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AHCA Contract No. MED 178: Florida Medicaid Drug Therapy Management Program for Behavioral Health

Project 9A: Understanding the Pregnancy and Birth Outcomes of Women with Serious Mental Illness Compared to Women without Serious Mental Illness in the Florida Medicaid Program

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Executive Summary

The purpose of this project is to provide the Agency with a comprehensive evaluation of the health care utilization and pregnancy/perinatal outcomes among women in Florida Medicaid who had a Serious Mental Illness (SMI) diagnosis – schizophrenia, bipolar disorder, or major depressive disorder – prior to becoming pregnant, compared to the general population of women in Florida Medicaid without an SMI diagnosis.

The objectives of this project are to:

1. Understand the reproductive health needs and challenges of Medicaid women with SMI during pregnancy and the postpartum period, and the risks of pharmacologically treating vs. not treating SMI on maternal health, birth outcomes, and infant development.
2. Understand the prescribing patterns of psychotherapeutic medications during pregnancy and the postpartum period.
3. Provide the Agency with actionable recommendations to improve the quality of care to pregnant women with SMI.

Study Population

The sample included all women in the Medicaid program who had evidence of a pregnancy or birth in the Medicaid claims and encounter data from January 1, 2011 through June 30, 2014. A subset of women was identified who had a SMI diagnosis – schizophrenia, bipolar disorder, and major depression – prior to pregnancy. The study reference group was women with a SMI diagnosis and the comparison group was all women without a SMI diagnosis.

Data Sources

The data sources used for this project included Florida Medicaid enrollment, claims, and encounter data; Hospital Discharge, Outpatient and Emergency Room data from the Florida Center for Health Information and Policy Analysis (FCHIPA); and Baker Act Involuntary Examination data from the Florida Mental Health Institute/USF (FMHI).

Key Findings

- Prior to becoming pregnant, women with SMI had considerably more pre-existing medical conditions and substance abuse problems compared to women without an SMI diagnosis.
- The rate of psychotherapeutic medication prescriptions for women with SMI declined from pre-pregnancy through pregnancy and then increased in the postpartum period for all medication classes.
- The use of behavioral health services among women with SMI declined from pregnancy through the postpartum period.
- For the women with SMI, adverse psychiatric events related to emergency room (ER) visits, inpatient stays, and Baker Act examinations were generally less frequent during

pregnancy than before or after pregnancy.
    - However, ER visits occurred for approximately 1 in 10 women with SMI during the first and second trimesters of pregnancy.
    - Psychiatric inpatient stays increased during the third trimester compared to the first and second trimesters for women with SMI.
- Pregnancy-related complications were generally more prevalent among women with SMI than women without an SMI diagnosis.
- Among women with SMI, rates of pregnancy complications varied.
    - A schizophrenia diagnosis was associated with higher rates of hypertension and diabetes, and a bipolar diagnosis was associated with higher rates of infections and complications related to drug dependence and tobacco use.
- Women with SMI had higher rates of C-section delivery than women without SMI.
- Newborns of mothers with SMI were significantly more likely to have neonatal abstinence syndrome (NAS) and to be admitted to a neonatal intensive care unit (NICU) than newborns of mothers without SMI.
- In the first year of life, infants of mothers with SMI were more likely to use outpatient, ER, and inpatient services, than infants of mothers without SMI.
- Women with SMI were far more likely to be diagnosed with postpartum depression in the year after giving birth than women without SMI (22 vs. 4 percent).
- Sixty-nine percent of women with SMI had at least one Medicaid reimbursed contraceptive claim in the year after giving birth, compared to 60 percent of women without SMI.
    - Long-acting reversible contraceptives (LARCS) were used by 9 percent of women with SMI in the year after delivery compared to 10 percent for women without SMI. Women with schizophrenia had the lowest rate of Medicaid compensable contraceptive use.

Recommendations

Women with SMI had higher rates of pre-existing medical conditions prior to pregnancy and thus were more likely to begin pregnancy in poorer health than their non-SMI counterparts. In addition, women with SMI also had higher rates of certain pregnancy complications, Cesarean delivery, and postpartum depression than women without SMI. Newborns of mothers with SMI were more likely to be admitted to the NICU, and in infancy had higher rates of ER visits and inpatient stays than newborns of women without SMI. All of these findings suggest a greater need for intensive treatment and services for women with SMI and their families. The data on behavioral health service use and psychotherapeutic medication also highlights this need. Women with SMI received less behavioral health outpatient services and psychotherapeutic medication during pregnancy; however, they had an increase in behavioral health inpatient stays toward the end of pregnancy. From the Medicaid data, it is not known whether psychotherapeutic medication discontinuation among women with SMI was self-initiated or recommended by a

medical professional.

Interestingly, women with SMI had higher rates of any contraceptive use in the year after giving birth, than women without SMI. However, what is not known from the analyses is the consistency of contraceptive use during this period (e.g., how many prescriptions were sequentially filled during this time period). The rate of LARCs use was lower for women with SMI, and in particular for women with schizophrenia of whom only 6 percent had received a LARC in the year after giving birth.

