CONTRACEPTIVE UTILIZATION AND DOWNSTREAM FETO-MATERNAL OUTCOMES FOR WOMEN WITH SUBSTANCE USE DISORDERS

A Dissertation Presented
By

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DEDICATION

This dissertation is dedicated to the memory of my father, Martin N. Griffith, for teaching me how the pursuit of knowledge can promote our understanding of others and expand our capacity for compassion.

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ABSTRACT

Background: One in ten people in the U.S. are affected by a substance use disorder (SUD), roughly one third of whom are women. Rates of unintended pregnancy are higher in this population than in the general public. Little is understood about how women with SUD use prescription contraception and think about pregnancy.

Methods: By analyzing Medicaid claims data and conducting qualitative interviews with women with SUD, this doctoral thesis seeks to: 1) compare any use of and consistent, continued coverage by prescription contraceptives between women with and without SUD; 2) determine the extent to which SUD is associated with pregnancy, abortion, and adverse feto-maternal outcomes in women who use prescription contraception; and 3) explore facilitators of and barriers to contraceptive utilization by women with SUD, using qualitative interviews.

Results: Compared to women without SUD, women with SUD are less likely to use any prescription contraceptive, particularly long-acting reversible methods. Among women who do use long-acting methods, SUD is associated with less continued, consistent coverage by a prescription contraceptive. Among women who use contraception, SUD is also associated with increased odds of abortion. When interviewed, women with SUD report fatalistic attitudes towards pregnancy planning, and have difficulty conceptualizing how susceptibility to pregnancy may change over time. Women with SUD also report that pregnancy has substantial impact on their drug treatment prospects.

Conclusions: This study is the first to examine contraceptive utilization by women with SUD who are enrolled in Medicaid or state-subsidized insurance. Our study may help to

inform clinical practice and policy development to improve the reproductive health and wellbeing of women with SUD.

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LIST OF ABBREVIATIONS

ACOG	American Congress of Obstetricians and Gynecologists
aOR	Adjusted Odds Ratio
COM	Commonwealth Care
CI	Confidence Interval
CPT	Current Procedural Terminology
DCF	Department of Children and Families
FASD	Fetal Alcohol Spectrum Disorder
HEDIS	Healthcare Effectiveness Data and Information Set
ICD-9	International Classification of Disease, Ninth Edition
IUD	Intrauterine Device
LARC	Long-Acting Reversible Contraception
MCO	Managed Care Organization
NAS	Neonatal Abstinence Syndrome
NDC	National Drug Code
OB/Gyn	Obstetrics & Gynecology
OCP	Oral Contraceptive Pills
OR	Odds Ratio
PCC	Primary Care Clinician
PCMH	Patient-Centered Medical Home
PCMHI	Patient-Centered Medical Home Initiative
PDC	Proportion of Days Covered
SARC	Short-Acting Reversible Contraception
STI	Sexually Transmitted Infection
SUD	Substance Use Disorder

PREFACE

Chapter II of this dissertation is under preparation for publication as:

Griffith, GJ et al. Prescription Contraceptive Use and Adherence by Women with Substance Use Disorders.

Chapter III of this dissertation is under preparation for publication as:

Griffith, GJ et al. The Association of Substance Use Disorders with Pregnancy, Abortion, and Adverse Feto-Maternal Outcomes Among Women on Prescription Contraception.

Chapter IV of this dissertation is under preparation for publication as:

Griffith, GJ et al. Barriers to and Facilitators of Contraceptive Use Among Women with Substance Use Disorders.

CHAPTER I:
INTRODUCTION

Over 21.6 million individuals in the United States meet criteria for a substance use disorder (SUD), which includes abuse of or dependence on alcohol or other drugs[1]. The majority of individuals with SUD are men[2], but the gender gap may be closing in younger age groups[3]. Compared to men, women begin use at an earlier age, progress to meet criteria for an SUD more rapidly, and present to treatment with greater medical, social, and employment impairment[4].

Pregnancy is a particular concern for young women with SUD due to the teratogenic effects of many substances[5], as well as the indirect effects on fetal development secondary to poor maternal health[6]. Moreover, women with SUD are at increased risk for unintended pregnancies[7], which are independently associated with inadequate prenatal care, low birth weight, and prematurity[8]. The American College of Obstetricians and Gynecologists recommends counseling women with SUD about prescription contraception[9], but SUD has been associated with lower odds of having, and consistently using contraception in selected populations [10,11]. Deepening our understanding of contraceptive utilization and decision-making by women with SUD may suggest improvements to clinical care and public policy that could reduce rates of unintended, complicated pregnancies in this population.

Pregnancy Intentions

An unintended pregnancy is one that is unwanted, mistimed, or about which the mother is ambivalent[12]. In the United States, approximately one in two pregnancies are

unintended[13]. One of the priorities of *Healthy People 2020* is a reduction in the unintended pregnancy rate[14]. Unintended pregnancies are associated with pregnancy complications, including delayed prenatal care initiation[15,16], prematurity[17,18], poorer long-term physical and mental health of the offspring[19-21], and poorer maternal-child bonding[22]. Moreover, unintended pregnancy may negatively impact maternal mental health[23].

Rates of unintended pregnancy vary across race, socioeconomic status, and age[13]. Drug use and SUD have been associated with higher rates of unintended pregnancy[7]. One British study found that past-year use of illicit drugs other than marijuana increased odds of unintended pregnancy over three-fold[24]. As many as 76 – 100% of pregnancies among opioid-dependent women are unintended[12,25,26]. Approximately equal proportions of women with SUD describe their unintended pregnancies as unwanted, mistimed, or ambivalent[12]. Our understanding of factors influencing how women with SUD think about pregnancy is limited.

Prescription Contraception

A variety of contraceptive methods are available to women who want to prevent pregnancy. Methods vary in their accessibility, effectiveness, side effect profile, ease of use, and ease of discontinuation. Prescription contraceptive methods are more effective at preventing pregnancy than over-the-counter methods, such as condoms[27]. Prescription contraceptive methods can be divided into irreversible contraception (male and female sterilization), long-acting reversible contraception (LARC; copper and hormonal intrauterine devices [IUDs], and hormonal implants), and short-acting reversible

contraception (SARC; oral contraceptive pills [OCPs], hormonal vaginal rings, and hormonal patches, and hormonal depot injections). Approximately one quarter of U.S. women of reproductive age used reversible prescription contraception in 2010, of which three-quarters used a short-acting method[13].

Prescription Contraception Initiation and SUD

Two studies conducted over 20 years ago suggest that SUD is associated with lower rates of contraceptive use[25,28], but trends in utilization by the general population have changed significantly since that time[29]. Recent studies have focused on the association of SUD with having a prescription contraceptive exclusively in adolescents[32,33] and veterans with concomitant mental illness[11]. No study has examined contraceptive use by women with SUD who are enrolled in Medicaid, despite Medicaid's critical role in funding care for SUD[34] and for unintended pregnancy[35].

Consistent, Continued Prescription Contraception Coverage and SUD

Appropriate adherence is critical for the effectiveness of any contraceptive method as evidenced by the discrepancy between "perfect-use" failure rates and "typical-use" failure rates[36] (Table 1.1). Non-adherence can result from inconsistent use (e.g., skipping one or more oral contraceptive pills), incorrect use (e.g., not refrigerating a hormonal ring), or discontinuation of use. In the general population, 18 – 27% of women use contraception inconsistently or incorrectly, and these women account for 41% of unintended pregnancies[13]. The amount of effort required of patients for correct, consistent contraceptive use varies substantially from method to method. Because LARC methods may only require patient action once every three to ten years for adequate

coverage, they have lower typical use failure rates than SARC methods, which require daily to monthly patient action[27,36].

Emerging evidence suggests that mental health diagnoses and psychiatric wellbeing have a significant impact on the likelihood of consistent use and continuation of prescription contraceptives[30,31]. One recent study of Veterans reported that women with comorbid mental illness and SUD had less consistent contraceptive coverage over 12 months than women without either diagnosis[10]. However, though SUD is a risk factor for inconsistent use of other medications[37-40], no studies to date have isolated the association of SUD with consistency of prescription contraceptive use.

Factors Influencing Initiation, Consistent Use, and Discontinuation of Prescription Contraception

Many factors, both personal and structural, impact when and how women with SUD initiate, use, and discontinue prescription contraceptives. Women with and without SUD may face barriers to consistent contraceptive use, including partner non-support of contraceptive use, and undesired side effects of the contraceptive[25,41]. Other barriers are unique to or heightened in women with SUD. Rates of co-occurring mental illnesses, which are known to affect how women use contraceptives, are elevated in women with SUD. Many women with SUD also report perceptions of stigma by healthcare professionals[25,41] that may deter them from seeking a prescription contraceptive, and drug-induced memory problems that may affect ability to consistently use medications[41].

Importantly, contraceptive decisions are not exclusively driven by the ease of obtaining and using a contraceptive, but also by a woman's feelings towards pregnancy.

Ambivalence or positive feelings about pregnancy strongly influence how adolescents use contraception[43], but it is unclear how pregnancy intentions drive contraceptive use among women with SUD. The existing literature exploring decision-making around contraceptive practices focuses predominately on women with opioid dependence[12,25,26], but ignores the experiences of women dealing with other SUDs. A deeper understanding of the factors driving how women with SUD use prescription contraception and think about pregnancy is important to help clinicians meet the reproductive healthcare needs of this population.

Pregnancy Outcomes to Women with SUD

Pregnancies among women with SUD, either due to contraceptive non-use, inconsistent contraceptive use, or innate contraceptive failure, can have short- and long-term consequences for both the mother and fetus. The biological effects of specific substances overlap, and many women concomitantly abuse multiple substances[44]. Maternal alcohol use is associated with fetal alcohol spectrum disorders (FASDs), which present with intellectual impairment, physical defects, growth deficits, central nervous system problems, and behavioral disorders[45]. FASD complicates 2-5% of births[46], and, in addition to its serious impact on fetal health, FASD costs the U.S. an estimated $4.0 billion annually[47].

Illicit substances also have a negative impact on fetal development. Maternal use of opioids, marijuana, or cocaine is associated with growth restriction, low birth weight, and poor neonatal outcomes[6]. Maternal opioid use is additionally associated with chorioamnionitis, intrauterine growth restriction, intrauterine fetal demise, and premature

delivery[48]. Pregnancies to opioid-dependent mothers can be further complicated by neonatal abstinence syndrome (NAS), a form of opioid withdrawal undergone by infants at birth[49]. NAS-afflicted infants have respiratory, gastrointestinal, and feeding difficulties[50], frequently resulting in longer hospital stays. The incidence of NAS has risen in recent years[50], costing the U.S. $720 million annually[50]. Cocaine use during pregnancy is associated with miscarriage, placental abruption, placenta previa, stillbirth, preterm delivery, and intrauterine growth restriction [44,51]. The effects of marijuana and amphetamine use during pregnancy are not as well established, but may be associated with low birth weight, shortening of gestation, and neonatal withdrawal symptoms[6,44]. Many physicians also discourage breast-feeding by women who use marijuana, though transfer via breast milk is minimal[52].

Legal Consequences of Pregnancy in Women with SUD

Pregnancy may also have unique social and legal consequences for women with SUD. Some states have funded drug treatment programs that are specifically targeted towards pregnant women, increasing access to a scarce resource in this vulnerable population[53]. However, many states have elected to deal with SUD in pregnancy as a civil or criminal offense. For example, substance use during pregnancy was specifically criminalized in Tennessee in 2014, and prosecutors in other states have successfully argued criminal cases against pregnant women with SUD using other existing laws. Furthermore, many states consider substance use during pregnancy an act of child abuse, a few states allow involuntary commitment of pregnant women with SUD, and some states require healthcare professionals to report substance use during pregnancy[53].

Massachusetts mandates reporting of substance use during pregnancy, but does not consider it a criminal act[53]. It has been suggested that laws around mandated reporting, prosecution, and involuntary commitment of women with SUD may damage patients' trust in providers, leading to avoidance of prenatal care[54]. A better understanding of how legal sanctions affect pregnant women with SUD and their children is needed to align legal and regulatory effort with best practices for maternal and fetal outcomes.

Specific Aims

This dissertation will explore how substance use disorders affect prescription contraceptive utilization, and describe the downstream associations with pregnancy and birth outcomes. First, we will analyze any use of and consistent, continued coverage by prescription contraception among 47,902 women with and without SUD using Massachusetts Medicaid (MassHealth) and state-subsidized insurance claims and encounter data from 2010 – 2014. We then will estimate the extent to which SUD is associated with odds of pregnancy, abortion, and adverse feto-maternal outcomes among women who used a prescription contraceptive in 2012. Finally, we will examine how women with SUD think about pregnancy and contraceptive use by conducting interviews with women from Obstetrics & Gynecology clinics in Worcester, MA. Interviews will discuss factors influencing contraception utilization, including perceptions of pregnancy and child-rearing, contraceptive use history, barriers to use, and the influence of substance use on contraceptive use. The specific aims of this dissertation are:

Aim 1. To compare any use of and consistent, continued coverage by reversible prescription contraceptives by reproductive-aged women with and without diagnosed SUDs who are enrolled in Medicaid or state-subsidized insurance.

