.9

Table A6. Early Medicaid Expansion States & Timing

State	**Effective Date**
California	November 2010
Connecticut	April 2010
District of Columbia	July 2010
Minnesota	March 2010
New Jersey	April 2011
Washington	Jan 2011

Table A7. Association Between Child Welfare Policies and Probability of OUD Diagnosis and Treatment and Prenatal Health Care Utilization (2007-2012)

	All Deliveries (N = 3,396,884)	OUD-Affected Deliveries (N = 26,039)		
	OUD Diagnosis aCoef (95% CI)	Any OUD Treatment aCoef (95% CI)	MOUD Treatment aCoef (95% CI)	Adequate Prenatal Care aCoef (95% CI)
Sociodemographic Characteristics				
Age				
18-25 (omitted)	REF	REF	REF	REF
26-35	0.01 (0.01, 0.01)	0.01 (-0.01, 0.04)	0.03 (0, 0.06)	-0.01 (-0.04, 0.01)
36-44	0.01 (0, 0.01)	0.01 (-0.02, 0.03)	0 (-0.05, 0.06)	-0.13 (-0.2, -0.07)
Race/Ethnicity				
Non-Hispanic White (omitted)	REF	REF		REF
Non-Hispanic Black	-0.01 (-0.02, -0.01)	-0.08 (-0.12, -0.05)	-0.2 (-0.28, -0.12)	-0.06 (-0.11, 0)
Hispanic	-0.01 (-0.02, -0.01)	-0.02 (-0.1, 0.05)	0.01 (-0.06, 0.08)	-0.04 (-0.1, 0.01)
American Indian & Alaska Native	0 (-0.01, 0.01)	-0.09 (-0.16, -0.02)	-0.05 (-0.12, 0.02)	-0.09 (-0.19, 0.02)
Other/Unknown Race/Ethnicity	-0.02 (-0.02, -0.01)	0 (-0.05, 0.05)	-0.01 (-0.07, 0.04)	-0.07 (-0.12, -0.01)
Urbanicity				
Metro (omitted)	REF	REF		REF
Non-metro, adjacent to urban area	0 (-0.01, 0)	0 (-0.02, 0.03)	-0.02 (-0.05, 0.02)	0 (-0.05, 0.04)
Non-metro, not adjacent to urban area	-0.01 (-0.01, 0)	-0.01 (-0.06, 0.05)	-0.01 (-0.08, 0.06)	-0.03 (-0.1, 0.04)
Clinical Characteristics				
Mental Health Comorbidities	0.03 (0.02, 0.03)	0.13 (0.1, 0.16)	0.04 (0.02, 0.07)	0.02 (-0.01, 0.05)
Any Chronic Condition	0 (0, 0)	0.02 (-0.01, 0.04)	0 (-0.03, 0.03)	0 (-0.03, 0.03)
Any Pregnancy Complication	0 (0, 0)	-0.01 (-0.02, 0)	-0.04 (-0.06, -0.02)	0.09 (0.06, 0.13)
Early Medicaid Expansion	0 (-0.01, 0.02)	-0.04 (-0.11, 0.03)	-0.13 (-0.18, -0.08)	0.12 (-0.04, 0.27)
Child Welfare Policy				
M1	0 (-0.01, 0)	0.02 (-0.2, 0.23)	0.12 (-0.16, 0.4)	0.06 (-0.11, 0.24)
M2	0 (-0.02, 0.01)	0.07 (-0.02, 0.17)	-0.1 (-0.19, 0)	0.08 (-0.18, 0.34)
M3	0 (-0.01, 0.01)	0.03 (-0.09, 0.15)	-0.16 (-0.41, 0.09)	0.11 (-0.15, 0.38)
M4	0 (-0.01, 0)	0.06 (-0.15, 0.28)	-0.03 (-0.17, 0.12)	-0.02 (-0.15, 0.11)
M5	-0.01 (-0.02, 0)	0.06 (-0.08, 0.19)	0.18 (0.05, 0.3)	-0.01 (-0.12, 0.1)
M6	-0.01 (-0.01, 0)	0.06 (-0.06, 0.17)	0.14 (-0.01, 0.28)	0.28 (0.02, 0.54)
M7	0 (-0.01, 0)	-0.05 (-0.4, 0.3)	0.03 (-0.1, 0.16)	0.12 (-0.09, 0.32)
M8	0 (-0.01, 0)	0.06 (-0.05, 0.16)	0.05 (-0.12, 0.23)	-0.08 (-0.29, 0.14)
M9	0 (0, 0)	0.14 (0.04, 0.25)	0.37 (0.22, 0.51)	0.04 (-0.21, 0.28)
M10	0 (0, 0)	0.09 (-0.01, 0.18)	0.19 (0.01, 0.36)	0.05 (-0.16, 0.26)