Given the project findings, the following recommendations are suggested to improve pregnancy, birth, and postpartum outcomes for women with SMI and their infants:

- Increase access to preconception health care and family planning for women with SMI, especially in behavioral health treatment settings. Planning a pregnancy is particularly important for women with SMI because they are in poorer health prior to becoming pregnant, have more problems with substance abuse, discontinue psychotherapeutic medications upon becoming pregnant, and reduce their use of behavioral health services in pregnancy and the postpartum – all which may increase the risk of adverse outcomes for mother and infant. Health care professionals can use a reproductive life plan tool as part of preconception health care to screen patients about their intention to become pregnant and their risk of becoming pregnant. Having established this plan could potentially increase women's consistent use of contraception, and in the event they want to become pregnant, would help them make informed and well-planned decisions about their behavioral health treatment in advance of a pregnancy.
- Educate providers about the option of prescribing LARCs to women with SMI who do not want to become pregnant to increase their rate of consistent use of contraceptives and ensure the recommended spacing of pregnancies (minimum of 18 to 24 months). These methods of contraception could potentially be more reliable to women with SMI, especially during episodes of illness, and would likely protect against having an unplanned and/or unwanted pregnancy (which is common in this population).
- Ensure that women with SMI stay connected to behavioral health services during pregnancy and the postpartum. The Florida Medicaid managed care organizations could review newly diagnosed pregnancies for a claims history of a recent mental health diagnosis (within past two years), and institute policies and procedures for ensuring that women receive integrated obstetrical and mental health care services. For example, the managed care organization could assign a care coordinator to pregnant women with a pre-existing mental health condition who would assist in making appointments with a mental health provider during pregnancy, and ensure that the obstetrician/gynecologist (OB/GYN) is aware of a woman's mental health history and is working with the mental health provider to provide optimal care.

- Provide group prenatal care to women with SMI, who would benefit from intensive prenatal care services and having the support of their peers. Group prenatal care (also known as centering), follows the recommended schedule of 10 prenatal care visits, but instead each visit is 90 minutes to 2 hours long, and includes a group of 8 to 10 women due at approximately the same time who meet together with the provider and support staff who educate the group on all aspects of pregnancy (e.g., nutrition, stress management) and facilitate a group discussion (www.centeringhealthcare.org). Such groups could be organized for women who also share the commonality of having a mental health condition. Thus, education and group discussions could also include issues prevalent in this population such as smoking and other substance use during pregnancy, medication use, and staying connected to a mental health provider.
- Examine in greater detail the health outcomes of infants born to women with SMI. The Florida Medicaid Drug Therapy Management Program for Behavioral Health proposes examining the health of these infants and the association with mothers' health in the first five years of life. Since infants of mothers with SMI were more likely to have ER visits and inpatient services in the first year of life, we also propose examining the timing of and diagnoses related to infant ER visits and inpatient stays for these infants.

Methods

Study Sample

The study sample was identified in two ways. All women in the Medicaid recipient information data who were between 15 – 50 years of age were identified. Then, we first identified those who had a Medicaid claim or encounter with a diagnosis indicating a pregnancy or delivery between January 1, 2011 and June 30, 2014. Second, we identified women who had a record in the Medicaid recipient information data that linked them with a newborn.[1] The mothers with linked newborns were retained in the sample if the newborn's birthdate fell within the study period. The unit of study for this project will be pregnancies. If a woman had more than one pregnancy, she would be represented in the data more than once.

To identify the subset of mothers with SMI from this larger sample, we examined claims and encounters from the 2 year period prior to the estimated conception date. At least 1 inpatient or 2 outpatient claims/encounters with a diagnosis indicating SMI were required to be classified as having an SMI. If a woman met criteria for more than one SMI diagnosis during the pre-conception period, the decision rule was to prioritize the most serious, disabling condition: schizophrenia over bipolar disorder and bipolar disorder over major depression.

For each pregnancy in the sample, the data were organized into time periods based on the delivery date. Conception was assumed to be 280 days prior to then delivery date. The year prior to conception was the preconception period. Pregnancy was divided in first, second, and third trimesters, and the 1 year after the delivery date was the postpartum period. For cases for which we could not establish the date of delivery, we used the date of the first claim with a pregnancy diagnosis as the date of onset of pregnancy and the estimated delivery date was set as 280 days later.

Only women with greater than 90 percent of days of Medicaid enrollment during the study period were retained in the sample.

Data Analyses

The data analysis compared women with SMI to women without SMI on: pre-existing medical conditions, timely and adequate use of prenatal care, pregnancy-related complications, ER and inpatient use related to pregnancy, birth and infant outcomes, and postpartum care. Within the group of women who had a SMI diagnosis, we examined their patterns of use of psychotherapeutic medications and any adverse events such as a psychiatric-related ER visits, inpatient admissions, or Baker Act examinations that occurred over the time periods of the study.

[1] A newborn data file is created from the Medicaid recipient information data by the staff of the Policy and Services Research Data Center (PSRDC) in the Department of Mental Health Law and Policy at the University of South Florida. The PSRDC newborn file allowed us to link mothers and infants because the file links the mother's recipient id to the newborn's recipient id.