Hypothesis 1a. Women with diagnosed SUD will be less likely to use prescription contraceptives than those without a diagnosis of SUD.

Hypothesis 1b. Women with diagnosed SUD who use prescription contraceptives will have a lower proportion of days covered by a contraceptive than women without a diagnosis of SUD.

Aim 2. To estimate the extent to which SUD is associated with odds of pregnancy, abortion, and negative feto-maternal outcomes among women enrolled in Medicaid or state-subsidized insurance who use prescription contraception.

Hypothesis 2a. SUD will be associated with increased odds of pregnancy. The association of SUD with increased odds of pregnancy will be stronger for women using SARC than for women using LARC.

Hypothesis 2b. Among women with a pregnancy, SUD be associated with increased odds of abortion and negative feto-maternal outcomes.

Aim 3. To explore facilitators of and barriers to initiation and consistent, continued use of contraception for women of reproductive age with SUDs,

Through these aims, this dissertation will describe and contextualize contraceptive practices and pregnancy outcomes by women with SUD. Findings from this study may help inform clinical practice and policy development to improve the reproductive health and wellbeing of women with SUD and their children.

Table 1.1. "Perfect Use" and "Typical Use" Failure Rates for Common Contraceptive Methods

	Category	Method	Frequency of Use	Typical Use Failure Rate	Perfect Use Failure Rate
		No method	N/A	85%	85%
Reversible	*Over the Counter Mehods*	Spermicides	Each Sexual Encounter	28%	18%
		NFP		24%	0.4% - 5%
		Withdrawal		22%	4%
		Sponge		12% - 24%	9% - 20%
		Condom		18% - 21%	2% - 5%
		Diaphragm		12%	6%
	SARC	Combined OCP	Daily	9%	0.30%
		Hormonal Transdermal Patch	Weekly	9%	0.30%
		Hormonal Ring	Monthly	9%	0.30%
		Depot Injection	Quarterly	6%	0.20%
	LARC	IUD	Once every 5-10 years	0.2% - 0.8%	0.2% - 0.6%
		Hormonal Implant		0.05%	0.05%
Irreversible		Female Sterilization	One-time Procedure	0.50%	0.50%
		Male Sterillization		0.15%	0.10%

Adapted from Trussell, 2011[36]

CHAPTER II:
ANY USE AND CONSISTENT, CONTINUED USE OF PRESCRIPTION CONTRACEPTION BY WOMEN WITH SUBSTANCE USE DISORDERS

ABSTRACT

Background: Rates of unintended pregnancy are substantially higher among women with substance use disorders (SUDs) than the general population. Emerging evidence suggests Veteran and adolescent women with SUD are less likely to have, consistently use, and continue use of prescription contraceptives. Although Medicaid beneficiaries have high rates of both SUD and unintended pregnancy, the prescription contraception utilization among women enrolled in Medicaid and subsidized insurance is unknown.

Objective: To examine to what extent SUD is associated with any use of, selected method of, and consistent, continued use of prescription contraceptives among women enrolled in Medicaid or subsidized insurance in Massachusetts.

Study Design: We conducted a retrospective cohort analysis of Massachusetts Medicaid (MassHealth) and Commonwealth Care (a subsidized insurance plan for individuals who were not eligible for Medicaid) claims and encounter data between 2010 and 2014 for 47,902 continuously-enrolled women aged 16-45 years. SUD was identified by the presence at least one *International Classification of Disease, Ninth Edition (ICD-9)* claim for an alcohol or drug use disorder. We examined the association of SUD with three outcomes: 1) any use of a reversible prescription contraceptive during 2012; 2) the type(s) of methods used; and, 3) the proportion of days covered by a prescription contraceptive in the 365 days following the first prescription contraceptive claim. We also examined whether the association between SUD and consistent, continued

contraceptive coverage was different between women using short-acting reversible contraception (SARC) and long-acting reversible contraception (LARC).

Results: Women with SUD were less likely than women without SUD to use a prescription contraceptive at any time during 2012 (19.2% v. 23.9%; adjusted Odds Ratio [aOR]: 0.80, $p < 0.001$). Among those women who used prescription contraception, SUD was associated with decreased LARC use (44.5% v. 42.8%; aOR 0.81, $p = 0.003$). Among women who used LARC, SUD was associated with lower odds of continued, consistent contraceptive coverage (aOR: 0.67, $p = 0.041$). Odds of consistent, continued coverage by SARC methods were not significantly different between women with and without SUD.

Conclusion: Among women enrolled on Medicaid and subsidized insurance, SUD is associated with lower odds of using a prescription contraceptive, and of continued, consistent use of LARC methods. Recommendations encouraging LARC use may not be sufficient to reduce rates of unintended pregnancy among women with SUD.

INTRODUCTION

Substance use disorders (SUDs), including abuse of and dependence on alcohol and drugs, affect about one in ten people in the United States[1]. Roughly one-third of people with SUD are women[3,55].

One issue particularly complicated by SUD is pregnancy. SUD is associated with preterm labor, premature rupture of membranes, fetal or maternal death, fetal malformation, fetal alcohol spectrum disorder, neonatal abstinence syndrome, intellectual disability, and poor growth in utero[5,6,9,45,56]. Moreover, unintended pregnancy is more common among women with SUD[6,12,25,26], which is independently associated with inadequate prenatal care, low birth weight, and prematurity[8].

To decrease the incidence of these high-risk pregnancies, the American Congress of Obstetricians and Gynecologists recommends prescription contraceptive counseling for women with SUD, including discussion of long-acting reversible contraceptive (LARC) methods[9]. Yet, emerging evidence from Veteran and adolescent populations suggests women with SUD are less likely than those without SUD to have, consistently use, and continue use of prescription contraceptives[10,11]. While Medicaid disproportionately funds both SUD care[34] and care related to unintended pregnancy[35], no studies have tracked contraceptive use in an SUD population enrolled in Medicaid or subsidized insurance. This study may help clinicians better understand the contraceptive practices of women with SUD, and ultimately improve their ability to meet women's contraceptive needs.

One potential tool to reduce disparities in contraceptive utilization by women with SUD is the delivery of care through expanded, comprehensive models like the Patient-Centered Medical Home (PCMH). The PCMH emphasizes a team-based, patient-centric approach to care, utilizing centralized primary care, expanded practice hours, integrated care delivery, and enhanced care coordination[57]. No studies have yet examined whether PCMH enrollment improves contraceptive use in vulnerable populations.

This analysis of Medicaid and Commonwealth Care (a subsidized insurance plan for individuals who are not eligible for Medicaid) claims data was conducted to examine associations between diagnosed SUD and use of reversible prescription contraceptives, the method(s) selected, and consistent, continued coverage by the selected method. We hypothesize that indicators of reversible prescription contraceptive use and consistent, continued coverage will be lower in patients with an SUD diagnosis and that the association between SUD and less consistent coverage will be weaker for patients using LARC. We also hypothesize that patients with SUD served by Medical Homes will have higher rates of contraceptive use and continued, consistent contraceptive coverage.

MATERIALS & METHODS

Data Source

We conducted a retrospective cohort study of Massachusetts Medicaid (MassHealth) and Commonwealth Care claims, using data extracted from the Executive Office of Health and Human Services Data Warehouse. This source contains eligibility and demographic information, linked with inpatient and outpatient medical claims and managed care encounter data, pharmacy claims, and long-term care claims. Our study

timeframe was from April 1st, 2010 to March 31st, 2014, which included the three years during which the Patient-Centered Medical Home Initiative (PCMHI) was conducted, plus one year of data prior to its start. The PCMHI was a demonstration project in Massachusetts that provided guidance and, in some cases, financial support to help primary care practices transform into Medical Homes.

Sample

Our sample included women aged 16-45 years who were continuously enrolled in Medicaid or Commonwealth Care, and who demonstrated use of their insurance benefit. Commonwealth Care was a program created in 2006 to expand coverage to many low-income Massachusetts residents who did not previously qualify for Medicaid. The vast majority of Commonwealth Care enrollees became eligible for Medicaid after the implementation of the Affordable Care Act. We defined continuous enrollment as 320 days or more during 2012[60], consistent with measures used by the Healthcare Effectiveness Data and Information Set (HEDIS), a national quality measurement tool developed by the National Committee for Quality Assurance[61]. We excluded women who had evidence of permanent sterilization, bilateral oophorectomy, or hysterectomy in the years 2010 – 2012. For analysis of consistent, continued contraceptive coverage, to ensure full availability of data in the 365 days following the first contraceptive claim of 2012, we further restricted our sample to women who also had continuous enrollment during 2013.

Measures

Exposure. The primary exposure of interest was operationalized as physician-diagnosed SUD, identified by at least one *International Classification of Disease, Ninth Edition (ICD-9)* claim from 2010 – 2012 in any position for an alcohol use disorder (303.x, 305.0x), or drug use disorder (292.x, 304.x, 305.x, excluding tobacco use disorders 305.1x). Women lacking any such ICD-9 claim from 2010 – 2012 were classified as not having an SUD. We conducted sensitivity analyses where we defined SUD using only 2012 diagnoses, but did not find any differences in our results.

Outcomes. We created a dichotomous indicator of "any use" of prescription contraceptives in 2012. We defined "any use" as at least one claim for an office procedure indicating contraceptive device placement or prescription fill during 2012; women without any claim during 2012 were classified as non-users. Oral contraceptive pills (traditional and extended cycle), transdermal hormonal patches, and vaginal rings were identified using National Drug Codes, and depot injections, hormonal implants, and IUDs were identified using ICD-9 Procedure and Current Procedural Terminology codes indicating placement, removal, or maintenance.

To examine method selection, women with evidence of prescription contraceptive utilization in 2012 were categorized into one of two groups: long-acting reversible contraception (LARC) users (IUDs or implants) and short-acting reversible contraception (SARC) users (Oral Contraceptive Pills [OCPs], patches, rings, or depot injections). If women used both SARC and LARC during 2012, they were categorized as LARC users.

We chose proportion of days covered (PDC) by a prescription contraceptive as our indicator of consistent, continued coverage[62]. PDC is an overall indicator of the

proportion of time a woman was preventing pregnancy with prescription contraception, and captures both how long a prescription contraceptive was continued, as well as the consistency of coverage during that time. PDC does not capture whether a contraceptive was used correctly (eg, taken at the same time everyday).

We created one PDC that included all forms of prescription birth control, such that a woman was "covered" if we could identify any method of prescription birth control available to her on a given day. Coverage length was determined by days' supply for oral contraceptive pills, hormonal patches, and vaginal rings. Coverage periods for depots, implants, and IUDs were assumed to be 90 days, three years (1,095 days), and five years (1,825 days), respectively, unless a removal code could be identified prior to these times. Although copper IUDs last up to 10 years, we were not able to consistently identify IUD type, and so we used the more conservative estimate appropriate to the hormonal IUD. Because we examined a period shorter than five years, this does not affect our PDC estimates. We identified the first use of a prescription contraceptive during 2012 (the "index" claim), and examined coverage by a contraceptive in the 365 days following that claim. When periods of contraceptive coverage overlapped, we excluded one overlapping section so as to not double count days covered. PDC was calculated as the proportion of days during which a women was covered by any prescription contraceptive in the 365 days following the index claim. In light of the fact that the minimum PDC for adequate contraceptive coverage is unknown, we created three PDC tertiles with equal numbers of women in each.

Covariates. Based on Andersen's Model of Healthcare Utilization, we theorized that contraceptive use, method selection, and PDC could be predicted by a combination of predisposing factors (age, overall health status, psychiatric comorbidity[10,11], coronary comorbidity, recent history of pregnancy, recent history of abortion, SUD), enabling factors (plan type, disability status, enrollment in the PCMHI), and evaluated need (SUD identification by a healthcare provider). Age, plan type, and disability status were obtained from the member file. Race was not included in our models due to high rates (34.2%) of missing data. We hypothesized that expanded access provided by Medical Homes might improve contraceptive use in women with SUD, so an indicator was included for enrollment in the PCMHI, the Massachusetts demonstration project that helped primary care practices become PCMHs. Overall health status was operationalized with the DxCG Score, a classification system developed for the purpose of risk-adjusted payments, and used here as a measure of disease burden[63]. Psychiatric comorbidity was operationalized as presence of ICD-9 codes during 2012 for major depression, bipolar disorder, post-traumatic stress disorder, or schizophrenia and other psychoses. Because use of estrogen-containing contraceptives is contraindicated or discouraged in patients with excessive coronary risk, we included a variable indicating coronary comorbidity (hypertension, venous thromboembolism, coronary artery disease, coronary vascular disease, stroke, tobacco use among women age 35 or older). We hypothesized that women in the period soon after a pregnancy or abortion might be additionally motivated to contraceptive use, so we included covariates for pregnancy (ICD-9 codes: 632, 634.x, 650.x – 677.x) during 2011, and abortion (ICD-9 codes: 635.x, 636.x) during 2011. In

recognition of differences in prior authorization procedures for managed care plans that could contribute to differences in contraceptive utilization, we included plan type as a three-level variable (managed care organization [MCO]; Primary Care Clinician Plan [PCC]; and all Commonwealth Care [COM]).

