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Predictors of Participation in Prenatal Substance Use Assessment, Counseling, and Treatment Among Pregnant Individuals in Prenatal Settings Who Use Cannabis

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Objectives: Assessment and counseling are recommended for individuals with prenatal cannabis use. We examined characteristics that predict prenatal substance use assessment and counseling among individuals who screened positive for prenatal cannabis use in prenatal settings.

Methods: Electronic health record data from Kaiser Permanente Northern California's Early Start perinatal substance use screening, assessment, and counseling program was used to identify individuals with ≥1 pregnancies positive for prenatal cannabis use. Outcomes included completion of a substance use assessment and among those assessed, attendance in Early Start counseling only or Addiction Medicine Recovery Services (AMRS) treatment. Predictors included demographics and past-year psychiatric and substance use disorder diagnoses evaluated with GEE multinomial logistic regression.

Results: The sample included 17,782 individuals with 20,398 pregnancies positive for cannabis use (1/2011–12/2021). Most pregnancies (80.3%) had an assessment. Individuals with Medicaid, anxiety, depression and tobacco use disorders, compared to those without, had higher odds and those with greater parity, older age (≥35) and in later trimesters, had lower odds of assessment. Among 64% (n = 10,469) pregnancies needing intervention based on assessment, most (88%) attended Early Start counseling only or AMRS (with or without Early Start). Greater parity and later trimester assessment was associated with lower odds, while Medicaid was associated with higher odds of Early Start counseling. Nearly all diagnosed psychiatric and substance use disorders were associated with higher odds of AMRS treatment.

Conclusions: A comprehensive prenatal substance use program engaged most pregnant individuals with prenatal cannabis use in substance use assessment and counseling. Opportunities to improve care gaps remain.

Key Words: cannabis, pregnancy, early intervention

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Cannabis use during pregnancy is increasing and in some US states, outpacing use of other high-risk substances (ie, tobacco, alcohol), with up to 20% of pregnant individuals reporting use at some point during pregnancy.[1–5] Cannabis use during pregnancy is associated with increased risk of lower birth weight, preterm delivery, neonatal intensive care unit admission, neurodevelopmental changes, and childhood psychopathology.[6–14] National recommendations advise against cannabis use during pregnancy.[7,15]

Individuals who use cannabis during pregnancy should be provided prenatal care that offers substance use counseling and treatment.[16] However, access to such care is often complex, with unique barriers, including potential legal consequences (ie, incarceration, loss of parental rights), as well as stigma, financial hardship, and competing demands.[17] Kaiser Permanente Northern California's (KPNC) Early Start program, which offers universal substance use screening, assessment, and counseling as part of prenatal care,[18] has been associated with reductions in adverse infant outcomes, including low birth weight, assisted ventilation at birth, intrauterine fetal demise, and preterm delivery.[19]

Not all individuals with prenatal substance use participate in Early Start, highlighting opportunities to address critical care

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gaps.[19,20] Evidence suggests that individuals screened for substance use later in pregnancy, who have greater parity, and who only use alcohol or other drugs have lower odds of participating, whereas individuals who report cannabis use only are more likely to participate, along with those who are younger, have lower income, single marital status and comorbid mental health (ie, depression, anxiety) or substance use disorders (SUDs).[4]

However, little is known about the characteristics of pregnant individuals who use cannabis associated with engagement in substance use counseling or treatment. Recent findings indicate pregnant individuals with a history of psychiatric disorders or SUDs have elevated odds of using cannabis and using cannabis more frequently.[21] However, whether these conditions impact engagement in substance use counseling or treatment for pregnant individuals who use cannabis has not been explored.

This current study uses electronic health record (EHR) data from KPNC's Early Start program to understand, among pregnant individuals identified with prenatal cannabis use in prenatal settings, the patient characteristics, including sociodemographics, psychiatric disorders, and SUDs, that predict completion of a comprehensive Early Start substance use assessment. Furthermore, this study explores, among those assessed and recommended follow-up, the characteristics that predict subsequent engagement in substance use counseling or treatment.