SAS statistical software version 9 was used in all analyses. Variables were described using means with standard deviations (for continuous variables such as age) or number with percent (for categorical/dichotomous variables such as race/ethnicity, type of delivery, or obesity). To further describe the study population, t-tests were performed to compare means for continuous variables (for example, age for women with SMI vs. without SMI) and chi-square statistics were used for categorical/dichotomous variables (for example, combined race/ethnicity or obesity for women with vs. without SMI). Lastly, we conducted multivariate analyses (e.g., logistic regression) to examine the effect of multiple variables simultaneously on various pregnancy and birth outcomes. Logistic regression allowed us to examine the association between a particular outcome and SMI status while controlling for a number of possible covariates (confounds).

Data Sources

The data sources used for this project included:

- Medicaid institutional, medical, and pharmacy claims and encounter data
- Medicaid recipient information and enrollment data
- Medicaid newborn recipient information data
- Hospital Discharge, Outpatient and Emergency Room data from the Florida Center for Health Information and Policy Analysis (FCHIPA).
- Baker Act Involuntary Examination data from the Florida Mental Health Institute/USF (FMHI).

The FCHIPA and Baker Act data were linked to the Medicaid data for each participant in the study using their Social Security Numbers (SSNs).

Results

Sample Characteristics

Table 1 provides information stratified by SMI status on the method of identification of the sample of pregnancies of women who met the eligibility criteria for inclusion in the study. That is, women who had a pregnancy between January 1, 2011 and June 30, 2014 and who had greater than 90 percent Medicaid enrollment for the sampling frame (pre-pregnancy [1 year], pregnancy, and postpartum period [1 year]). The total sample is comprised of 126,221 pregnancies. Within this sample, there are 8,046 pregnancies for Medicaid women who met the criteria for a SMI diagnosis, and a comparison group of 118,175 Medicaid pregnancies to women without a SMI diagnosis.

Women with SMI were twice as likely as women who do not have an SMI to have been identified only by having a claim with a pregnancy diagnosis, but no other indication of a delivery. Women who do not have SMI were more likely to be identified in the newborn data file. This suggests that the women who do not have SMI are more likely to have obtained Medicaid benefits for their newborn child.

Table 1. The Study Sample Organized by Pregnancy and Delivery Diagnosis

Pregnancy/Delivery in the Medicaid Claims Data	**Total Sample (N=126,221)**	**SMI Group (N=8,046; 6.4%)**	**No SMI Group (N=118,175; 93.6%)**
Pregnancy diagnosis only	14,013 (11.1%)	1,630 (20.3%)	12,383 (10.5%)
Pregnancy diagnosis only and newborn record	10,058 (7.8%)	642 (8.0%)	9,416 (8.0%)
Pregnancy and delivery diagnosis	12,943 (10.3%)	1,107 (13.8%)	11,836 (10.0%)
Pregnancy and delivery diagnosis and newborn record	83,090 (65.8%)	4,314 (53.6%)	78,776 (66.7%)
Newborn record, but neither pregnancy nor delivery diagnosis	6,117 (4.9%)	353 (4.4%)	6,117 (4.9%)

Table 2 provides the demographic and pre-existing health characteristics of the sample. Women with SMI were more likely to be older and White than the women without SMI. Twenty-nine percent of the SMI group had a substance abuse diagnosis in the two years before their pregnancy, compared to 5 percent of the non-SMI group. So women with SMI were almost six times more likely to have a substance use disorder. The most common SMI diagnosis was bipolar disorder (45 percent), followed by major depression at 37 percent and schizophrenia at 19 percent.

Table 2. The Demographic and Health Characteristics of Women

Demographic/Health Characteristics	**Total Sample (N=126,221)**	**SMI Group (N=8,046)**	**No SMI Group (N=118,175)**
Mean Age (SD)	24.55 (6.1)	25.84 (7.2)	24.47 (5.9)
Median Age	24	25	24
Age Range	(15, 50)	(15, 50)	(15, 50)
Age Groups			
15-18 years old	21,078 (16.7%)	1,371 (17.0%)	19,707 (16.7%)
19-29 years old	79,597 (63.1%)	4,440 (55.2%)	75,157 (63.6%)
30-39 years old	23,320 (18.4%)	1,867 (23.2%)	21,363 (18.1%)
40-50 years old	2,316 (1.8%)	368 (4.6%)	1,948 (1.6%)
Race-ethnicity			
African American	55,102 (43.6%)	2,379 (29.6%)	52,723 (44.6%)
Hispanic, Latino	24,680 (19.5%)	1,365 (16.9%)	23,316 (19.7%)
White, Non-Hispanic	40,788 (32.3%)	3,477 (43.2%)	37,311 (31.6%)
Asian American	1,069 (0.8%)	30 (0.4%)	1,039 (0.8%)
Native American	233 (0.2%)	21 (0.4%)	202 (0.2%)
Other	1,904 (1.5%)	90 (1.1%)	1,814 (1.5%)
Unknown	2,444 (1.9%)	674 (8.4%)	1,770 (1.5%)
Pre-Existing Serious Mental Illness (Mutually exclusive categories)			
Schizophrenia	--	1,507 (18.7%)	--
Bipolar Disorder		3,591 (44.6%)	
Major Depression		2,948 (36.6%)	
Pre-Existing Substance Use Disorder	8,082 (6.4%)	2,295 (28.5%)	5,787 (4.9%)

Note. Only women with greater than 90 percent of days of Medicaid enrollment during the study period (including the pre-pregnancy period) were included in the sample.