Analysis

We conducted univariate tests of normality of continuous variables. Based on non-normal distributions, we categorized age and DxCG score. Patient demographic and comorbidity profiles were described by SUD category. Differences were tested using chi-square tests for categorical variables and student's t-tests for continuous variables. We created separate models to explore our three outcomes: any prescription contraceptive use during 2012 (*dichotomous*: any use/ no use); type of method used (*dichotomous*: SARC/ LARC); and PDC (*ordinal*: tertiles). Any prescription contraceptive use and contraceptive method (LARC/SARC) were described with logistic models. Odds of falling into a higher PDC category were described by simple and multivariable ordinal logistic models. Adjusted odds ratios (aOR) for PDC represent both the odds of being in the highest PDC tertile versus being in the middle or lowest PDC tertiles, and the odds of being in the middle PDC tertile versus being in the lowest PDC tertile in women with SUD compared to women without SUD.

We first created simple regression models with SUD diagnosis as the only predictor. We then created multivariable models using stepwise addition of covariates (alpha-to-enter = 0.05; alpha-to-remove = 0.10) [64]. All covariates described above were

tested in each model. The models described in Tables 2.2 and 2.4 represent parsimonious models where all included covariates that met this criterion.

RESULTS

Of 67,007 women aged 16-45 years enrolled at any time during 2012, 52,894 (78.9%) were continuously enrolled. We excluded 3,330 women (6.3%) with no evidence of benefit use during 2012, 1,443 women (2.9%) with a history of permanent sterilization, and 219 women (0.5%) with history of a hysterectomy or bilateral oophorectomy for a final sample of 47,902 women. For analysis of PDC, we further restricted this sample to 30,353 women continuously enrolled in 2013 (63.4%).

Demographics

On average, compared to women without SUD, women with SUD were slightly older and were more likely to be white, be enrolled in the PCC plan, be enrolled in a PCMHI, qualify for Medicaid through a disability, have had a recent pregnancy, or have had a recent abortion. Compared to women without SUD, those with SUD were in poorer health with higher DxCG scores, and were much more likely to be diagnosed with a serious mental illness. Among women with SUDs, the most frequently diagnosed use disorders were opioids (58.1%), alcohol (41.6%), cocaine (22.3%), and marijuana (21.5%).

Any Use of a Prescription Contraceptive

Women with SUD were less likely to use a prescription contraceptive at any time during 2012 (19.2% v 23.9%, Odds Ratio [OR]: 0.76, $p < 0.001$). This difference persisted when adjusting for age, DxCG score, plan type, PCMHI enrollment,

gynecological exam, disability status, STI diagnosis, recent history of pregnancy, and recent history of abortion (aOR: 0.80, $p < 0.001$) (Table 2.2). Among women who used prescription contraception, odds of LARC use were approximately equal between women with and without SUD in unadjusted models (44.5% v. 42.8%; OR: 1.07, $p = 0.261$). However, when adjusting for age, DxCG score, plan, PCMHI enrollment, disability status, STI diagnosis, recent history of pregnancy, and recent history of abortion, women with SUD had lower odds of using LARC than those without SUD (aOR: 0.81, $p = 0.003$) (Table 2.2). To explore whether increased healthcare access through the PCMHI mitigated differences in contraceptive use for women with SUD, an interaction term between PCMHI and SUD was tested in each model, but ultimately did not meet criteria for inclusion.

Consistent, Continued Use of Prescription Contraception

Among the women who used a prescription contraceptive in 2012, we identified 7,161 women with continuous enrollment in 2012 and 2013. We excluded 1,809 women who used LARC during 2012, but for whom we could not identify the device placement date, for a final sample size of 5,352 women. From this sample, three PDC categories were created with approximately equal numbers of subjects in each group: lowest PDC ($PDC \leq 0.247$), intermediate PDC ($0.247 < PDC \leq 0.704$), and highest PDC ($PDC > 0.704$). The majority of women on LARC fell into the highest PDC group (78.7%), and women on SARC were more commonly in the lowest (41.8%) or intermediate (40.3%) PDC groups (Table 2.3).

A diagnosis of SUD was associated with lower odds of being in a higher PDC tertile in our unadjusted model (OR: 0.82, p = 0.024), but not in our model adjusted for DxCG score, plan type, PCMHI enrollment, and STI diagnosis (aOR 0.85, p = 0.083), models. In separate models created based on type of contraceptive used, we found that the negative association of SUD with PDC tertile was stronger in women using LARC (OR: 0.70, 0.079; aOR: 0.67, p = 0.041) than in women using SARC (OR: 0.79, p = 0.023; aOR: 0.95, p = 0.613) (Table 2.4). Again, to detect any impact of Medical Home enrollment on contraceptive use by women with SUD, an interaction term for PCMHI and SUD was tested, but not included in the final model.

COMMENT

Our study, conducted in a large database that demonstrated real-world behavior, found that women with SUD had lower odds of using prescription contraception during 2012 and a lower proportion of days covered over one year for women using LARC methods. SUD was not associated with less consistent, continued contraceptive coverage among women using SARC methods. Our study is the first to isolate the association between SUD and consistent, continued contraceptive coverage in any population. It is also the first to study contraceptive use in an SUD population enrolled in Medicaid or subsidized insurance, which disproportionately fund both SUD care[34] and care related to unintended pregnancy[35].

Our findings of an association between SUD and lower rates of contraceptive any use and continued, consistent contraceptive coverage are consistent with previous studies

of adolescents and Veterans. One recent study reported that Veteran women with SUD had 21 – 27% reduced odds of having any form of prescription contraceptive, compared to women without[11]. A subsequent paper in the same population reported that women with combined mental illness and SUD had fewer months of contraceptive coverage in the first year, as well as reduced odds of continuation at 12-months[10]. In the Veteran population described in these studies, however, SUD was not associated with reduced use of LARC methods.

There are several plausible explanations for lower rates of prescription contraceptive any use and continued, consistent contraceptive use by women with SUD. First, compared to women without SUD, women with SUD may be less sexually active or rely more on condoms. However, our finding of elevated STI rates among women with SUD suggests that unprotected sexual encounters are at least as prevalent in women with SUD as the general population. Existing literature suggests that condom use is less prevalent and more inconsistent in substance-using populations[65,66]. Literature also suggests women with SUD may have higher numbers of sexual partners, and increased engagement in commercial sex work[67]. However, it should also be noted that STI prevalence is only a rough indicator of sexual activity, and differences in the prevalence of STIs in the sexual partners of women with SUD may also contribute to the their elevated rates of STIs. In either case, our findings highlight the importance of dual use of prescription contraception and condoms for adequate protection against unintended pregnancy and STIs.

Alternatively, the association between SUD and lower contraceptive any use and continued, consistent contraceptive coverage could reflect changing pregnancy intentions. We found that SUD was associated with lower PDC tertile among women on LARC, but not among women using SARC. Whereas our PDC measure captures both discontinuation and inconsistent use of SARC methods, low PDC among LARC users is predominately driven by discontinuation. This suggests women with SUD are making an active choice to discontinue LARC methods, which could represent a desire to be, or at least ambivalence towards becoming, pregnant. Consistent with changing pregnancy intentions, qualitative studies have described strong desires for future pregnancy among women with SUD using LARC[26]. Alternatively, women with SUD may discontinue LARC methods due to the end of a relationship, or undesired side effects such as menstrual irregularity[26].

Finally, lower contraceptive use and consistent, continued contraceptive coverage among women with SUD may result from higher barriers to physician access. All women in our study used their healthcare benefit in 2012, but a higher level of involvement with the healthcare system may be necessary to initiate or continue prescription contraception. For example, a woman could qualify for the study through an emergent ER visit, but lack transportation to get to a physician to get a prescription contraceptive. SUD does appear to impact physician access; several small studies have reported that active drug use will often be prioritized over healthcare utilization[41,68], and others have found that SUD is associated with poorer attendance at scheduled physician visits[69]. Although one study found higher rates of sexual and reproductive health services utilization in women who

use substances[70], we found decreased rates of gynecological exams in women with SUD, which could be indicative of poorer physician access.

Models integrating sexual and reproductive health with substance use screening and treatment could help to alleviate disparities in access, if present[71]. However, we did not find that one potential such modifier, enrollment in the PCMHI, mitigated the association between SUD and contraceptive utilization. The PCMH is an evolving model, and our data cannot identify to what extent women enrolled in the PCMHI received expanded services. Further exploration of expanded care models will be necessary to determine their value for increasing contraceptive utilization in marginalized populations.

Limitations

Our study has several limitations worth noting. First, our identification of SUD is susceptible to misclassification. We cannot identify women with SUD who have not been diagnosed by providers, and we cannot tell how many of the women we do identify are in recovery. Also, our study necessarily underestimates the number of patients who use sterilization or IUDs, as we cannot identify patients for whom procedures were conducted prior to 2010. We cannot directly identify patients who are at risk for unintended pregnancy, or who solely rely on condoms for pregnancy prevention. We have used STI diagnoses to indirectly adjust for levels of unprotected sexual activity. Finally, our data source lacks information on potentially important confounders such as income, and has high rates of missing race data.

Conclusions

Despite these limitations, our study presents important findings from a large source of reliable data. Our study adds to the literature by examining contraceptive use in a population with low incomes, as indicated by their enrollment in Medicaid or subsidized insurance. Ours is also the first to isolate the association of SUD with indicators of consistent, continued contraceptive coverage. Future research that examines the association of SUD with discontinuation and inconsistent use as separate outcomes may help clinicians better understand factors driving prescription contraceptive use in this population.

Table 2.1. Demographic characteristics and comorbidities of reproductive-aged women continuously enrolled in Massachusetts Medicaid or Subsidized Insurance in 2012, by Substance Use Disorder (SUD) (N = 47,902)

	SUD N = 6,121 %	No SUD N = 41,781 %
Demographics		
Age (years), mean (SD) **	30.9 (7.6)	29.9 (8.2)
16 – 24	25.5	33.3
25 – 34	42.7	36.1
35 – 45	31.8	30.6
Race **		
Non-Hispanic White	54.9	23.4
Non-Hispanic Black	11.9	14.8
Hispanic	8.7	16.3
Other	1.7	9.6
Unknown	22.7	35.9
Health Care Access		
Plan Type **		
Commonwealth Care (COM)	9.5	20.1
Managed Care Organization (MCO)	46.7	48.4
Primary Care Clinician (PCC)	43.8	31.5
Patient-Centered Medical Home (PCMH) Enrollment **	66.6	59.5
Disability **	28.5	9.2
Gynecological Exam in 2012 **	16.5	22.1
Medical Conditions		
DXCG Score, mean (SD) **	2.7 (2.4)	1.0 (1.4)
Lowest Quartile	1.9	17.5
2nd Quartile	4.4	29.3

HIV Diagnosis **	1.7	0.5
HCV Diagnosis **	15.4	0.5
Other Sexually Transmitted Infection (STI) Diagnosis (2012) **	18.5	16.9
Recent History of Pregnancy (2011) **	21.0	18.1
Recent History of Abortion (2011) **	3.2	1.9
Serious Mental Illness Diagnosis		
Major Depression **	27.6	8.0
Bipolar Disorder **	25.6	3.1
Post Traumatic Stress Disorder **	25.0	4.8
Schizophrenia & Other Psychoses **	9.9	1.4
Identified Substance Use Disorders		
Alcohol Use Disorder	41.6	0.0
Drug Use Disorder		
Opioids	58.1	0.0
Cocaine	22.3	0.0
Cannabis	21.5	0.0
Other Drug Use Disorder	40.3	0.0
Prescription Contraceptive Use, 2012		
Any Prescription Contraceptive Use, 2012 **	19.2	23.9
Short-Acting Reversible Contraception Use, 2012		
Oral Contraceptive Pills	6.4	9.5
Hormonal Patch or Ring	1.3	1.3
Depot Injection	2.5	2.3
Long-Acting Reversible Contraception Use, 2012		
Implant	1.4	1.6
IUD	5.9	7.1
Multiple Methods	1.7	2.1

DxCG Score: A summary score developed for the purpose of calculating risk adjusted payments, used here as an indicator of overall disease burden. Higher scores indicate higher disease burden. [63] A score of 1.0 indicates average disease burden. The interquartile range for scores in our sample was 0.233 – 1.702.

* $p < 0.05$ by χ^2 test

** $P < 0.01$ by χ^2 test

Table 2.2. Odds of any prescription contraceptive use and long-acting reversible contraceptive use in 2012 among women of reproductive age enrolled in Medicaid or state-subsidized insurance (N = 47,902)

	SUD %	No SUD %	Odds Ratio OR (95% CI)	Adjusted Odds Ratio aOR (95% CI)
Any Prescription Contraceptive Use, 2012	**N = 6,121**	**N = 41,781**		
No	80.8	76.1	*Ref*	*Ref*
Yes	19.2	23.9	0.76** (0.71-0.81)	0.80** (0.74-0.86)
Method of Contraceptive Used, 2012	**N = 1,175**	**N = 9,997**		
Short-Acting Reversible Contraceptive	55.5	57.2	*Ref*	*Ref*
Long-Acting Reversible Contraceptive	44.5	42.8	1.07 (0.95-1.21)	0.81** (0.71-0.93)

Any Prescription Contraceptive Use aOR adjusted for: age, DxCG, plan type, PCMHI enrollment, gynecological exam, disability status, STI diagnosis, recent history of pregnancy, recent history of abortion
Method of Contraceptive Used aOR adjusted for: age, DxCG, plan, PCMHI enrollment, disability status, STI diagnosis, recent history of pregnancy, recent history of abortion
* $p < 0.05$
** $P < 0.01$

Table 2.3. PDC tertile distribution among women of reproductive age with and without SUD enrolled in Medicaid or state-subsidized insurance, by method (N = 5,352)

	Short-Acting Reversible Contraception Users N = 3,709 %	Long-Acting Reversible Contraception Users N = 1,643 %
Lowest Tertile	41.8	10.1
Middle Tertile	40.3	11.2
Highest Tertile	17.9	78.7

Lowest Tertile: PDC ≤ 0.247
Intermediate Tertile: PDC > 0.247 & PDC ≤ 0.704
Highest Tertile: PDC > 0.704 & PDC ≤ 1

Proportion of Days Covered (PDC): The proportion of days a woman was covered by any reversible prescription contraceptive in the 365 days following the first prescription contraceptive use in 2012.