M11	0 (0, 0)	0.2 (0.07, 0.33)	0.29 (0.06, 0.53)	0.19 (0.05, 0.33)
M12	-0.01 (-0.03, 0.01)	-0.13 (-0.49, 0.23)	0.03 (-0.16, 0.22)	0.01 (-0.33, 0.34)
M13	0 (-0.01, 0.01)	-0.07 (-0.16, 0.02)	-0.02 (-0.14, 0.09)	0.08 (-0.11, 0.28)
M14	0 (-0.01, 0)	-0.05 (-0.25, 0.14)	0.11 (-0.25, 0.46)	0 (-0.24, 0.23)
M15	0 (-0.01, 0)	0.05 (-0.02, 0.11)	0.03 (-0.08, 0.13)	-0.03 (-0.16, 0.11)
M16	0 (-0.01, 0.01)	-0.03 (-0.29, 0.22)	0 (-0.18, 0.18)	-0.01 (-0.1, 0.09)
M17	-0.01 (-0.02, 0)	0.08 (-0.03, 0.2)	0.12 (0, 0.24)	0.05 (-0.08, 0.18)
M18	-0.01 (-0.02, 0)	-0.08 (-0.34, 0.18)	0.13 (-0.05, 0.3)	0.08 (-0.08, 0.25)
M19	0 (-0.01, 0)	0.09 (-0.04, 0.23)	0.13 (-0.04, 0.3)	-0.04 (-0.16, 0.09)
M20	0 (-0.01, 0)	0.22 (0.08, 0.35)	-0.17 (-0.67, 0.33)	-0.35 (-0.71, 0)
M21	0 (-0.01, 0)	0.18 (-0.06, 0.41)	-0.26 (-0.64, 0.12)	0.15 (-0.08, 0.39)
M22	-0.01 (-0.01, 0)	0.09 (-0.29, 0.46)	0.31 (0.03, 0.59)	0.41 (-0.19, 1)
M23	0 (-0.01, 0)	0.06 (-0.11, 0.22)	0.34 (0.19, 0.5)	0.03 (-0.13, 0.19)
M24	-0.01 (-0.01, 0)	0.11 (-0.15, 0.37)	0.35 (-0.25, 0.95)	0.06 (-0.48, 0.59)
M25	0 (-0.01, 0)	0.02 (-0.17, 0.22)	0.19 (-0.01, 0.38)	0.01 (-0.14, 0.16)
M26	-0.01 (-0.02, 0)	-0.42 (-1.13, 0.3)	-0.21 (-0.86, 0.45)	-0.23 (-0.41, -0.05)
M27	-0.01 (-0.02, 0)	0 (-0.26, 0.27)	0.08 (-0.01, 0.18)	-0.16 (-0.5, 0.17)
M28	-0.01 (-0.02, 0)	0.06 (-0.1, 0.22)	0.09 (-0.07, 0.24)	0.1 (-0.23, 0.44)
M29	-0.01 (-0.02, 0)	-0.1 (-0.59, 0.39)	0.03 (-0.4, 0.46)	-0.05 (-0.3, 0.21)
M30	-0.01 (-0.02, 0)	0.04 (-0.15, 0.22)	0.13 (-0.01, 0.27)	-0.29 (-0.52, -0.06)
M31	-0.01 (-0.02, 0)	0.13 (-0.16, 0.42)	0.19 (-0.01, 0.38)	-0.14 (-0.5, 0.22)
M32	-0.01 (-0.01, 0)	0.03 (-0.15, 0.2)	0 (-0.15, 0.14)	-0.25 (-0.47, -0.04)
M33	-0.01 (-0.02, 0)	0.02 (-0.15, 0.19)	-0.04 (-0.19, 0.11)	-0.05 (-0.14, 0.03)
M34	-0.01 (-0.03, 0)	0.11 (-0.27, 0.48)	0.46 (0.02, 0.89)	0.23 (0.02, 0.43)
M35	-0.01 (-0.02, 0)	-0.11 (-0.36, 0.14)	-0.16 (-0.54, 0.22)	-0.13 (-0.62, 0.35)
M36	0 (-0.01, 0)	0.08 (-0.06, 0.22)	0.29 (0.06, 0.51)	0.08 (-0.14, 0.29)