Table 3 provides the demographic characteristics separately for the women with schizophrenia, bipolar disorder, major depression, and co-morbid substance use. Among the younger three groups of women (between the ages of 15 and 29 years) bipolar disorder (75 percent) was the most frequent diagnosis, followed by major depression (73 percent). Schizophrenia was least frequent in the younger groups (64 percent), but was more frequent than bipolar disorder (8 percent compared to 3 percent) in the oldest group of women (40-50 years of age). Women with schizophrenia were more likely to be Black, Non-Hispanic (43 percent) and less likely to be White, Non-Hispanic (26 percent) than the other diagnostic groups (bipolar and major depression), which were each about 22 percent Black and 55 percent White.

Table 3. The Demographic and Health Characteristics of Women with SMI by Diagnosis and Comorbid Substance Use

Demographic/Health Characteristics	**Schizophrenia (N = 1,507)**	**Bipolar Disorder (N = 3,591)**	**Major Depression (N = 2,948)**	**Co-morbid Substance Use (N = 2,295)**
Mean Age (SD)	27.8 (7.6)	25.1 (6.8)	25.8 (7.1)	26.2 (6.9)
Median Age	27.0	24.0	25.0	26.0
Age Range	(15, 50)	(15, 50)	(15, 50)	(15, 50)
Age Groups				
15-18 years old	154 (10.2%)	697 (19.4%)	520 (17.6%)	377 (16.4%)
19-29 years old	807 (53.6%)	2006 (55.8%)	1,627 (55.2%)	1,221 (53.2%)
30-39 years old	426 (28.3%)	780 (21.7%)	661 (22.4%)	598 (26.1 %)
40-50 years old	120 (7.9%)	108 (3.0%)	140 (4.7%)	99 (4.3%)
Race-ethnicity				
Black, Non-Hispanic	652 (43.3%)	762 (21.2%)	965 (22.4%)	502 (21.9%)
Hispanic, Latino	217 (14.4%)	487 (13.6%)	661 (13.6%)	301 (12.1%)
White, Non-Hispanic	393 (26.1%)	1,953 (54.4%)	1,953 (54.4%)	1,263 (55.0%)
Asian American	8 (0.5%)	12 (0.3%)	10 (0.3%)	8 (0.4%)
Native American	5 (0.3%)	15 (0.4%)	11 (0.4%)	4 (0.2%)
Other	10 (0.7%)	41 (1.1%)	39 (1.3%)	0 (0.0%)
Unknown	222 (14.7%)	321 (8.9%)	131 (4.4%)	192 (8.4%)

Table 4 provides data on the pre-existing medical conditions (e.g., specific co-occurring substance use disorders, diabetes, hypertension, diabetes, and asthma) identified from the Medicaid claims and encounters during the two years preceding the estimated conception date. Prior to pregnancy, women with SMI had significantly higher rates of obesity, diabetes, hypertension, and asthma than women without SMI (about 2.5 times higher for each condition). Having a substance use diagnosis was also significantly more common among women with SMI in the 2 years prior to pregnancy than among women without SMI. Women with SMI were about 2.5 times more likely to have a Tobacco Use disorder; however, they were more than 5 times more likely to have a substance use disorder associated with cannabis, cocaine, opioids, or alcohol.

Table 4. Pre-existing Medical Conditions and Substance Use

	SMI (n = 8,046)	**No SMI (n = 118,175)**
Obesity	15.0%	6.4%
Diabetes	8.8%	3.2%
Hypertension	14.8%	5.2%
Asthma	21.2%	8.5%
Substance Use	28.5%	4.9%
Tobacco Use	33.9%	12.3%
Cannabis Use	11.2%	1.9%
Cocaine Use	5.9%	0.6%
Opioid Use	14.2%	2.0%
Alcohol Use	8.1%	0.9%

Note. Women with SMI had statistically significant (at $p < .001$) higher rates of pre-existing medical conditions and substance use than women without SMI. *A substance use diagnosis includes having 1 or more diagnoses of a substance use problem related to a specific substance such as alcohol, tobacco, cannabis, etc.

Service Utilization

The use of psychotherapeutic medications across time periods related to pregnancy was examined (See **Table 5**).[2] Across all medication classes, psychotherapeutic medication use declined from pre-pregnancy to the 1st trimester, and then continued to gradually decline until the delivery date. After delivery, medication use increased for all classes.

Table 5. Psychotherapeutic Medication Prescriptions among Women with SMI

	Women with SMI (N = 8,046)				
	Pre-pregnancy	1st Trimester	2nd Trimester	3rd Trimester	Postpartum
Antidepressants	23.7%	20.0%	14.9%	11.4%	19.4%
Antipsychotics	15.0%	12.7%	9.3%	7.1%	11.7%
Anticonvulsants	11.5%	10.2%	7.6%	6.0%	10.35%
Hypnotics	2.4%	2.0%	2.0%	1.0%	2.0%
Polypharmacy*	16.8%	14.2%	10.5%	8.1%	13.6%
	Specific High Risk Agents				
Benzodiazepines	11.9%	10.8%	8.5%	6.5%	10.7%
Carbamazapine	0.7%	0.7%	0.4%	0.2%	0.4%
Lithium	1.3%	1.1%	0.6%	0.5%	0.9%
Paroxetine	1.3%	1.0%	0.7%	0.5%	1.0%
Valproic Acid	2.8%	2.3%	1.3%	0.9%	1.9%

*Polypharmacy is defined as 2 or more psychotherapeutic agents used concurrently. High-risk agents are included in the total rates for medication categories.