METHODS

Study Setting

KPNC is a large, multispecialty healthcare system serving ~4.6 million diverse members representative of Northern California's insured population. Since 2003, all KPNC prenatal clinics have offered Early Start, a comprehensive substance use program successfully integrated into standard prenatal care in prenatal settings (ie, obstetrics and gynecologic clinic settings). The program provides substance use screening, assessment, and counseling staffed by licensed counselors (ie, social workers, therapists, and psychologists). Universal prenatal substance use screening is offered at a first prenatal visit (~8–10 weeks gestation) through both a self-administered questionnaire and urine toxicology testing (most often same day). Compared to toxicology testing, the sensitivity of self-reported prenatal cannabis use is low (33.9%); thus, a combined screening approach is optimal.[22] Patients consent to urine toxicology testing included within a standard panel of prenatal laboratory tests. Positive immunoassay results are immediately available and confirmed by additional testing (eTable 1, http://links.lww.com/JAM/A557).

Pregnant individuals identified as using cannabis and other substances (based on self-report or toxicology testing) are offered an Early Start clinical assessment from a licensed counselor, which includes a detailed substance use interview, including Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria for SUDs, brief medical history, patient education, brief counseling, and follow-up care plan. Individuals who are at increased risk of continued substance use during pregnancy and those who meet DSM-5 criteria for an SUD are offered Early Start substance use counseling. A variety of effective counseling techniques and therapeutic interventions, including motivational enhancement and cognitive behavioral therapies for cannabis use,[23] are offered virtually or in-person, based on patient preference and clinician judgment, to support reductions or cessation of substance use throughout pregnancy. Clinicians may also refer some individuals, with severe SUDs, polysubstance use, or potential need for medications (eg, withdrawal management), to KPNC's Addiction Medicine and Recovery Services (AMRS) to access intensive outpatient services, like day treatment (eg, partial hospitalization) or residential care. In California, clinicians are not mandated to report prenatal substance use to law enforcement or social services agencies, allowing for increased confidentiality.[24]

Data Source and Study Subjects

Using KPNC's EHR data, we identified individuals with one or more pregnancies who 1) had KPNC membership two years prior to pregnancy, 2) were screened at their first prenatal care encounter (~8–10 weeks gestation) for cannabis use via a single-item on the questionnaire (ie, *Since pregnancy, how often have you used marijuana? [never, monthly or less, weekly, daily]*) and urine toxicology (January 2011–December 2019 and January 2021–December 2021), and 3) screened positive for prenatal cannabis use, reported as the frequency of use or urine toxicology positive for those who self-reported no use and had a positive toxicology test.[22] All eligible pregnancies were included, with some individuals contributing more than one (Fig. 1). Data for 2020 were not included due to care changes early in the COVID-19 pandemic and an EHR system change that temporarily compromised data capture of self-reported substance use. During the study timeframe, 20,398 pregnancies among 17,782 individuals were positive for prenatal cannabis use. The KPNC Institutional Review Board approved this study and