Table 2.4. Association of SUD with higher PDC tertile among women of reproductive age enrolled in Medicaid or state-subsidized insurance, by method of prescription contraception used (N = 5,352)

	Women on Any Reversible Contraception in 2012 N = 5,352		Stratified Models			
			Women on Short-Acting Reversible Contraception in 2012 N = 3,709		Women on Long-Acting Reversible Contraception in 2012 N = 1,643	
	Odds Ratio (OR) (95% CI)	**Adjusted Odds Ratio (aOR) (95%CI)**	**OR (95% CI)**	**aOR (95%CI)**	**OR (95% CI)**	**aOR (95%CI)**
Higher PDC Tertile	0.82* (0.69 – 0.97)	0.85 (0.70 – 1.02)	0.78* (0.64 – 0.96)	0.95 (0.76 – 1.17)	0.70 (0.49 – 1.00)	0.67* (0.46 – 0.98)

Higher PDC Tertile aOR adjusted for: age, DxCG, plan type, PCMHI enrollment, STI diagnosis

Table 2.5 Supplementary analyses exploring the effect on all models of varying the window for identification of substance use disorders (SUDs)

	Original Model: *SUD diagnosis 2010-2012*	***Model 2:*** *SUD diagnosis 2011-2012*	***Model 3:*** *SUD diagnosis 2012*
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Any Use	0.80** (0.74 – 0.86)	0.76** (0.72 – 0.84)	0.77** (0.71 – 0.84)
LARC Use	0.81** (0.71 – 0.93)	0.78** (0.67 – 0.90)	0.77** (0.66 – 0.90)
Consistent, Continued Use			
All Contraceptive Users	0.85 (0.70 – 1.02)	0.87 (0.72 – 1.06)	0.80* (0.65 – 0.99)
SARC Users Only	0.95 (0.76 – 1.17)	0.96 (0.77 – 1.21)	0.90 (0.70 – 1.15)
LARC Users Only	0.67* (0.46 – 0.98)	0.73 (0.49 – 1.09)	0.64* (0.42 – 0.98)

aOR Adjusted Odds Ratio
SARC Short-Acting Reversible Contraception
LARC Long-Acting Reversible Contraception

** $p < 0.05$*
*** $P < 0.01$*

CHAPTER III:
THE ASSOCIATION OF SUBSTANCE USE DISORDERS WITH PREGNANCY, ABORTION, AND ADVERSE FETO-MATERNAL OUTCOMES AMONG WOMEN ON PRESCRIPTION CONTRACEPTION

ABSTRACT

Objectives: To estimate the association of substance use disorders (SUDs) with odds of pregnancy, abortion, and adverse perinatal outcomes among women using reversible prescription contraceptives.

Study Design: We conducted a retrospective cohort study of women who were enrolled in Medicaid or state-subsidized insurance and who used a reversible prescription contraceptive during 2012. Using multivariable logistic regression, we estimated the association of SUD with odds of pregnancy, abortion, adverse maternal events, and adverse fetal events. We also explored whether these associations differed between women using long-acting reversible contraception (LARC) and women using short-acting reversible contraception (SARC).

Results: Among 7,062 contraceptive users, we identified 1,833 women with pregnancies in 2013 (SUD: 28.9%, non-SUD: 25.6%). SUD was not associated with increased odds of pregnancy among women who used SARC (adjusted Odds Ratio [aOR]: 1.20, 95% CI: 0.97 – 1.47) or among women who used LARC (aOR: 1.00, 95% CI: 0.76 – 1.30). Among women who became pregnant, SUD was associated with increased odds of abortion (SUD: 19.1%, non-SUD: 11.8%; aOR: 1.58, 95% CI: 1.09 – 2.30).

Conclusions: SUD was associated with higher rates of abortion among women who used prescription contraception. A different approach may be required to help women with SUD prevent pregnancies when they don't want to get pregnant.

INTRODUCTION

Approximately one in ten people in the United States suffer from a substance use disorder (SUD), which includes abuse and dependence of alcohol and drugs[1]. Women represent roughly one-third of people with SUD[3,55]. SUD increases a woman's risk of unintended pregnancy [6,12,25,26], which is associated with inadequate prenatal care, low birth weight, and prematurity[8]. SUD is also independently associated with many maternal complications (preeclampsia, abruptio placentae, placenta previa, preterm labor, and death) as well as poor fetal outcomes (fetal malformation, fetal alcohol spectrum disorder, neonatal abstinence syndrome, intellectual disability, poor growth, and fetal death) [5,6,9,45,51,56].

Consistent use of effective contraceptive methods reduces rates of unintended pregnancy. However, up to 41% of unintended pregnancies result from inconsistent contraceptive use[13]. SUDs have been associated with inconsistent use of prescription contraception[10,11], as well as other medications[37,39,40]. Long-acting reversible contraceptive (LARC) methods (intrauterine devices [IUDs] and implants) require less active participation by users for consistent use. These methods more effectively prevent unwanted pregnancies than short-acting reversible contraception (SARC) methods. While we would expect this to be true for women with SUD, no studies have yet examined the association of SUD with pregnancy, abortion, and adverse perinatal outcomes among women using prescription birth control.

Among women who do become pregnant, receipt of adequate preconception care and early prenatal care are additional important determinants of pregnancy outcomes[72,73].

The Patient-Centered Medical Home (PCMH) has been suggested as a particularly apt vehicle for delivery of preconception and prenatal care[74]. The PCMH emphasizes a team-based, patient-centric approach to care, utilizing centralized primary care, expanded practice hours, integrated behavioral health care delivery, and enhanced care coordination[57]. No studies have yet examined whether pregnancy rates or adverse perinatal outcomes are impacted by enrollment in a PCMH.

We analyzed Medicaid and Commonwealth Care (a state-subsidized insurance plan for lower-income individuals who do not qualify for Medicaid) claims data to examine the association of diagnosed SUD with odds of pregnancy, abortion, and adverse perinatal events in women using prescription contraception. Because LARC and SARC users might have different rates of inconsistent or discontinued contraceptive use, we also wanted to examine whether the association of SUD and pregnancy was modified by method of contraceptive used. We hypothesized that SUD would increase the odds of pregnancy, abortion, and adverse perinatal outcomes, and that these associations would be diminished in women using LARC. We also hypothesized that enrollment in a Medical Home would reduce risk of adverse perinatal outcomes.

METHODS

Data Source

We conducted a retrospective cohort study of Massachusetts Medicaid (MassHealth) and Commonwealth Care claims, using data extracted from the Executive Office of Health and Human Services Data Warehouse. This source contains eligibility and demographic information, linked with inpatient and outpatient medical claims and managed care encounter data, pharmacy claims, and long-term care claims. We analyzed

data from April 1st, 2010 to March 31st, 2014. This period included the three years of implementation of the Patient-Centered Medical Home Initiative (PCMHI), plus one year prior to its start. The PCMHI was a demonstration project in Massachusetts, during which primary care practices were provided with guidance and, in some cases, financial support, to transform into Medical Homes.

Sample

Our sample included women aged 16-45 years who were continuously enrolled during both 2012 and 2013 in a Managed Care Organization (MCO) or Primary Care Clinician (PCC) plan administered by Massachusetts Medicaid or Commonwealth Care. Commonwealth Care, part of Massachusetts Health Reform in 2006, expanded coverage to low-income Massachusetts residents who did not previously qualify for Medicaid. After implementation of the Affordable Care Act, the vast majority of Commonwealth Care enrollees were eligible for Medicaid. Our enrollment criterion was chosen to be consistent with Healthcare Effectiveness Data and Information Set (HEDIS), a national quality measurement tool from the National Committee for Quality Assurance[61]. To be eligible, women had to: 1) have one or more codes indicating the fill of a prescription contraceptive, contraceptive injection, or placement of a contraceptive device during 2012; and 2) demonstrate use of their insurance benefit during 2013. We excluded women who had evidence of permanent sterilization, bilateral oophorectomy, or hysterectomy in the years 2010 – 2012. For analysis of abortions and adverse perinatal outcomes, we further restricted our analysis to women who became pregnant in 2013.

Measures

Exposure. The primary exposure of interest was operationalized as physician-diagnosed SUD, identified by at least one *International Classification of Disease, Ninth Edition (ICD-9)* claim from 2010 – 2013 in any position for an alcohol use disorder (303.x, 305.0x), or drug use disorder (292.x, 304.x, 305.x, excluding tobacco use disorders 305.1x). Women lacking any ICD-9 claim for an SUD from 2010 – 2013 were classified as not having an SUD. We conducted sensitivity analyses in which only women with a diagnosis of SUD in the last year were identified as having an SUD, but did not find any significant differences in our estimates (Table 3.6).

Outcomes. Prevalence of pregnancy during 2013 was our primary outcome. Pregnancy was identified by the presence of at least one ICD-9 code during 2013 for routine prenatal care, routine postpartum care, normal delivery, abortion, miscarriage, or perinatal complication. Women lacking any of these codes were classified as not pregnant during 2013.

Among women who had a pregnancy in 2013, we also explored prevalence of abortions, adverse maternal events, and adverse fetal events. Because the effects of specific substances overlap, and many women may concomitantly abuse multiple substances[44], we elected to create two composite outcomes to track adverse maternal and fetal outcomes. An "adverse maternal event" included placenta previa, maternal infection, maternal hemorrhage, preeclampsia, eclampsia, and premature labor. Similarly, we explored rates of adverse fetal events, which included fetal death, poor fetal growth, neonatal infection, diagnosed fetal alcohol spectrum disorder, neonatal

abstinence syndrome, neonatal hemorrhage, digestive problems, and neonatal temperature regulation problems.

Covariates. Using Andersen's Model of Healthcare Utilization[75], we theorize that pregnancy rates will be associated with a combination of predisposing factors (age, psychiatric comorbidity[10,11], overall health status, sexual activity level, recent pregnancy, recent abortion, type of prescription contraceptive used during 2012, SUD), enabling factors (plan type, disability status, enrollment in the PCMHI), and perceived need (SUD identification by a healthcare provider). Age, race, enrollment in the PCMHI, and disability status were obtained from the member file. Enrollment in the PCMHI was included to evaluate the potential contribution of Medical Home enrollment, through improved care access, to improved pregnancy outcomes. Due to high rates of missing data, race was not included in our final models. We conducted sensitivity analyses with different parameterizations of the available race data, but did not find that our results differed significantly.

Psychiatric comorbidity was operationalized as the presence of ICD-9 codes during 2013 for major depression, bipolar disorder, post-traumatic stress disorder, or schizophrenia and other psychoses. To capture overall health status, we used the DxCG score, a system originally developed for the purpose of risk-adjusted payments[63]. However, we discovered that among women of this age group, DxCG score is largely driven by pregnancy, making its inclusion in models as a covariate inappropriate. In recognition of differences in prior authorization procedures for MCO plans that could contribute to differences in reproductive healthcare utilization, we included an indicator

for 2012 plan type (MCO and PCC). Plan type in 2013 could not be used, as pregnancy is a qualifier for particular plan types. Although we could not directly identify sexual activity level from claims data, we identified diagnosed sexually transmitted infections (STIs) in 2013 as a proxy for unprotected sexual activity. Type of prescription contraceptive used in 2012 was categorized into one of two groups: LARC (IUDs or implants) and SARC (oral contraceptive pills, patches, rings, and depot injections). If women used both SARC and LARC during 2012, they were categorized according to the last method used in 2012.

Recent pregnancy and recent abortion were both evaluated as covariates in all models. We theorized that recent pregnancy or abortion might influence contraceptive consistent, continued use of contraceptives[76,77], as well as outcomes for women who did become pregnant quickly[14,78,79]. Recent abortion was defined as any code for a pregnancy termination in 2012. Any pregnancy that was completed but not terminated in 2012 (e.g., normal delivery, complicated delivery, or miscarriage) was included as a "recent pregnancy." We did not include cases of pregnancy without an indication of their completion in 2012 to avoid including pregnancies that continued into 2013. To assess for the risk of over-adjustment by including these variables, we also conducted a secondary analysis excluding them from our models and found no significant impact on the association between SUD and pregnancy or pregnancy outcomes.

Several maternal comorbidities associated with adverse maternal and fetal outcomes (gestational diabetes, pregnancy-induced hypertension, maternal obesity, and

plurality of the pregnancy) were also included as covariates in pregnancy outcome models, but not in models of pregnancy rates or abortion.