Table A8. Assessing for Parallel Trends

	All Deliveries (N = 3,396,884)	OUD-Affected Deliveries (N = 26,039)		
	OUD Diagnosis	**Any OUD Treatment**	**MOUD Treatment**	**Adequate Prenatal Care**
Sociodemographic Characteristics				
Age				
18-25 (omitted)	REF	REF	REF	REF
26-35	0.007	-0.066**	-0.157***	0.1
36-44	0.012***	0.018	0.027	-0.015
Race/Ethnicity				
Non-Hispanic White (omitted)	REF	REF	REF	REF
Non-Hispanic Black	0.009*	0.004	-0.001	-0.152***
Hispanic	-0.019***	-0.083***	-0.212***	-0.052
American Indian & Alaska Native	-0.018***	-0.031	0.011	-0.042
Other/Unknown Race/Ethnicity	-0.005	-0.061	-0.036	-0.085
Urbanicity				
Metro (omitted)	REF	REF	REF	REF
Non-metro, adjacent to urban area	-0.022***	0.036	0.006	-0.084**
Non-metro, not adjacent to urban area	-0.005*	0.008	-0.015	-0.008
Clinical Characteristics				
Mental Health Comorbidities	-0.008	-0.017	-0.019	-0.05
Any Chronic Condition	0.034***	0.125***	0.044***	0.023
Any Pregnancy Complication	0	0.019	0.002	-0.001
Early Medicaid Expansion	-0.004*	-0.007	-0.033**	0.09***
Event-Time <=0	0	0	0.001	0.002

Note: *** p< 0.01, ** p< 0.05, * p< 0.10

Table A9. Assessing for Anticipatory Effects

	All Deliveries (N = 3,396,884)	OUD-Affected Deliveries (N = 26,039)		
	OUD Diagnosis	**Any OUD Treatment**	**MOUD Treatment**	**Adequate Prenatal Care**
Sociodemographic Characteristics				
Age				
18-25 (omitted)	REF	REF	REF	REF
26-35	0.009***	0.014	0.031**	-0.013
36-44	0.008**	0.006	0.002	-0.133***
Race/Ethnicity				
Non-Hispanic White (omitted)	REF	REF	REF	REF
Non-Hispanic Black	-0.014***	-0.082***	-0.202***	-0.055**
Hispanic	-0.013***	-0.024	0.011	-0.044
American Indian & Alaska Native	-0.001	-0.086**	-0.053	-0.086*
Other/Unknown Race/Ethnicity	-0.015***	0	-0.01	-0.068**
Urbanicity				
Metro (omitted)	REF	REF	REF	REF
Non-metro, adjacent to urban area	-0.004***	0.004	-0.016	-0.004
Non-metro, not adjacent to urban area	-0.005	-0.007	-0.009	-0.032
Clinical Characteristics				
Mental Health Comorbidities	0.026***	0.128***	0.043***	0.023
Any Chronic Condition	0.001	0.017	-0.002	0.001
Any Pregnancy Complication	-0.002**	-0.01	-0.039***	0.093***
Early Medicaid Expansion	0.003	-0.039	-0.134***	0.117
Child Welfare Policy				
Average Monthly Effect Year -1	0.000	0.010	-0.064	0.070**
Average Monthly Effect Year 1	-0.003	0.049	0.064	0.091**
Average Monthly Effect Year 2	-0.004	0.054	0.056	0.061
Average Monthly Effect Year 3	-0.009**	-0.012	0.049	-0.045