The rate of behavioral health (BH) outpatient utilization across time periods for women with SMI is provided in **Table 6**. Most of the women had a BH outpatient visit during the 1 year before the estimated conception date (83 percent overall; 49 percent on average per quarter). This rate declined significantly in the 1st trimester of pregnancy (to 42 percent) and continued to decline across pregnancy. During each trimester, less than half of the women with SMI received any BH outpatient services. During the year after childbirth, women continued to receive BH outpatient services at a lower rate than during pregnancy (33 percent).

Table 6. Behavioral Health Outpatient Visits for Women with SMI

	Women with SMI (N = 8,046)				
	Pre-pregnancy	1st Trimester	2nd Trimester	3rd Trimester	Postpartum
BH Outpatient Visits	49.1%	42.4%	40.3%	34.2%	32.6%

[2] Note: for Tables 5-7 the penetration rates presented for the Pre-Pregnancy and Postpartum periods are the average of the rates for each quarter within those years. This way when comparing rates over time all the rates are for similar length of time.

Table 7 provides the rates of women with SMI that visited the emergency room or had an inpatient visit related to a psychiatric event, or that had a Baker Act examination. Behavioral health ER visits and Baker Act examinations occurred at a slightly lower rate overall during pregnancy than prior to pregnancy, and the rate decreased across the pregnancy. The rate remained relatively lower in the postpartum period. However, behavioral health inpatient visits increased from the first two trimesters (about 4 percent) to the third trimester (about 14 percent).

Table 7. Adverse Psychiatric Events for Women with SMI

	Women with SMI (N = 8,046)				
	Pre-pregnancy	1st Trimester	2nd Trimester	3rd Trimester	Postpartum
BH-Related Emergency Room	10.1%	11.4%	9.1%	6.4%	6.1%
BH-Related Inpatient Event	5.6%	3.7%	4.0%	13.6%	2.3%
Baker Act Examination	4.9%	3.5%	2.8%	1.7%	2.0%

In **Table 8,** the rates of ER visits and inpatient stays associated with medical problems (non-behavioral health) are presented by SMI status and pregnancy trimesters. Women with SMI consistently had higher rates of ER visits and inpatient stays related to medical problems than women without SMI. Rates of ER visits associated with medical problems were highest for women with SMI in the first trimester, whereas rates for women without SMI were similar across trimesters (19 and 20 percent). Conversely, rates of inpatient stays for medical problems (not associated with delivery) increased across pregnancy for both groups and were highest in the 3rd trimester.

Table 8. Non-Behavioral Health Medical Problems Emergency Room Visits and Inpatient Stays by SMI Status and Pregnancy Trimesters

	ER Visits	**Inpatient Stays**
1st Trimester		
SMI*	27.2%	3.7%
No SMI**	19.2%	1.6%
2nd Trimester		
SMI	24.4%	7.2%
No SMI	19.9%	4.6%
3rd Trimester		
SMI	19.9%	15.6%
No SMI	18.5%	13.7%

Note. Chi-Square tests revealed statistically significant differences at $p < .001$ between SMI and no SMI women on rates of pregnancy-related ER visits and inpatient stays.

* The N for SMI = 8,046. **The N for No SMI = 118,175.

Pregnancy Complications

Table 9 provides the rates of various pregnancy complications by whether or not a woman had an SMI diagnosis. Overall, women with SMI had significantly higher rates of pregnancy-related complications (with the exceptions of anemia, preeclampsia, and sepsis). Women with SMI had higher rates of tobacco and drug use during pregnancy which is not surprising since they also had higher rates of pre-pregnancy substance use disorder.

Table 9. The Prevalence of Pregnancy Complications by SMI Status

	SMI (n = 8,046)	**No SMI (N = 118,175)**
Ectopic Pregnancy	5.1%	3.1%
Miscarriage	12.6%	10.0%
Hyperemesis Gravidarum (excessive vomiting)	26.3%	19.9%
Placenta Problems (*placenta previa, placental abruption, or hemorrhage unspecified*)	14.6%	12.2%
Progesterone Use for Early/Threatened Labor	4.7%	3.9%
Preeclampsia	5.7%	6.4%
Eclampsia	0.6%	0.4%
Hypertension	17.9%	16.6%
Gestational Diabetes	5.4%	3.9%
Obesity	12.1%	10.1%
Thyroid Dysfunction	3.5%	2.1%
Anemia	22.8%	23.6%
Infections of Genitourinary Tract	38.8%	31.6%
Drug Dependence	10.4%	4.3%
Tobacco Use Disorder	26.4%	12.6%
Other Infections	17.1%	12.8%
Sepsis	0.2%	0.1%

Note. Chi-Square tests were used to examine differences in the rates of pregnancy complications between women with SMI and women without SMI. For each variable, there were statistically significant differences (at $p < .05$) between the groups with the exception of anemia and sepsis.