Analysis

We categorized age into three groups. Patient demographic and comorbidity profiles were described by SUD category. Chi-square tests were used to test differences in categorical variables, and Student's t-tests were used to test continuous variables. Including all women who used prescription contraception during 2012, we created a logistic model to examine odds of pregnancy during 2013. Among women who became pregnant in 2013, we then created three separate logistic models to examine odds of abortion, adverse fetal events, and adverse maternal events. For each of these four models, we first created simple logistic models with SUD diagnosis as the only predictor. We fit multivariable models using stepwise addition of covariates (alpha-to-enter = 0.05; alpha to remove = 0.10) [64]. Indicators for SUD, PCMHI enrollment, and LARC/SARC use were all retained in all final parsimonious models, to allow us to comment specifically on the associations between these variables and pregnancy outcomes. We theorized that type of contraceptive might modify the association of SUD and pregnancy, so we created separate unadjusted and adjusted models for SARC and LARC users.

RESULTS

Of 44,195 women aged 16-45 enrolled at any time during 2013, 33,319 women (75.4%) were continuously enrolled during 2012 and 2013. We excluded 1,889 women (5.7%) with no evidence of benefit use during 2013, 938 women (3.0%) with a history of a permanent sterilization, 139 women (0.4%) with a history of hysterectomy or bilateral

oophorectomy, and 316 women (1.0%) with a diagnosis of infertility. Of the remaining 30,037 women, we identified 2012 prescription contraceptive use in 7,062 (23.5%).

Demographics

Relative to women without SUD, women with SUD were more likely to be 25-35 years old, be non-Hispanic white, be enrolled in the PCC plan, and to qualify for Medicaid through a disability. Women with SUD tended to be in poorer health, as indicated by higher DxCG scores, and had much higher rates of diagnosed mental illness compared to women without SUD. Rates of infection with hepatitis C virus and sexually transmitted infections were also substantially higher in women with SUD. Women with SUD had higher rates of recent pregnancy and of recent abortion. Diagnosed SUDs included opioids (40.7%), alcohol (18.9%), cannabis (12.0%) cocaine (11.3%), and other drug use disorder (17.4%). The majority of women, both with and without SUD, used only SARC during 2012 (SUD: 57.3%; non-SUD: 57.3%) (Table 3.1).

Pregnancy

Rates of pregnancy were slightly higher in women with SUD than in women without SUD (28.9% v. 25.6%; Odds Ratio [OR]: 1.19, 95% Confidence Interval [CI]: 1.01 – 1.39) (Table 3.3). However, after adjusting for age, plan type, contraceptive type, STI diagnosis, PCMHI enrollment, recent pregnancy, and recent abortion, the confidence interval around the estimate of effect included unity (adjusted Odds Ratio [aOR]: 1.12, 95% CI: 0.95 – 1.31) (Table 3.3). PCMHI enrollment was associated with slightly increased odds of pregnancy (aOR: 1.13, 95%CI: 1.01 – 1.26). When including only SARC users, SUD was associated with increased odds of pregnancy (OR: 1.31, 95% CI:

1.07 – 1.60), although after adjustment, the confidence intervals included unity (aOR: 1.20, 95% CI: 0.97 – 1.47). We found no association between SUD and increased pregnancy rates among LARC users (OR: 1.01, 95% CI: 0.78 – 1.32; aOR: 1.00, 95% CI: 0.76 – 1.30) (Table 3.3).

Pregnancy Outcomes

Rates of abortions were higher among women with SUD than women without SUD (19.1% v. 11.8%; OR: 1.77, 95% CI: 1.24 – 2.51), and the association of SUD with increased odds of abortion persisted after adjustment for age, STI diagnosis, recent history of pregnancy, recent history of abortion, and PCMHI enrollment (aOR: 1.58, 95% CI: 1.09 – 2.30) (Table 3.4). Rates of adverse fetal events were higher in women with SUD compared to those without (17.5% v. 14.5%) (Table 3.2), but confidence intervals around our estimate of effect included unity in both unadjusted (OR: 1.25, 95% CI: 0.87 – 1.79) and adjusted (aOR: 1.33, 95% CI: 0.92 – 1.92) models (Table 3.4). Our analysis did not detect an association between SUD and adverse maternal outcomes (22.0% v 21.1%; OR: 1.05, 95% CI: 0.76 – 1.45; aOR: 0.91, 95% CI: 0.64 – 1.30) (Table 4). Type of contraceptive did not modify the association between SUD and adverse perinatal outcomes (Table 3.4).

PCMHI enrollment was associated with increased odds of abortion, though the confidence interval included unity (aOR: 1.29, 95% CI: 0.94 – 1.76), but was not associated with adverse fetal events (aOR: 1.07, 95% CI: 0.81 – 1.41) or adverse maternal events (aOR: 1.04, 95% CI: 0.82 – 1.33).

DISCUSSION

In our analysis of Massachusetts Medicaid and subsidized insurance claims data, among women who used any prescription contraceptive in 2012, SUD was not associated with increased odds of pregnancy. Among women who became pregnant, SUD was associated with higher odds of abortion. Our study is the first to examine pregnancy outcomes in women with SUD who use prescription contraception.

SUDs are associated with inconsistent prescription contraception use[10,11], but little research has been done looking at how SUD is associated with odds of pregnancy among women using contraception. One study in Vancouver, Canada found a higher-than-average incidence of pregnancy among injection drug-using women[80]. The authors of this study attributed the increased incidence to a very low uptake of hormonal contraception within the population, but did not look at differences in pregnancy rates among women who used prescription contraception.

While we found higher rates of pregnancy in contraceptive-using women with SUD, we did not find evidence of an association after adjustment for other factors. This suggests that the association we observe between SUD and pregnancy among contraceptive-using women may be attributable to other factors associated with SUD, rather than SUD itself.

However, our study shows different estimates of effect for the association of SUD with pregnancy among SARC and LARC users. Our finding that SUD is more strongly associated with pregnancy among SARC users than LARC users suggests that LARC may be superior to SARC in preventing unwanted pregnancies in this population.

Barriers to transportation[81], housing instability[82], drug-induced memory problems [41], or the disinhibition associated with SUD[4042] may impact the consistent, continued use of SARC methods more so than LARC methods. The increased frequency of physician visits required for SARC methods may be more challenging for women with SUD than for those without, particularly because women with SUD report perceptions of stigma by healthcare professionals[25,41]. However, as our study did not randomly assign LARC and SARC use to subjects, it is also possible that any differences here may be due to differences in the population selecting these methods.

We also find higher odds of abortions in women with SUD, regardless of chosen contraceptive method. Consistent with previous literature[2412,25,26], this suggests that many pregnancies in this population were unintended and ultimately unwanted. This finding emphasizes the importance of providing women with SUD with prescription contraceptive methods they are able to easily, consistently use for as long as they desire contraception. We do not find significant associations between SUD and adverse perinatal outcomes that have been established in larger studies[5,6,9,45,56], possibly because our study did not examine infant claims.

Although PCMHI enrollment was not associated with adverse perinatal events, this finding alone does not preclude the importance of primary care/behavioral care integration, preconception care or regular prenatal care as important factors in determining pregnancy outcomes. Our data describes participation in the Massachusetts PCMHI, but we cannot evaluate what services are expanded for PCMHI enrollees in our sample.

Limitations

Our study has several limitations. First, we cannot identify the pregnancy intentions of the women in our study. Secondly, our dataset is limited by the absence of information on selected important variables, including income, severity of addiction, sexual activity level, and marital status. We also have high rates of missing race and ethnicity data. Our identification of SUD is also imperfect, and we may incorrectly identify women who meet criteria for SUD but who have not yet been identified by a provider.

Conclusions

Despite these limitations, our study uses a large, reliable data source to ascertain information on the pregnancy outcomes of women with SUD. Our findings add to the literature by describing the pregnancy outcomes in women with inconsistent or discontinued contraceptive use, rather than outcomes of contraceptive non-users. The association of SUD with higher rates of abortions among women who initiate prescription contraception suggests barriers to continued, consistent use of prescription contraceptives may be higher for women with SUD than those without. New approaches to prescription contraceptive delivery may help women prevent unwanted pregnancies..

Table 3.1. Demographic characteristics and comorbidities of contraceptive-using women of reproductive age continuously enrolled on Massachusetts Medicaid or state-subsidized insurance in 2012 and 2013, by Substance Use Disorder (SUD) (N = 7,062)

	SUD N = 850 mean (SD) or %	No SUD N = 6,212 mean (SD) or %
Demographics		
Age (years), mean (SD)**	27.2 (6.2)	27.3 (7.0)
16 – 24	41.2	43.1
25 – 34	46.8	40.6
35 – 45	12.0	16.3
Race/ethnicity**		
Non-Hispanic White	51.4	26.1
Non-Hispanic Black	15.3	15.2
Hispanic	8.4	16.0
Other	2.0	7.1
Unknown	22.9	35.7
Health Care Access		
Plan Type**		
Commonwealth Care (COM)	15.1	19.7
Managed Care Organization (MCO)	64.2	63.1
Primary Care Clinician (PCC)	20.7	17.2
Patient-Centered Medical Home Initiative (PCMHI) Enrollment	62.6	60.7
Disability**	19.5	6.9
Medical Conditions		
DXCG Score, mean (SD) **	2.3 (2.1)	1.0 (1.3)
Lowest Quartile	4.5	19.6

2nd Quartile	10.0	29.2
3rd Quartile	30.2	28.4
Highest Quartile	55.3	22.8
Obesity	13.1	14.4
Hepatitis C Virus (HCV)**	8.9	0.4
Sexually Transmitted Infection (STI) Diagnosis*	21.8	18.8
Recent History of Pregnancy (2012)*	24.5	20.7
Recent History of Preterm Delivery (2012)	1.9	1.3
Recent History of Abortion (2012)**	12.0	5.9
Serious Mental Illness (SMI) Diagnosis		
Major Depression**	23.9	7.8
Bipolar Disorder**	20.3	2.9
Post Traumatic Stress Disorder**	19.1	4.5
Schizophrenia & Other Psychoses**	6.8	1.1
Prescription Contraceptive Use, 2012		
Short-Acting Reversible Contraception (SARC) use only	57.3	57.3
Long-Acting Reversible Contraception (LARC) use only	36.9	37.3
SARC and LARC use	5.8	5.4

DxCG Score: A summary score developed for the purpose of calculating risk adjusted payments, used here as an indicator of overall disease burden. Higher scores indicate higher disease burden.[63] A score of 1.0 indicates average disease burden. The interquartile range for scores in our sample was 0.255 – 1.688.

* $p < 0.05$ by χ^2 test
** $P < 0.01$ by χ^2 test

§ $p < 0.01$ by Student's t-test
§§ $p < 0.001$ by Student's t-test

Table 3.2. Pregnancy, and adverse perinatal outcomes in 2013 to previous prescription contraceptive users enrolled in Medicaid or state-subsidized insurance, by Substance Use Disorder (SUD) Status (N = 7,062)

	SUD %	No SUD %
	N = 850	**N = 6,212**
Any Pregnancy, 2013*	28.9	25.6
	N = 246	**N = 1,587**
Abortion**	19.1	11.8
Adverse Fetal Outcomes	17.5	14.5
Preterm Birth (PTB) and Small for Gestational Age (SFGA)	5.7	3.3
Fetal Distress (Respiratory Distress, Infection, Hemorrhage, Digestive, Temperature Regulation, FASD, NAS)	4.9	4.0
Fetal Loss (Stillbirth, Fetal Demise, Spontaneous Abortion)	8.9	8.4
Adverse Maternal Outcomes	22.0	21.1
Preterm Labor	6.9	6.4
*Infection***	4.9	2.4
Placenta Previa and Hemorrhage	15.5	14.9

* $p < 0.05$ by χ^2 test
** $P < 0.01$ by χ^2 test

Table 3.3. Influence of Substance Use Disorder on Odds of Pregnancy During 2013, Overall and Stratified by Type of Last Contraceptive Used in 2012, for Women Enrolled in Massachusetts Medicaid (N = 7,062)

	Women on Any Reversible Contraception in 2012 N = 7,062		Stratified Models: Women on Short-Acting Reversible Contraception in 2012 N = 4,259		Stratified Models: Women on Long-Acting Reversible Contraception in 2012 N = 2,803	
	Odds Ratio (OR) (95% CI)	**Adjusted Odds Ratio (aOR) (95%CI)**	**OR (95% CI)**	**aOR (95%CI)**	**OR (95% CI)**	**aOR (95%CI)**
Any Pregnancy, 2013	1.19* (1.01 – 1.39)	1.12 (0.95 – 1.32)	1.31** (1.07 – 1.60)	1.20 (0.97 – 1.47)	1.01 (0.78 – 1.32)	1.00 (0.76 – 1.30)

Adjusted model covariates age, plan type, contraceptive type, STI diagnosis, PCMHI enrollment, recent pregnancy, and recent abortion
** $p < 0.05$*
*** $P < 0.01$*

Table 3.4. Influence of Substance Use Disorder (SUD) on odds of abortion and adverse perinatal outcomes, overall and stratified by type of last contraceptive used in 2012, for women enrolled in Massachusetts Medicaid who were pregnant in 2013 (N = 1,833)