Note: *** p< 0.01, ** p< 0.05, * p< 0.10

Model Specification.

Fixed Effects Event-Time Model:

$$Y_{i,t} = \beta_0 + \beta_1 ChildWelfare_{ij} + \beta_2 EarlyMedicaidExpansion_{ij} + \beta_3 Race_i + \beta_4 Age_i + \beta_5 MHC_i + \beta_6 CC_i + \beta_7 PC_i + \beta_8 Urbanicity_i + \beta_9 State_i + \beta_{10} Month_i + u_{ij}$$

where $Y_{i,t}$ is the binary outcome for delivery *i* from state *j* (*j* = 1, ..., 51). $ChildWelfare_{ij}$ = [0, 354] denotes the policy variable, specified as a vector of monthly indicators of the time since policy effective date in state *j* until the delivery month. Time-since-enactment monthly indicator is coded as 0 if the policy was not effective in the state during our study period. $Race$ is a vector of variables indicating individual-level race/ethnicity, Age is a vector of variables indicating individual-level age group, MHC is an indicator indicating individual-level mental health comorbidities, CC is an indicator indicating individual-level chronic conditions, PC is an indicator indicating individual-level pregnancy complications, $Urbanicity$ is a vector of variables indicating county-level urbanicity, $State$ is a state fixed effect, $Month$ is a month fixed effect, and + u_{ij} is the error term. Standard errors are clustered at the individual (patient) level to account for multiple deliveries for the same woman.

Chapter Six: Summary and Conclusions

In my three-paper dissertation, I explored several dimensions of perinatal health care utilization in the context of OUD in Medicaid. In paper one, I examined trends and sociodemographic and clinical disparities in receipt of OUD treatment and type of treatment over time. In paper two, I analyzed the relationship between OUD status and utilization of adequate prenatal, postpartum and emergency care, and among OUD-affected deliveries, I explored the extent to which adequate prenatal, postpartum and emergency care utilization varied by sociodemographic and clinical characteristics. In paper three, I investigated the association between punitive child welfare policies and changes in the probability of OUD diagnosis, any OUD treatment, MOUD, and receipt of adequate prenatal care. Although these relationships have been explored to some extent in previous work, evidence is limited for large, multi-year Medicaid populations, and existing research is very limited on OUD treatment and perinatal health care utilization among American Indian/ Alaskan Native (AI/AN) women due to limited sample size. By utilizing a national, multi-year Medicaid claims dataset, I worked to fill in these gaps in existing literature.