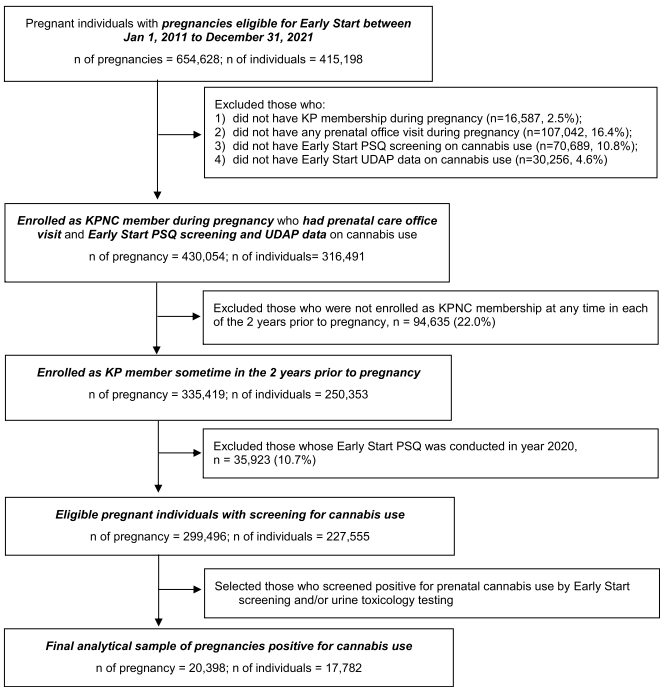

FIGURE 1. STROBE diagram of patient selection. LMP, last menstrual period; PSQ, prenatal screening questionnaire; UDAP, urine toxicology test.

waived informed consent. This study followed Strengthening the Reporting of Observational Studies in Epidemiology (STROBE reporting guidelines.[25]

Measures

Outcomes

We identified whether individuals who screened positive for prenatal cannabis use had documented completion of an ***Early Start substance use assessment*** within 6 months of their screening date. Individuals who completed the Early Start substance use assessment may have been identified as needing substance use counseling or treatment, which we identified from EHR discrete text fields: "follow-up/treatment plan," "follow up PRN," "follow at every prenatal visit," or "follow up indicated but refused." Among individuals identified as needing follow-up, we examined the ***type of intervention*** received, defined as Early Start counseling only, any AMRS treatment (which could include Early Start counseling), or neither (ie, no intervention). We did not evaluate individuals who attended AMRS only as few individuals meet criteria for AMRS.

Psychiatric Disorders and SUDs

Using ICD-9-CM and ICD-10-CM codes extracted from the EHR (eTable 1, http://links.lww.com/JAM/A557), we identified whether patients had a documented psychiatric or SUD diagnosis at an encounter from 1 year before pregnancy onset (based on date of last menstrual period) through the date of prenatal substance use screening. We created indicators for seven psychiatric disorders (attention deficit hyperactivity, anxiety, bipolar, depressive, personality, posttraumatic stress, psychotic disorders) and five SUDs (alcohol use, cannabis use, opioid use, stimulant use, and tobacco use disorders). Because burden of psychiatric disorders and SUDs is predictive of participation in substance use treatment,[26] we generated counts of psychiatric disorders and SUDs (range 0–7 and 0–5, respectively), as well as type of comorbidity (psychiatric disorders only, SUDs only, both and neither).

Sociodemographic and Clinical Characteristics

From the EHR, we extracted the following baseline information as of pregnancy onset date: age (<18, 18–24, 25–34, >34 years old), self-reported race/ethnicity (Hispanic, non-Hispanic White, Asian/Pacific Islander, Black, and other/unknown/multiracial), neighborhood deprivation index (NDI; categorized into quartiles),[27] insurance payor (Medicaid, non-Medicaid), and parity (number of births). Limited missing demographic data were coded as a separate category. Based on self-report data, we categorized frequency of prenatal cannabis use during early pregnancy as mutually exclusive categories of "none," "monthly or less," "weekly," and "daily"; a category "urine toxicology positive, frequency unknown" was created to characterize individuals who self-reported no cannabis use but had a positive toxicology test. We also calculated trimester of pregnancy at time of screening and the initial Early Start assessment/counseling.

Statistical Analysis

We described the demographic and clinical characteristics of pregnancies among pregnant individuals who screened positive for prenatal cannabis by whether they completed an Early Start substance use assessment, and among individuals identified as needing substance use intervention by type of intervention (Early Start counseling only, any AMRS, or no intervention). Associations between patient demographics and clinical characteristics, including psychiatric disorders and SUDs, and completion of the Early Start substance use assessment were examined using generalized estimating equation (GEE) logistic models, clustered to account for nonindependence of multiple pregnancies from some individuals. Analyses were conducted in two steps. First, GEE logistic regression was used to estimate associations between sociodemographic and clinical characteristics (age, race and ethnicity, NDI, insurance, parity, trimester of pregnancy, frequency of cannabis use) and completion of an Early Start substance use assessment, accounting for length of pregnancy and calendar year. Next, for each psychiatric and SUD diagnosis, GEE logistic regression was used to estimate the adjusted odds ratios (aORs) of completion of the Early Start substance use assessment, adjusting for patient sociodemographic and clinical characteristics.