	Women on Any Reversible Contraceptive who Became Pregnant N = 1,833		Women on Short-Acting Reversible Contraception (SARC) N = 1,126		Women on Long-Acting Reversible Contraception (LARC) N = 707	
	Odds Ratio (OR) (95% CI)	**Adjusted Odds Ratio (aOR) (95%CI)**	**OR (95% CI)**	**aOR (95%CI)**	**OR (95% CI)**	**aOR (95%CI)**
Abortion	1.77** (1.24 – 2.51)	1.58* (1.09 – 2.30)	1.76** (1.15 – 2.70)	1.56 (1.00– 2.46)	1.72 (0.92 – 3.23)	1.60 (0.82 – 3.15)
Adverse Fetal Event	1.25 (0.87 – 1.79)	1.33 (0.92 – 1.92)	1.31 (0.86 – 2.00)	1.34 (0.87 – 2.07)	1.07 (0.54 – 2.10)	1.40 (0.67 – 2.91)
Adverse Maternal Event	1.05 (0.76 – 1.45)	0.91 (0.64 – 1.30)	1.03 (0.69 – 1.55)	0.90 (0.58 – 1.39)	1.08 (0.63 – 1.87)	0.86 (0.47 – 1.60)

Abortion Model Covariates age, STI diagnosis, recent abortion, recent pregnancy, PCMHI enrollment
Adverse Fetal Event Covariates age, plan type, disability status, pregnancy-induced hypertension, gestational diabetes, multiple pregnancy, PCMHI enrollment
Adverse Maternal Event Covariates age, plan type, PTSD, recent pregnancy, recent abortion, pregnancy-induced hypertension, gestational diabetes, multiple pregnancy, PCMHI enrollment
** $p < 0.05$*
*** $P < 0.01$*

Table 3.5. Categorization of Reversible Contraceptive Methods as Short-Acting Reversible Contraception (SARC) or Long-Acting Reversible Contraception (LARC)

Contraceptive Category	Contraceptives Included	Claims Identification
	Oral Contraceptive Pills	ICD-9, NDC, HCPCS codes
Short-Acting Reversible Contraception (SARC)	Hormonal Patch	NDC, HCPCS codes
	Vaginal Ring	NDC, HCPCS codes
	Depot Injection	NDC, HCPCS codes
	Hormonal Implant	ICD-9, CPT, HCPCS codes
Long-Acting Reversible Contraception (LARC)	Copper IUD	ICD-9, CPT, HCPCS codes
	Hormonal IUD	ICD-9, CPT, HCPCS codes

NDC National Drug Codes
HCPCS Healthcare Common Procedure Coding System
ICD-9 International Classification of Disease, Ninth Edition
CPT Common Procedural Terminology

Table 3.6 Supplementary analyses exploring the effect on all models of varying the window for identification of substance use disorders (SUDs)

	Original Model: *SUD diagnosis 2010-2013*	***Model 2:*** *SUD diagnosis 2011-2013*	***Model 3:*** *SUD diagnosis 2012-2013*	***Model 4:*** *SUD diagnosis 2013*
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
		Pregnancy		
All Users	1.10 (0.94 - 1.30)	1.07 (0.91 - 1.27)	1.03 (0.87 - 1.24)	0.94 (0.82 - 1.23)
SARC Users	1.18 (0.96 – 1.46)	1.15 (0.93 - 1.42)	1.19 (0.95 - 1.48)	1.08 (0.84 - 1.39)
LARC Users	0.98 (0.75 – 1.28)	0.96 (0.73 - 1.27)	0.82 (0.61 - 1.11)	0.72 (0.51 - 1.03)
		Abortion		
All Users	1.58* (1.09 - 2.30)	1.55* (1.05 - 2.29)	1.50 (0.99 - 2.28)	1.73* (1.09 - 2.73)
SARC Users	1.56 (0.99 - 2.45)	1.42 (0.89 - 2.29)	1.52 (0.94 - 2.48)	2.22** (1.32 - 3.72)
LARC Users	1.60 (0.82 - 3.15)	1.84 (0.93 - 3.66)	1.36 (0.61 - 3.03)	0.65 (0.21 - 2.01)
		Adverse Fetal Events		
All Users	1.33 (0.92 - 1.93)	1.39 (0.95 - 2.03)	1.35 (0.90 - 2.02)	1.37 (0.86 - 2.18)
SARC Users	1.34 (0.87 - 2.07)	1.33 (0.85 - 2.08)	1.20 (0.75 - 1.92)	1.13 (0.66 - 1.96)
LARC Users	1.40 (0.67 - 2.91)	1.72 (0.82 - 3.60)	2.06 (0.93 - 4.55)	2.69* (1.09 - 6.64)
		Adverse Maternal Events		

All Users	0.91	0.89	0.87	1.08
	(0.64 - 1.30)	(0.62 - 1.29)	(0.59 - 1.29)	(0.70 - 1.66)
SARC Users	0.91	0.94	0.88	1.09
	(0.59 - 1.41)	(0.60 - 1.48)	(0.55 - 1.42)	(0.65 - 1.83)
LARC Users	0.87	0.76	0.83	1.06
	(0.47 - 1.61)	(0.39 - 1.48)	(0.40 - 1.69)	(0.47 - 2.38)

aOR Adjusted Odds Ratio
SARC Short-Acting Reversible Contraception
LARC Long-Acting Reversible Contraception

** $p < 0.05$*
*** $P < 0.01$*

CHAPTER IV:
BARRIERS TO AND FACILITATORS OF CONTRACEPTIVE USE AMONG WOMEN WITH SUBSTANCE USE DISORDERS

ABSTRACT

Purpose: Women with substance use disorders (SUDs) are at particularly high risk for unintended pregnancy. SUD may be associated with lower any use and consistent, continued use to prescription contraception, but little is understood about how women in this population think about pregnancy and make contraceptive decisions.

Methods: We conducted in-person, individual interviews with pregnant or recently pregnant women with SUD from two obstetrics & gynecology clinics in Worcester, MA. *Verbatim* transcripts were analyzed using the constant comparative method.

Results: Five themes emerged that described the way in which women with SUD approach contraception and pregnancy planning. 1) Unintended pregnancies were viewed positively by many women. 2) Women frequently relied on an external locus of control, such as fate or God, to manage their fertility. 3) Active drug use decreased women's ability to access contraception. 4) Women did not always account for past experiences or possibility of future changes when making contraceptive decisions. 5) Pregnancy sometimes facilitated access to particular SUD treatment services, but women may also avoid treatment for fear of social or legal consequences.

Conclusions: For some women with SUD, positive feelings about pregnancy may influence contraceptive decision-making. Pregnancy may be a motivator for sobriety, but reducing barriers to treatment entry will be important for improved care in this population.

INTRODUCTION

About half of pregnancies in the United States are unintended[83], and 40% of these pregnancies are terminated[83]. Unintended pregnancies are associated with delayed prenatal care initiation[15,84], premature delivery[17,18], poorer long-term physical and mental health of the offspring[19-21], poorer maternal mental health[23], and impaired maternal-child bonding[22].

Disparities in rates of unintended pregnancy exist across race, age, and socioeconomic status[83]. Women with substance use disorders (SUDs) are one group at particularly high risk for unintended pregnancy, with rates as high as 76 – 100%[12,24-26]. Pregnancies in women with SUD are complicated by increased risk of preterm labor, poor in-utero growth, fetal malformation, fetal alcohol spectrum disorder, neonatal abstinence syndrome, and fetal and maternal death[5,6,9,45,56].

Emerging evidence suggests women with SUD are less likely to have and consistently use prescription contraception[10,11], but little is understood about the factors influencing contraceptive decision-making by women with SUD. One study described reasons for use and discontinuation of particular contraceptive methods in this population, but did not discuss broader concepts such as pregnancy intention[26].

We examine data from in-depth, semi-structured individual interviews with pregnant and recently pregnant women with SUD to describe the factors influencing their contraceptive utilization and pregnancy intentions. Understanding how women with SUD think about pregnancy and contraception may help to inform clinical practice and

policy development to improve delivery of reproductive health services to this group of women.

METHODS

Study Sample

We used purposive sampling to recruit participants from two general obstetrical and gynecological (OB/Gyn) clinics and one specialized clinic for pregnant women with opioid dependence in Worcester, MA. Potential subjects were referred to study staff by their treating OB/Gyn physician, resident physician, nurse practitioner, or social worker. Eligible participants were 18-45 years old, heterosexually active within the past six months, identified as having an SUD by the referring provider, English-speaking, and cognitively intact. Providers were asked to refer women who abused or were dependent on alcohol or any illicit or prescription drug. Women with active SUD, as well as those with a history of SUD, were included. Currently institutionalized or incarcerated women were excluded. We aimed to recruit 15-20 women in the study, the point at which we hypothesized we would hit thematic saturation. The University of Massachusetts Medical School Institutional Review Board approved this study, and verbal consent was obtained from all subjects at the time of enrollment.

Development of Interview Guide

Initial development of the semi-structured interview guide was informed by Gelberg's Behavioral Model for Vulnerable Populations, an expansion of Andersen's Model of Healthcare Utilization (Figure 4.1) [85]. The initial guide was reviewed by treating OB/Gyn physicians and SUD treatment providers for clarity and content. During

data collection, members of the study team iteratively reviewed collected responses to evaluate whether questions in the interview guide were clearly communicating intended meaning. No changes were made to the study guide in this process. Interview guide topics included perceptions of pregnancy and child-rearing, history of prescription contraceptive use, barriers to any use and consistent, continued use to contraceptives, and the influences of substances on contraceptive use (Table 4.1).

Semi-Structured Interviews

In-person, semi-structured individual interviews were conducted at the time of enrollment, or were scheduled at the subject's convenience. Interviews lasted 30-45 minutes, were conducted in a private space by a single member of the study team, and were audio recorded with the subject's permission. Subjects were given a $40 gift card for their participation. The interviewer and primary investigator discussed weekly whether interviews were continuing to generate new or different information, or whether concept saturation had been reached. These two study members agreed concept saturation had been reached after 15 interviews, and after conferring with the rest of the study investigators, recruitment was closed.

Analysis

All interviews were transcribed *verbatim* by a member of the study team. Each transcript was reviewed for accuracy of the transcription. The first three transcripts were independently coded by two members of the study team, who then met to resolve discrepancies and create an initial codebook. The initial coding structure was developed using the framework of Gelberg's Model as well as concepts emerging from the data.

The remaining twelve interviews were then coded by a single member of the study team using the constant comparative method[86]. Coding was reviewed weekly with a second study team member. New codes and alterations to codes were discussed between the two members of the analysis team, and any changes to the codebook were applied to all transcripts. All investigators reviewed and agreed upon interpretation of thematic summaries and final analysis.

RESULTS

Between November 2015 and January 2016, we conducted 15 interviews with women with SUD who received care at one of the study locations. Thirteen women (87%) were pregnant at the time of the interview; the remaining two women had delivered within the last year. The median age was 25 years, and participants ranged from 22 – 32 years. Seven women (47%) had completed high school, and only one woman had graduated from college. Ten women (67%) reported cohabitating with a stable partner; eleven (73%) reported sexual activity in the last month. Most women were multiparous, and nine women (60%) had a history of miscarriage. A history of polysubstance use was present in all but one woman. Four women (27%) reported using methadone or buprenorphine for management of an opioid use disorder (Table 4.2).

We identified five themes that impacted the way in which women used contraception and/or planned their pregnancies. First, women in our sample generally viewed current pregnancy favorably, and almost never described their pregnancy as unwanted. Second, many participants had specific ideas of how to time pregnancy in their lives, but were also comfortable relinquishing fertility control to external forces.

Third, even though women in our sample had no problems getting contraception when sober, active drug use decreased their access. Fourth, contraceptive decision-making was grounded in women's current situation, and did not always account for past experiences or possible future changes in risk. Fifth, women perceived pregnancy as a facilitator of access to substance use treatment, but it could also present barriers to SUD treatment. We describe each theme in more depth below.

Continued unintended pregnancies were not identified as unwanted

Many women in our sample identified their current pregnancies as unintended, but not as unwanted. Many women reported feeling thrilled when they found out they were unexpectedly pregnant. One woman described her reaction to finding out about her unintended pregnancy: "And then [the technician] put the noise on [the ultrasound], and there was the heartbeat. And I'm screaming and crying outta joy … I was very excited to see and hear that" (S1). Even in situations that were less than ideal, women were still enthusiastic about unintended pregnancies. One woman, who became pregnant in a period when she and her partner were using heavily, explained even though "timing could've been better," they "were definitely excited" (S6).

Though pregnancy was exciting for most women, it could also come with negative consequences, leading to conflicted feelings. One woman whose partner did not want more children explained, "when I found out I was pregnant, I was excited, but scared at the same time to tell him" (S1). For another woman, unintended pregnancy was accompanied by worries about losing custody: "my first pregnancy… [I] was very [um] excited about… and like this time around, I've had just a lot of stress… thinking about

[um] just the worst happening, cause I don't have custody of my [other] son" (S8). Several women in the study had undergone or considered and rejected abortions for unintended pregnancies in the past.