Table 10 provides the rates of pregnancy complication separately for each SMI diagnosis. Which disorder has higher rates varies across the types of complications. However, in almost every case each of these SMI disorders is associated with a higher rate of occurrence of the complication than is observed among the women who do not have SMI. Women with schizophrenia were significantly more likely to have had a miscarriage, and have hypertension and diabetes as a pregnancy complication than women with bipolar disorder or major depression. Women with bipolar disorder were significantly more likely to have infections leading to pregnancy complications as well as complications related to drug dependence and tobacco use than women with major depression or schizophrenia.

Table 10. The Prevalence of Pregnancy Complications by SMI Diagnosis

	Bipolar Disorder (N = 3,591)	**Major Depression (N = 2,948)**	**Schizophrenia (N = 1,507)**
Ectopic Pregnancy	5.0%	4.9%	5.7%
Miscarriage	12.5%	11.6%	14.8%
Hyperemesis Gravidarum (excessive vomiting)	24.0%	29.6%	22.9%
Placenta Problems (*placenta previa, placental abruption, or hemorrhage unspecified*)	15.7%	14.4%	12.5%
Preeclampsia	5.9%	6.0%	4.6%
Eclampsia	0.5%	0.4%	1.1%
Progesterone Therapy for Early/Threatened Labor	5.1%	4.7%	3.9%
Hypertension	17.6%	17.3%	20.0%
Gestational Diabetes	5.6%	4.8%	6.3%
Obesity	12.2%	11.8%	12.4%
Thyroid Dysfunction	2.8%	3.9%	3.9%
Anemia	22.3%	23.5%	22.7%
Infections of Genitourinary Tract	41.4%	36.4%	37.5%
Drug Dependence	12.2%	8.4%	9.8%
Tobacco Use Disorder	32.5%	19.5%	25.2%
Other Infections	19.4%	15.1%	15.7%
Sepsis	0.22%	0.14%	0.27%

Note. Chi-Square tests revealed statistically significant differences between SMI groups on all variables at $p < .001$, with the exception of preeclampsia and progesterone use at $p < .05$, and anemia and sepsis (no significance).

Birth Outcomes

The type of delivery for women with and without SMI is presented in **Table 11.** The rate of C-section delivery was significantly higher for women with a SMI diagnosis than for women without a SMI diagnosis (41 versus 37 percent). Vaginal birth after C-section delivery (VBAC) was rare for both SMI and non-SMI groups (less than a tenth of a percent).

Table 11. Type of Delivery by SMI Status

	SMI (N = 5,421)*	**No SMI (N = 90,612)***
Normal/Vaginal Delivery	58.5%	63.1%
Cesarean Delivery	41.4%	36.7%
Vaginal Birth after C-section Delivery (VBAC)	0.04%	0.01%

Note. Chi-Square tests revealed statistically significant differences at $p < .001$ between SMI and no SMI women on normal delivery and Cesarean delivery outcomes. There were no statistically significant differences in rates of VBAC between groups.

*The N's include women with both pregnancy and delivery claims in the Medicaid data.

Table 12 provides the delivery type – normal, C-section, and VBAC - for women by their SMI diagnosis. Women with depression had the highest rates of C-section delivery (43 percent), followed by women with schizophrenia at 42 percent and women with bipolar disorder at 40 percent. Each of these is a higher rate than that for women who do not have an SMI diagnosis.

Table 12. Type of Delivery by SMI Diagnosis

	Bipolar Disorder (N = 2,485)	**Major Depression (N = 2,030)**	**Schizophrenia (N = 906)**
Normal/Vaginal Delivery	60.1%	56.7%	58.0%
Cesarean Delivery	39.7%	43.2%	41.9%
Vaginal Birth after C-section Delivery (VBAC)	0.04%	0.00%	0.11%

Note. Chi-Square tests revealed statistically significant differences at $p < .001$ between SMI diagnoses on normal delivery and Cesarean delivery outcomes.

Table 13 presents the neonatal outcomes by SMI status of the mother. Infants of mothers with SMI had significantly higher rates of narcotics and cocaine exposure, fetal alcohol syndrome, birth trauma, infections, neonatal abstinence syndrome, and neonatal intensive care unit (NICU) admissions.

Table 13. Neonatal Outcomes by SMI Status

	SMI (N = 5,421)*	**No SMI (N = 90,612)***
Still Birth	1.2%	0.9%
Neonatal Intensive Care Unit (NICU)	10.9%	8.4%
Neonatal Abstinence Syndrome	2.6%	0.9%
Neonatal Infections	9.7%	8.6%
Birth Trauma	2.7%	2.0%
Congenital Abnormality	19.2%	18.1%
Respiratory Conditions	1.2%	1.1%
Cocaine Exposure	0.5%	0.2%
Narcotics Exposure	1.8%	0.5%
Fetal Alcohol Syndrome	0.14%	0.04%

Note. Chi-Square tests revealed statistically significant differences at $p < .001$ between SMI vs. no SMI groups on all variables with the exception of still birth, respiratory conditions, and congenital abnormalities.