Among individuals identified as needing substance use intervention, GEE multinomial logistic regression was used to examine associations between each psychiatric disorder and SUD with type of intervention, repeating the above-mentioned two steps. Similar analyses were also conducted to examine associations between counts of psychiatric disorders and SUDs, as well as type of comorbidity, with type of intervention. To characterize individuals who attend AMRS, post-hoc analyses assessed the prevalence of SUD diagnoses documented at Early Start assessment. All analyses were conducted in SAS 9.4. Two-sided P values <0.05 were considered statistically significant.

RESULTS

Among 299,496 pregnancies, 20,398 (6.8%) from 17,782 individuals were positive for prenatal cannabis use and included (Fig. 1), with 43.7% (n = 8,922) positive based on self-report and 56.3% (n = 11,476) based on urine toxicology testing. The sample was 36.8% non-Hispanic White, 27.9% Hispanic, 23.0% Black, 5.2% Asian/Pacific Islander and 7.1% other race/ethnicity, 46.4% aged 25–34, 25.9% with Medicaid insured, and 17.3% with parity ≥2 (Table 1). The most prevalent psychiatric disorders were anxiety (18.8%) and depressive (18.3%) disorders, followed by posttraumatic stress disorder (2.9%), bipolar (2.6%), attention-deficit/hyperactivity disorder (2.5%), personality (1.4%), and psychotic disorders (0.7%). The prevalence of SUD ranged from 0.9% for opioid use disorder to 13.5% for tobacco use disorder.

Patient Factors Associated With Completion of Early Start Substance Use Assessment

Among pregnant individuals with prenatal cannabis use, 16,387 (80.3%) completed an Early Start substance use assessment within 6 months of screen date, with a median of 39 days (interquartile range: 20 and 72). Being Medicaid-insured was associated with higher odds (aOR 1.17 [95% CI 1.08–1.28]), while ages 35 and older (vs 25–34; 0.72 [0.65–0.80]), greater parity (vs no prior live births; aORs 0.77 [0.70–0.84] for 1 and 0.61 [0.55–0.68] for ≥2 births), and having been screened

TABLE 1. Patient Characteristics Associated With Completion of an Early Start Substance Use Assessment (n = 20,398)*

	Assessed		Not Assessed		Early Start Assessment†	
	n	%	n	%	aOR (95% CI)	*P* Value
Age, yr						
<18	567	3.5	111	2.8	0.97 (0.78, 1.20)	0.755
18–24	6337	38.7	1412	35.2	0.96 (0.88, 1.05)	0.350
25–34	7631	46.6	1825	45.5	Ref	–
>34	1852	11.3	663	16.5	**0.72 (0.65, 0.80)**	**<0.001**
Race and ethnicity						
Asian/Pacific Islander	843	5.1	214	5.3	0.95 (0.80, 1.11)	0.497
Black	3788	23.1	904	22.5	1.04 (0.94, 1.15)	0.423
Hispanic	4554	27.8	1127	28.1	0.99 (0.90, 1.08)	0.786
White	6059	37.0	1453	36.2	Ref	–
Other	1143	7.0	313	7.8	0.89 (0.77, 1.02)	0.090
NDI quartile						
1st	1881	11.5	476	11.9	Ref	–
2nd	2961	18.1	714	17.8	1.05 (0.92, 1.20)	0.460
3rd	3915	23.9	977	24.4	1.02 (0.90, 1.16)	0.759
4th	5585	34.1	1503	37.5	0.94 (0.83, 1.06)	0.327
Missing	2045	12.5	341	8.5	**1.49 (1.27, 1.74)**	**<0.001**
Medicaid insured						
Yes	4267	26.0	1009	25.2	**1.17 (1.08, 1.28)**	**<0.001**
No	12,120	74.0	3002	74.8	Ref	–
Parity						
0	8372	51.1	1716	42.8	Ref	–
1	4497	27.4	1212	30.2	**0.77 (0.70, 0.84)**	**<0.001**
≥2	2628	16.0	897	22.4	**0.61 (0.55, 0.68)**	**<0.001**
Missing	890	5.4	186	4.6	0.99 (0.84, 1.18)	0.947
Trimester at screening						
1st	14,711	89.8	3551	88.5	Ref	–
2nd	1478	9.0	350	8.7	1.00 (0.88, 1.14)	0.987
3rd	198	1.2	110	2.7	**0.41 (0.32, 0.52)**	**<0.001**
Frequency of cannabis use						
≤Monthly	3798	23.2	895	22.3	Ref	–
Weekly	1865	11.4	391	9.8	1.11 (0.97, 1.27)	0.123
Daily	1616	9.9	357	8.9	1.07 (0.93, 1.23)	0.343
Unknown/positive urine‡	9108	55.6	2368	59.0	0.92 (0.84, 1.01)	0.065