Women wanted to control the timing of their pregnancy, but also accepted an external locus of control

Many women in our sample wanted to control the timing of their pregnancy to meet their concept of what a "family" should resemble, or to fit with certain life goals. Many women wanted to time their pregnancies to facilitate the development of sibling bonds: "I'm a product of five [siblings] and we're close together… and we grew up as such a tight knit clan… so that to me was really important" (S12). Another woman explained she didn't want to have kids "back to back , 'cause then there's no nurture time" (S1).

Women in our sample wanted to have a steady relationship, adequate income, and stable housing before getting pregnant. One postpartum woman who was about to start a long-acting contraceptive explained,

> *I would like the option [to get pregnant] to be there in a year – say in a year we buy this big beautiful house, and you know, things are going so well, and the wedding has happened… I don't want the door to be closed for three years (S7).*

Like this participant, many women were eager to avoid contraceptive methods that they perceived would not be flexible when they wanted to become pregnant:

> *Well, once you have the shot… that's that for X amount of time… it's just so final, it's like they're deciding for you how long you need to … wait before you think about having another child* (S14).

However, despite having ideas about ideal pregnancy timing, women in our sample did not always actively try to prevent pregnancy. As one woman who became pregnant while not using contraception explained,

> *I wasn't pregnancy planning, but I wasn't not pregnancy planning, if that makes sense. Like, I wasn't trying to get pregnant, but I wasn't avoiding it either* (S13).

Instead, many women accepted an external locus of control[87], such as fate or God, over their fertility. One postpartum woman who was very eager to avoid pregnancy until her husband returned from active military service still felt, "if [she] was to get pregnant … well, that's the way God wanted it to be" (S15). For some women, this may have been the result of perceived inability to control their fertility or other aspects of their lives; as one women explained, "it's like nothing pretty much goes as planned, I've seen" (S1).

Women had few structural barriers to prescription contraception, except when actively using

When sober, most women in our sample did not report structural barriers to accessing prescription contraception. Women reported that they were able to see a physician for contraception when they needed to. One woman explained that she'd "always had a doctor," and even when they were unavailable, she felt she could get contraception at Planned Parenthood (S6). However, as one woman described, physician visits could be onerous, and would sometimes influence choice of method:

> *I didn't like [the shot] because I had to go to the doctor's and get it done so [if I] like was doing something, then I had to take time out of my life to go to the hospital and then go see my doctor* (S5).

Two women in the sample reported that transportation problems could impair physician or pharmacy access. Because one woman "never had reliable transportation," she "couldn't make it to … doctors to talk to them to get the prescription" (S12).

Cost of prescription contraceptives was generally considered manageable by the women in our study. Insurance coverage was common, and women were confident their prescription contraceptives would be covered:

> *I actually got billed for this IUD for $6,800, and I'm don't even care about. I'm not worried about it, cause I'm sure my insurance … will eventually cover it* (S15).

However, one woman who had considered using condoms for birth control in the past noted she felt she would have to "cut down on sex" to afford them (S8).

Although this group of women reported few access issues while sober, active drug use could decrease physician contact and subsequently, access to contraception. One woman said:

> *Well, [uh] like I said, [um] when you're using drugs… not going to the doctor is a big thing. Nobody really goes to see the doctor when they're, you know, on a drug run* (S2).

Another woman missed several appointments to have a Mirena placed because, as she explained, "keeping appointments is super, super hard" when using drugs (S4). Decreased physician contact seemed to stem primarily from decreased motivation for contraceptive use and health promotion more generally. One woman said that during periods of use, her "life wasn't about not having a child, or taking care of [her] body" (S7).

In choosing contraception, women had difficulty incorporating past experience and planning for future changes

When evaluating their perceived need for contraception, the women in our study focused predominately on their present circumstances. Many women would stop using contraception when they ended a committed relationship, and not account for the possibility of a new relationship or casual partners. As one woman, who was not in a committed relationship at the time of her delivery, explained, "I never think to get [the IUD after delivery] … because that's not my plan… If I was gonna be actively having sex with somebody, then I could see, you know, I need it" (S5). Subsequently, women needed immediate coverage when they were sexually active again: "I need something that's gonna work like today. I need something that's not gonna take a month to kick in" (S15). One woman, who had become pregnant after starting a new relationship without contraception, said she "just never think[s pregnancy is] gonna happen so fast" (S3).

Conversely, women sometimes had difficulty applying past experiences with pregnancy and contraception to current decision-making. Many women in our sample had experienced contraceptive failures with particular methods in the past. For some, these failures would inform their current method selection; one woman reported that she now avoided the vaginal ring, because she had previously become pregnant while using it (S5). However, another woman adamantly continued her oral contraceptive pill use despite multiple unintended pregnancies, saying it "doesn't 100% work, but for the most part, [it] was working" (S14).

Pregnancy increased the desire for sobriety and impacted perceived access to treatment

For many women who were actively using when they became pregnant, pregnancy became an impetus to sobriety and other life improvement: "we were losing everything… and then we found out I was pregnant and it was just like a total … turn around" (S6). When describing her extra motivation to get clean, one pregnant woman explained she could "hide [substance use] from her kids, but [she] can't hide it from this one" (S12).

Many women felt their access to SUD treatment was limited, but some felt pregnancy could improve their access. One woman, who had been trying unsuccessfully to get into a residential program for a year and a half, explained "it's very difficulty getting sober nowadays… they don't have the right resources" (S3). Pregnancy, however, might push women up the priority list for treatment, increasing women's ability to access the specific services they wanted, and even potentially helping them regain custody of other children:

> *I think in the back of my mind, I wanted to [get pregnant] because … my boyfriend and I wanted to get into this one specific program… that you can go together… if you're pregnant, you can get in without [a referral from the Department of Children and Families (DCF)], so that was always kinda in the back of my head. So it wasn't like I was trying to get pregnant on purpose… but I felt like I wanted to be a mother and I felt like there was no other way that I was gonna get my son back* (S8).

However, some women saw negative consequences to treatment during pregnancy. Several women expressed concern over how use of medication-assisted

therapy (methadone and buprenorphine) for the treatment of an opioid use disorder might affect their fetus:

> *I have the Subutex* [buprenorphine]*, but really that's my biggest fear and I kind of feel sad – I might cry – but I kind of feel sad cause I feel like I'm already bringing my poor baby into this world with – it's like a shitty situation for a baby* (S13).

For other women, fear of involvement with DCF deterred treatment-seeking during pregnancy. One woman who had lost her children after entering a residential treatment facility described treatment programs as "the fastest way to lose your children" (S14). Another woman said she would have abstained from medication-assisted therapy if she knew the extent to which DCF would be involved:

> *I had assumed if you're taking illicit street drugs, [DCF would] get involved, [um] but I had no idea if you were on maintenance … that they could come in and do what they do. I think that if I had known [um] about DCF, though, it definitely would have been very different. I would've said [um] I'll get off [buprenorphine] and then [um] once I give birth, I'll get back on* (S8).

DISCUSSION

Our study of pregnant and postpartum women with SUD gives important insight into pregnancy planning and contraceptive use in this population. Many women in our study had positive or neutral feelings towards pregnancy, and allowed external forces partial control over their fertility. For women who wanted to prevent pregnancy, active drug use could make getting prescription contraception more difficult. Contraceptive choices were often made with little thought towards the future or consideration of past experiences. Women who became pregnant might see changes in the availability of SUD treatment.

The women in our sample were generally positive or neutral about their pregnancies, identifying many as unplanned or poorly timed, but not unwanted. This may partly be related to women's reliance on external forces to control their fertility. Increasingly, researchers are recognizing that the dichotomous label "unintended" or "intended" may be inadequate to describe many pregnancies[88]. Several studies have established an association between substance use and higher rates of unintended pregnancy[7,12,24], but few identify whether these pregnancies were mistimed, unwanted, or ambivalent. As our sample was made up of women who elected to continue their current pregnancies, our study was not designed to comment on women with SUD who had unwanted pregnancies. Rather, our study provides some insight into a group of women who have received less attention: those who continued their pregnancies.

When sober, women in our study generally reported ease in accessing and using contraception, and were not limited by cost, physician access, or contraceptive availability. However, active drug use often resulted in decreased physician contact, and subsequently, missed opportunities for contraceptive uptake. Other studies have also demonstrated heightened structural barriers to contraceptive utilization with active drug use[25,89]. The relatively strong access to contraception for women in our sample while sober may reflect high rates of insurance coverage in Massachusetts, expansions in contraceptive coverage implemented through the Affordable Care Act[90], or our sampling strategy selecting for women who were established in the healthcare system. Nonetheless, our findings suggest that laws and policies requiring a physician visit for

initiation or continuation of prescription contraception may represent a burden for women with active SUD.

Women's difficulty incorporating past experience and planning for future changes could be explained by a tendency toward present time orientation. Individuals with a stronger present time perspective base decisions on concrete, immediate factors and place significantly less emphasis on events that occurred in the past or that might occur in the future[91]. Some studies suggest present time orientation is stronger among individuals with SUD[92,93].

Importantly, many women in our study describe how pregnancy impacted SUD. We found that pregnancy may represent a window of increased motivation for sobriety in the same way it has been shown to motivate other lifestyle changes[94]. However, perceived social and legal consequences may represent a barrier to SUD treatment and prenatal care[95]. While some states fund SUD treatment programs specifically targeted toward pregnant women, others criminalize substance use during pregnancy[53]. To reduce barriers to care entry, the American Congress of Obstetricians and Gynecologists had called for the retraction of punitive legislation against pregnant women with SUD[96].

Limitations

Our study was not designed to represent women with SUD who are not already established in the healthcare system, or those who elect to terminate their pregnancies. Our study is also susceptible to the risk of recall and social desirability biases, particularly with regards to reported pregnancy intentions, substance use, and sobriety

intentions. Finally, we were not able to pilot our semi-structured interview questions prior to our study.

Implications for Future Research and Clinical Practice

This study's finding that pregnancy intentions are fluid in women with SUD may help inform contraceptive counseling for these women. Our findings also stress that barriers to initiating and continuing prescription contraceptives should be made as low as possible to enable full-spectrum contraceptive access for women with SUD,

We also find that unmet need for SUD treatment may increase during pregnancy. Our study supports the importance of SUD treatment services targeted to the needs of pregnant women, and emphasizes the importance of delicate management of pregnancy in the context of SUD. Our study also suggests that, despite some expanded treatment availability for pregnant women with SUD, fear of losing custody of children to a child protection agency due to perceived neglect or abuse may actually deter treatment-seeking. Reducing legal and social consequences of treatment-seeking during pregnancy may help improve care for women with SUD and their children.

Table 4.1. Semi-structured Interview Guide

Grand Tour Questions
How they decide to use birth control or not
How they decide what method to use or not

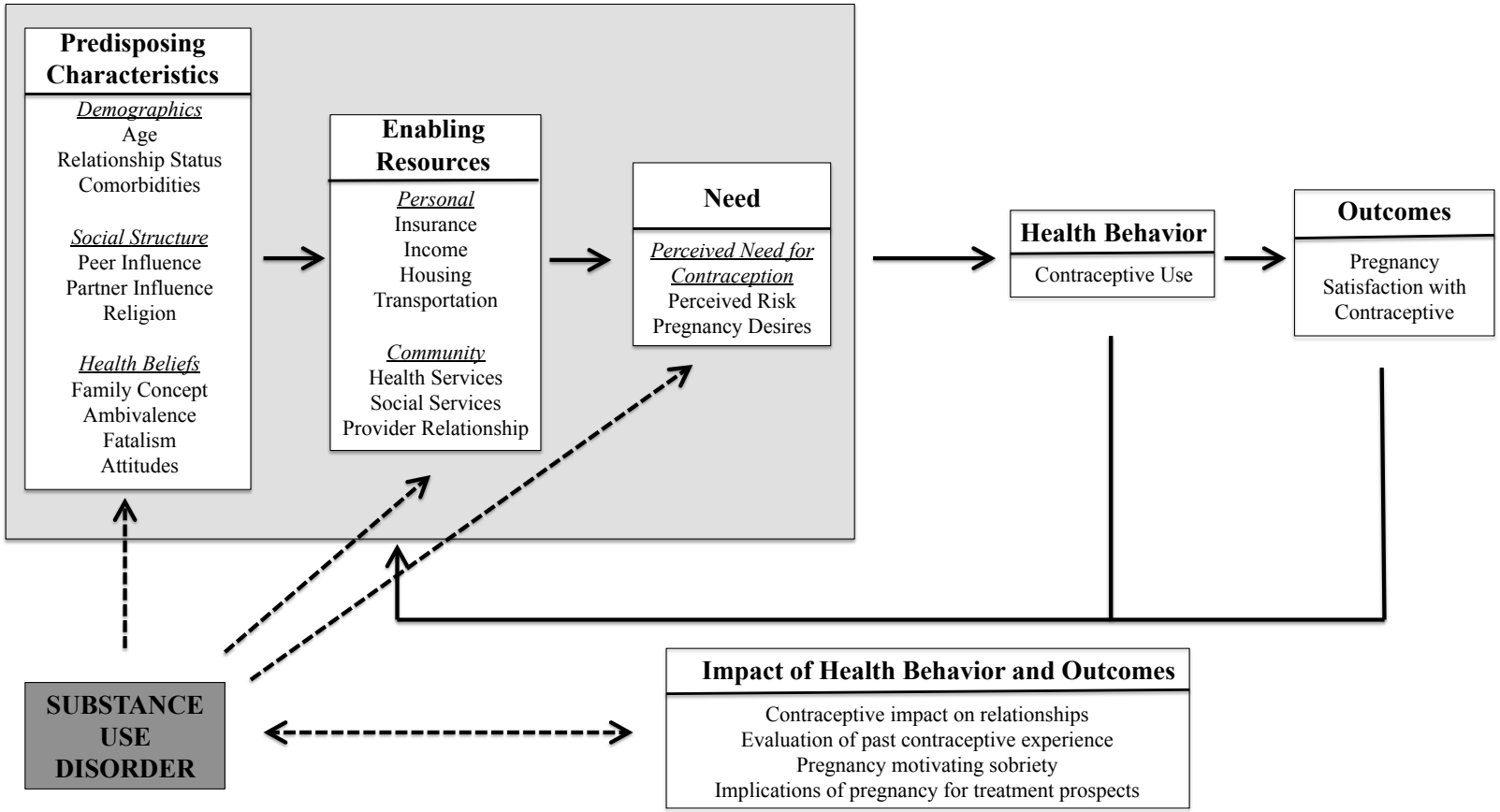
Pregnancy Perceptions
Their plans for children
What it did mean or would mean for them to become pregnant
Their perceived pregnancy risks
Discussions with doctors about their pregnancy planning