*The N's include women with both pregnancy and delivery diagnoses in the Medicaid data.

The neonatal outcomes by SMI diagnosis are presented in **Table 14**. Infants of mothers with schizophrenia were more likely to have infections after birth and congenital abnormalities than women with bipolar disorder or major depression.

Table 14. **Neonatal Outcomes by SMI Group**

	Bipolar Disorder (N = 2,485)	**Major Depression (N = 2,030)**	**Schizophrenia (N = 906)**
Still Birth	1.5%	1.0%	0.8%
Neonatal Intensive Care Unit (NICU)	10.5%	11.4%	10.9%
Neonatal Abstinence Syndrome	4.0%	2.4%	2.7%
Neonatal Infections	9.0%	9.1%	13.8%
Birth Trauma	2.4%	3.0%	2.5%
Congenital Abnormality	18.1%	19.6%	21.5%
Respiratory Conditions	1.2%	1.0%	1.6%
Cocaine Exposure	0.71%	0.18%	0.47%
Narcotics Exposure	2.1%	1.7%	1.4%
Fetal Alcohol Syndrome	0.20%	0.06%	0.16%

Postpartum Outcomes for Women and Infants

The use of outpatient, ER, and inpatient services by infants in the first year of life is presented by mother's SMI status in **Table 15**. Infants of mothers with SMI were significantly more likely to use outpatient, ER, and inpatient services than infants of mothers without SMI.

Table 15. Infant Service Use by Mothers' SMI Status

	SMI (N = 4,314)*	**No SMI (n = 78,776)***
Outpatient Services	91.6%	89.3%
Emergency Room Services	34.0%	29.5%
Inpatient Services	8.4%	6.7%

Note. Chi-square tests to assess group differences were statistically significant at $p < .001$.

*The N's include women who had a pregnancy and delivery diagnoses in the Medicaid claims, as well as a newborn record.

Table 16 provides the rates of postpartum depression in women one year after the birth of their child by SMI status and diagnosis. The rate of postpartum depression was significantly higher in women with SMI (22 percent) than women without SMI (4 percent). Approximately 1 in 4 women with a previous history of major depression and schizophrenia had a postpartum depression diagnosis in the year after childbirth.

Table 16. Postpartum Depression in the Year after Childbirth by SMI Status and Diagnosis

	Postpartum Depression
No SMI (N = 90,612)*	4.2%
SMI (N = 5,421)*	22.3%
Major Depression	25.6%
Bipolar Disorder	18.7%
Schizophrenia	24.6%

Note. Chi-square tests to assess group differences were statistically significant at $p < .001$.

*The N's include women with both pregnancy and delivery diagnoses in the Medicaid data.

Table 17 provides the percentage of women who had a prescription for any type of contraceptive method in the 1 year after childbirth. Women with a SMI were significantly more likely to have a prescription for a contraceptive in the year after childbirth than women without a SMI (69 vs. 60 percent). The use of long-acting reversible contraceptives (LARCs) was similar for the two groups (10% no SMI vs. 9% SMI). Among women with SMI, those with schizophrenia had the lowest rates of using any contraceptives including LARCs.

Table 17. Contraceptive Use in the Year after Childbirth by SMI Status and Diagnosis

	Any Contraceptive Use	LARCs
No SMI (N = 90,612)*	59.6%	10.0%
SMI (N = 5,421)*	68.5%	8.8%
Major Depression	67.4%	9.4%
Bipolar Disorder	62.1%	9.8%
Schizophrenia	58.8%	5.5%

Note. Chi-square tests to assess group differences were statistically significant at $p < .001$.

*The N's include women with both pregnancy and delivery diagnoses in the Medicaid data.

Multivariate analysis of various pregnancy complications by SMI status

To identify the relationship between SMI status and several of the pregnancy complications outcome measures, we used logistic regression. Logistic regression is a multivariate procedure that estimates the risk of occurrence of a particular outcome. Multiple variables may be entered into the analysis and the contribution to the risk of the outcome is estimated simultaneously for each of the predictor variables. In each case, the risk associated with each predictor is estimated after the contribution of all other predictors is calculated, so in this way it is estimating the independent contribution of each predictor to the risk of the outcome.

We conducted several logistic regression analyses, one each for the likelihood of a) having a caesarian section delivery, b) infant death, c) having anemia, d) having genitourinary tract infection, and e) having other infection or parasitic condition diagnosed. For each analysis, we included SMI and substance use disorder (SUD) as the main predictors. We also included several covariates that could potentially be associated with risk for the outcome, namely, mother's age at conception, race/ethnicity of the mother, whether the mother had various pre-pregnancy medical risk factors (obesity, hypertension, diabetes, and asthma), and whether the mother received any psychotherapeutic medication during the pregnancy.

The results for each of these analyses are presented below in **Tables 18 – 22**. In each table, the Wald chi-square and its p value are presented along with the hazard ratio estimate. Due to the number of tests involved, we used an alpha of .01 for each predictor variable. For each predictor variable, if the p value indicates a significant result, the hazard ratio (HR) provides an estimate of the variable's contribution to the risk of the outcome. If the HR is greater than 1, then the variable is associated with increased risk (decreased risk if less than 1). The difference between

the HR and a value of 1 provides the magnitude of the change in risk.