An examination of overall trends and patterns in OUD diagnosis, receipt and type of OUD treatment, and perinatal and emergency care utilization obscures notable and significant racial and ethnic disparities for Black, Hispanic and AI/AN women relative to non-Hispanic White women. Compared to their White counterparts, Black and AI/AN women were significantly less likely to receive any OUD treatment and MOUD. Over time, the disparity in receipt of any OUD treatment between Black and White women increased, with Black women becoming progressively less likely to receive any OUD

treatment relative to White women. Because OUD treatment and especially MOUD are associated with improved outcomes for women and infants,[13] these disparities in OUD treatment may be exacerbating well-described racial inequities in perinatal outcomes, including reduced prenatal care engagement, increased risk of maternal morbidity and mortality, and increased risk of preterm birth.[66,107-109]

We found that women with OUD-affected deliveries were significantly less likely to receive adequate prenatal care and attend the postpartum visit and significantly more likely to have perinatal emergency visits than women without OUD-affected deliveries. And among women with OUD-affected deliveries, Black, Hispanic and AI/AN women were significantly less likely to receive adequate prenatal care and attend the postpartum visit relative to non-Hispanic White women. Black and AI/AN women were also significantly more likely to receive emergency care. These findings add to the concerning results on racial and ethnic disparities from paper one, suggesting that Black, Hispanic and AI/AN women may also be missing opportunities for preventive care and comprehensive management of their physical and behavioral health during pregnancy.

Our policy assessment suggests that punitive child welfare policies are associated with lower probability of OUD diagnosis, but among women with diagnosed OUD, these policies are associated with a higher probability of MOUD. These findings highlight the importance of understanding the complex and multidimensional impacts of punitive policies addressing prenatal opioid use. Our finding that these policies result in lower probability of OUD diagnosis suggests that despite the intent of child welfare policies to reduce illicit prenatal opioid use and the incidence of neonatal opioid withdrawal syndrome (NOWS), these policies may have the unintended effect of exacerbating the

stigma of prenatal opioid use and deterring women from engaging with OUD treatment and obstetric providers for fear of judgment, detection and punishment, and the potential involvement of Child Protective Services (CPS) if their infant is diagnosed with NOWS. Providers cannot treat a condition that they do not observe, and this reduction in the probability of OUD diagnosis among pregnant patients suggests that pregnant women with undiagnosed OUD may be missing important opportunities for the care that they need.

Although our analysis suggests that child welfare policies are associated with an increase in the probability of MOUD among pregnant women diagnosed with OUD, it is important to ensure that these policies do not increase utilization of evidence-based treatment via a compulsory mechanism of fear and shame: these women may engage in MOUD treatment to avoid being reported to authorities and losing custody of their child. Although MOUD is the standard of care for perinatal OUD treatment, it is also important that policy strategies for reducing perinatal opioid use foster a patient-provider relationship built on mutual trust, which is crucial for successful management of OUD.[218] Contradictory to our hypothesis, we found that child welfare policies were not associated with a change in the probability of adequate prenatal care. This finding is counterintuitive and warrants future research; it is possible, for example, that these policies differentially affect demographic subgroups (e.g., women living in rural areas or women of racial/ethnic minority groups), but this should be examined in future work.

Taken together, my dissertation fills in evidence gaps surrounding disparities in perinatal OUD treatment and health care utilization and motivates a broader discussion on the impact of punitive policy responses to perinatal substance use. Research has

consistently demonstrated that pregnant women with OUD face multiple and substantial barriers to OUD treatment, including pervasive stigma,[34,46,93-99] complex treatment delivery models,[204] transportation challenges, lack of child care, and difficulty finding and enrolling in treatment,[34] and our study suggests that Black, Hispanic and AI/AN women with perinatal OUD have additional barriers relating to longstanding structural racism and cultural differences. Furthermore, we find that child welfare policies may represent yet another barrier to appropriate perinatal OUD treatment via reduced OUD diagnosis, and future work should explore the extent to which the impact of punitive policies varies for sociodemographic subgroups, especially women of racial and ethnic minority groups. As perinatal opioid use continues to increase in the U.S.,[6] especially among Black and AI/AN individuals,[114,149] it is crucial that policymakers understand the potentially harmful impacts of punitive policies addressing prenatal substance use and reorient toward evidence-based, treatment-supportive, and culturally-sensitive policy strategies that promote and protect access to perinatal OUD treatment.

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