Contraceptive Use
What kinds of advice they have received about birth control
Who has given them birth control advice
Qualities that make a birth control method useful or less useful
Reasons they stopped using birth control in the past
Methods they have avoided using, and why
Any times they had difficulty getting birth control when they wanted
Any times they had difficulty using birth control in the way it was supposed to be used
Any ways in which alcohol or drug use affected their sexual activity

Table 4.2. Demographic Characteristics of Participating Women

Characteristic	No. (%)
Age, years, median (range)	25 (22 – 32)
Highest level of education	
Some High School	3 (20)
High School Diploma	7 (47)
Some College	4 (27)
College Graduate	1 (7)
Relationship Status	
Cohabitating Relationship	*10 (67)*
Non-Cohabitating Relationship	*2 (13)*
On-Off Relationship	*0 (0)*
Not Currently in Relationship	*3 (20)*
Sexually Active in Last Month	11 (74)
Parity, median (range)	3 (1 – 14)
History of Miscarriage	9 (60)
History of Abortion	3 (20)
Currently Pregnant	13 (87)
Substances Used in Last 12 Months	
Alcohol	6 (40)
Prescription Drug	10 (67)
Street Drug	14 (93)
Currently on Opioid Agonist Treatment	4 (27)

Figure 4.1. Application of the Behavioral Model for Vulnerable Populations to Contraceptive Use in Women with SUD



Adapted from the Behavioral Model for Vulnerable Populations

CHAPTER V:
DISCUSSION AND CONCLUSIONS

This dissertation estimates and contextualizes the association of SUD with any use and consistent, continued use of prescription contraceptives, pregnancy, abortion, and adverse feto-maternal outcomes. Unintended pregnancies, already common in the general population[13], are even more prevalent among women with SUD[7]. Pregnant women with SUD and their fetuses face higher risks for many complications, making it particularly important to prevent unwanted pregnancies in this population, and to quickly identify unplanned but wanted pregnancies for appropriate management. Evidence suggests SUD is associated with lower rates of having and consistently using contraception among Veteran women[10,11].

This doctoral thesis: 1) compares any use and consistent, continued use of prescription contraception between women with and without SUD; 2) determines the extent to which SUD is associated with pregnancy, abortion, and adverse feto-maternal outcomes in women who use contraception; and 3) explores facilitators of and barriers to contraceptive utilization by women with SUD, using qualitative interviews. We found an association of SUD with lower odds of contraceptive use in a civilian sample enrolled in Medicaid or state-subsidized insurance. Among this population, SUD was also associated with lower rates of consistent, continued use of Long Acting Reversible Contraceptive (LARC) methods. Among women who got pregnant while using contraception, abortion rates were higher for those with SUD than for those without. Importantly, in speaking to women with SUD, we found that "unintended" pregnancies were not always "unwanted" pregnancies, and that many women were primarily focused

on the present when thinking about pregnancy. Some women reported that pregnancy increased their desire for and access to substance use treatment, but fear of involvement by child protective services prevented some women from seeking treatment.

Differences in Contraceptive Use for Women with SUD

The analysis of Medicaid and Commonwealth Care claims data conducted in Aim 1 demonstrated that women with SUD were less likely to use any form of prescription contraception. As discovered in our qualitative interviews, this could partly result from increased structural barriers to care during active use, such as limited access to physicians or the pharmacy. However, women also reported that the decision not to use prescription contraception was sometimes driven by a perceived low immediate risk of pregnancy, often in the context of a dissolved relationship. It is important to note that a different sampling strategy to identify women not already established in care might find additional structural barriers to contraceptive use, such as prohibitive cost, for women with SUD.

If women with SUD did use a prescription contraceptive, they were less likely to use LARC methods, compared to their counterparts without SUD. Though most interviewed women expressed interest in simplified contraceptive regimens like those of LARC, many were hesitant to use LARC methods. Several women expressed concern about the "flexibility" of long-acting methods; women wanted to be able to get pregnant quickly when they were ready, and worried that LARC methods could not be stopped as easily as SARC methods. Again, given our selected sample, we cannot exclude the possibility that some women with SUD may face heightened structural barriers to LARC placement. In particular, LARC method uptake may be inhibited for some women with

SUD due to substantial upfront out-of-pocket expense[97], or by clinic policies requiring multiple physician visits or sexual abstinence for method placement[98]. In our qualitative study, women did express that onerous care processes could affect their selection of contraceptive method.

Aim 1 analysis also demonstrated that SUD was associated with less consistent, continued use of LARC, but not SARC. This finding was surprising in light of data suggesting that women with SUD may have more difficulty adhering to intensive regimens, such as those required for SARC use[40]. When evaluating this apparent contradiction, one must first consider the measure we chose to examine consistent, continued contraceptive use. Our PDC measure examined the proportion of time a woman was in possession of her medication, but it may not be a perfect representation of her actual contraceptive use. PDC is a more accurate measure of actual use for LARC methods than it is for most forms of SARC, which rely on a patient taking the medication. It may be that the relationship of SUD with actual contraceptive use, rather than observed use, varies more predictably across SARC and LARC users. Future studies using different measures of coverage by LARC and SARC might explain this apparent discrepancy.

Our qualitative findings from Aim 3 suggest two additional possible explanations for discontinuation of LARC methods. First, women may discontinue contraception because they are interested in becoming pregnant. Alternatively, women may discontinue LARC methods during periods when they feel they are less susceptible to a

pregnancy, such as after the end of a relationship, not accounting for the possibility of casual partners or a new relationship.

Pregnancy Rates and Adverse Feto-Maternal Outcomes Associated with SUD

In our Aim 2 analysis, we found that SUD was not associated with increased odds of pregnancy. Interestingly, though we were unable to demonstrate statistical significance, our findings suggested that SUD may be associated with increased odds of pregnancy in SARC users more than in LARC users. This finding would be expected based on previous literature demonstrating less consistent use of prescription contraception in women with SUD[10], but is surprising in light of our Aim 1 findings that SUD was associated with inconsistent and discontinued use only among LARC users. This is another finding that may be the result of imperfect measures, as observed contraceptive use is a weaker representation of actual use for SARC methods than for LARC methods, and inconsistent use or discontinuation may be higher among SARC users than we observe.

Alternatively, this discrepancy might be explained by differences in *patterns* of contraceptive use between SARC and LARC users. If LARC users discontinue use only when they are at lower risk for pregnancy, such as after the end of a committed relationship, it might partially explain how SUD could negatively impact our PDC measure among LARC users without impacting pregnancy rates. In our interviews, women with SUD commonly reported stopping contraceptive use because they ended a committed relationship. Conversely, low PDC values for SARC users might represent inconsistent use during times of regular sexual activity, which would result in a higher

effect on pregnancy rates. Our overall PDC measure, which captured both inconsistency and discontinuation in one measure, was not sensitive to these differences. Future work examining types of non-adherence in this population could give further insight into barriers to contraceptive use.

Among women who became pregnant, SUD was associated with elevated odds of abortions. This finding gives important context to the insights on pregnancy intentions gleaned from our interviews. While we emphasize in our Aim 3 analysis that many unintended pregnancies in women with SUD are wanted, our findings in Aim 2 stress that SUD is also associated with an increased risk of *unwanted* pregnancy. Our interviews were not designed to comment on the portion of unintended pregnancies to women with SUD that are unwanted, though others studies have found that about a third are unwanted, a third mistimed, and a third ambivalent[12]. Future research will be necessary to explore barriers to contraceptive use and adherence among women with unwanted pregnancies.

We did not find statistically significant associations between SUD and adverse fetal or adverse maternal outcomes. These associations have been widely demonstrated in previous literature. Our analysis, which only used maternal claims data, was not optimally designed to detect this association.

Insights into Contraceptive Decision-Making by Women with SUD

Pregnancy intentions have substantial influence over contraceptive use, but are essentially unmeasurable in claims data. Women in our sample often left pregnancy planning to fate, but when they did describe specific plans, these plans changed as their circumstances evolved. However, women often based contraceptive decision-making on

their current situation only, which sometimes left them scrambling for effective contraception or vulnerable to unintended pregnancy when circumstances changed. One possible solution to overcome this barrier in women with SUD would be to meet contraceptive needs in real time through a major shift in the provision of contraception. Though our sample did not identify many structural barriers to obtaining contraception, a few did describe their need for immediate contraceptive coverage in cases of unanticipated, casual partners or when their relationship status changed. Policies requiring one or more physician visits for contraceptive access may result in significant delays, particularly for women without established primary care physicians. Over-the-counter contraceptives[99], online and app-based contraceptive prescribing[100], and mail-order contraceptives[101] may each hold promise for improving real-time access to contraceptive care for women with SUD. Emergency contraception may be another method equipped to provide real-time access to women with SUD, though our interviews did not explicitly explore emergency contraceptive use. Future studies will need to evaluate the acceptability and the impact of such programs, especially on marginalized populations.

The subsequent effects of pregnancy on other aspects of women's lives cannot be ignored. Many women described pregnancy as a motivator for sobriety, though sobriety was not always maintained after the pregnancy. This suggests, similar to studies of other health behaviors, that pregnancy might be a window for behavior change and health improvement. It is important to remember there may be pent-up demand for comprehensive care for women with SUD, who in our study reported decreased physician

contact during periods of active drug use. Pregnancy may represent an opportunity to address some of these back-logged health concerns, including SUD treatment.

However, pregnancy may also increase barriers to medical and substance use treatment for women with SUD. In particular, several women feared that seeking substance use treatment could result in involvement of child protective services and subsequent loss of custody. The possible harm created by policies around mandated reporting and criminal or civil liability of pregnant women with SUD has been debated for several decades. Existing literature suggests that mandated reporting policies damage the patient-doctor relationship[54,102], and may result in decreased prenatal care[103], potentially leading to adverse feto-maternal outcomes. The American Congress of Obstetricians and Gynecologists has gone as far as to recommend that physicians work with lawmakers to retract punitive legislation against pregnant women with SUD[96]. Although Massachusetts does not officially consider SUD in pregnancy a criminal act or an act of child abuse[53], our study demonstrated that mandated reporting and the resulting consequences may negatively impact women with SUD.

Limitations

Both of the data sources used in this dissertation only identify women who have some exposure to the healthcare system. This limits our study's generalization to the many women with SUD who have limited contact with the healthcare system. However, compared to women with SUD who have no healthcare interface, women in our study may represent a group that may be more easily reached by possible interventions.

Our claims data is also limited by several poor quality or absent measures. We have high rates of missing race data. We are only able to capture a rough proxy for sexual activity. We are also missing information in these analyses on condom use, marital status, and pregnancy intentions. Finally, our measure for identification of SUD may miss women who meet criteria for SUD, but who have not yet been identified by the medical profession. We have attempted to partially address some of these topics in our qualitative analysis.

Future Research

Future research will be necessary both to hone our understanding of the population we study in this sample, and to expand our knowledge of women with SUD who are not currently engaged in the healthcare system. In future studies, sources with more sensitive measures of consistent, continued contraceptive use will be needed to establish the mechanism of SUD's association with adherence and pregnancy outcomes. These studies will ideally measure closer estimates of actual adherence, such as self-reported adherence, and will examine discontinuation and short gaps of coverage as separate outcomes. Additionally, careful evaluation in larger samples of women with SUD of the impact of laws on mandated reporting of child abuse or neglect will be necessary to establish whether such policies do more harm than good.

Conclusions

Compared to women without SUD, those with SUD have lower rates of prescription contraception any use and continued, consistent use. Women with SUD also had a heightened incidence of pregnancy, though this finding did not appear to be

exclusively due to SUD. Among contraceptive users who become pregnant, SUD is associated with higher rates of abortion. Women in this group frequently identify an external locus of control when pregnancy planning, and struggle to incorporate past experience or anticipated future changes into current contraceptive choices. Pregnancy may increase access to substance use treatment programs, but fears of child protective service involvement may pose a barrier to pregnant women seeking treatment.

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