SMI status is associated with increased risk of genitourinary tract infections (25% increase) and other infectious or parasitic conditions (17% increase), but not caesarian section delivery, infant death, or anemia. However, being on a psychotherapeutic medication was associated with increased risk for caesarian section delivery. Above, we reported that women with SMI had higher rates of caesarian section delivery than women who did not have SMI. This finding from the multivariate analysis may suggest that the increased rate of caesarian section in women with SMI may be due to other risk factors such as being older and having multiple pre-existing medical conditions which are associated with having SMI and are associated with increased risk for caesarian section delivery.

Substance abuse is associated with increased risk of genitourinary tract infections (38% increase), other infectious or parasitic conditions (77% increase), and anemia (9% increase), but not caesarian section delivery or infant death.

Several of the covariates were significantly associated with risk of these various outcomes, although the pattern of relationship varied from one outcome to another. All of the outcomes had at least one of the preexisting medical conditions that were a significant predictor. In fact, for infant death, diabetes was the only significant predictor. Pre-existing diabetes in the mother was associated with more than a two-fold increase in the risk of infant death. For the other outcomes, being Black was consistently associated with increased risk. Being younger was associated with increased risk of anemia and infectious conditions, but a decreased risk for caesarian section delivery.

Table 18. Caesarian Section Delivery

Parameter	Wald Chi-Square	Pr > ChiSq	Odds Ratio Estimates
Intercept	3145.8416	<.0001	
Age at Conception	1288.1554	<.0001	1.046
Black, non-Hispanic	62.3691	<.0001	1.168
Hispanic	239.3237	<.0001	1.391
Other Race	0.2565	0.6125	1.088
SMI Status	5.2099	0.0225	1.134
Substance abuse	1.4772	0.2242	1.096
Obesity	368.2930	<.0001	1.785
Diabetes	192.1713	<.0001	1.876
Hypertension	123.8310	<.0001	1.506
Asthma	15.5793	<.0001	1.149
Any Psych Med	55.4053	<.0001	1.225

Table 19. Infant Death

Parameter	Wald Chi-Square	Pr > ChiSq	Odds Ratio Estimates
Intercept	489.4875	<.0001	
Age at Conception	2.9606	0.0853	0.984
Black, non-Hispanic	0.1239	0.7248	1.044
Hispanic	10.2546	0.0014	0.555
Other Race	3.0558	0.0805	0.546
SMI Status	4.4653	0.0346	0.548
Substance abuse	2.5439	0.1107	1.387
Obesity	2.1306	0.1444	1.332
Diabetes	12.1736	0.0005	2.193
Hypertension	0.1020	0.7495	1.076
Asthma	0.6895	0.4063	0.848
Any Psych Med	0.3109	0.5771	1.099

Table 20. Anemia Complicating Pregnancy

Parameter	Wald Chi-Square	Pr > ChiSq	Odds Ratio Estimates
Intercept	1275.1525	<.0001	
Age at Conception	308.8030	<.0001	0.980
Black, non-Hispanic	2037.3685	<.0001	2.093
Hispanic	60.1439	<.0001	1.176
Other Race	70.0182	<.0001	1.340
SMI Status	0.1289	0.7196	1.011
Substance abuse	8.9202	0.0028	1.090
Obesity	6.1958	0.0128	1.070
Diabetes	0.3866	0.5341	1.024
Hypertension	25.4072	<.0001	1.162
Asthma	76.7422	<.0001	1.220
Any Psych Med	0.0687	0.7932	1.006

Table 21. Genitourinary Infections Complicating Pregnancy

Parameter	Wald Chi-Square	Pr > ChiSq	Odds Ratio Estimates
Intercept	50.7149	<.0001	
Age at Conception	2149.4055	<.0001	0.950
Black, non-Hispanic	709.3796	<.0001	1.471
Hispanic	12.4199	0.0004	0.937
Other Race	2.9729	0.0847	1.056
SMI Status	77.4533	<.0001	1.254
Substance abuse	160.5479	<.0001	1.375
Obesity	68.8929	<.0001	1.226
Diabetes	6.1123	0.0134	1.089
Hypertension	18.9170	<.0001	1.129
Asthma	288.8931	<.0001	1.418
Any Psych Med	133.3826	<.0001	1.251

Table 22. Infections and Parasitic Conditions Complicating Pregnancy

Parameter	Wald Chi-Square	Pr > ChiSq	Odds Ratio Estimates
Intercept	2073.0403	<.0001	
Age at Conception	173.7325	<.0001	0.981
Black, non-Hispanic	671.8646	<.0001	1.679
Hispanic	53.8822	<.0001	0.816
Other Race	11.6667	0.0006	1.159
SMI Status	21.2894	<.0001	1.167
Substance abuse	347.0829	<.0001	1.773
Obesity	35.5843	<.0001	1.212
Diabetes	22.0470	<.0001	1.229
Hypertension	2.4081	0.1207	0.944
Asthma	93.1230	<.0001	1.298
Any Psych Med	95.0195	<.0001	1.282