*All patient characteristics examined in one multivariable GEE logistic model.

†Early start assessment measured 2 weeks before to 6 months after screening date

‡Includes individuals who had a urine toxicology screen positive for cannabis use and reported no prenatal cannabis use on the questionnaire.

aOR indicates adjusted odds ratio; NDI, neighborhood deprivation index.

in the third trimester (vs first; aOR 0.41 [0.32–0.52]) were associated with lower odds of completing an Early Start substance use assessment (*P* values <0.001; Table 1). No significant differences were found by race/ethnicity, frequency of cannabis use, or use identified by urine toxicology.

Individuals with prenatal cannabis use and past-year history of anxiety and depressive disorders (vs without) had greater odds of completing an Early Start assessment (aORs 1.12 [1.01–1.24] and 1.13 [1.02–1.25], respectively; Table 2); those with tobacco use disorders also had higher odds of completing an Early Start assessment than those without (aOR 1.13 [1.00–1.27]). No other significant associations were found between the other psychiatric disorders and SUDs and completion an Early Start assessment

Patient Factors Associated With Early Start Counseling or AMRS Treatment

Out of the 16,387 pregnancies with complete Early Start substance use assessment, 10,469 (63.9%) had indication of needing further substance use intervention. Among them, 9179 (87.7%) attended Early Start counseling and/or AMRS treatment: 9069 (86.6%) attended Early Start counseling only, 110 (1.1%) attended AMRS treatment (with a majority [96.4%] also having at least one Early Start counseling visit), and 1290 (12.3%) had neither Early Start counseling nor AMRS treatment. Among individuals who attended AMRS, 85% (93 of 110) had an SUD diagnosis documented at the time of assessment.

Among individuals with prenatal cannabis use identified as needing intervention, those with Medicaid insurance compared to other insurance (aOR 1.30 [1.12–1.51]) and those with missing parity compared to no prior birth (aOR 1.40 [1.03–1.91]) had higher odds of Early Start counseling (Table 3). Completion of the substance use assessment in the 2nd or 3rd trimester (aORs 0.57 [0.49–0.66] and 0.16 [0.13–0.19], respectively), compared to first, and at least one prior birth compared to none (aOR 0.83 [0.71–0.97]) was associated with lower odds of Early Start counseling. Completion of the substance use assessment in the 2nd or 3rd trimester (aORs 0.42 [0.27–0.64] and 0.10 [0.04–0.25], respectively), compared to first, was also associated with lower odd of AMRS treatment. Compared to White, individuals with Asian/Pacific Islander or Black racial/ethnic background had lower odds of AMRS treatment (aORs 0.13

TABLE 2. Patient Psychiatric and SUD Diagnoses Associated With Completion of an Early Start Substance Use Assessment (N = 20,398)*

	Assessed		Not Assessed		Early Start Assessment†	
	n	%	n	%	aOR (95% CI)	*P* Value
Psychiatric diagnosis, yes vs no						
ADHD	433	2.6	82	2.0	1.28 (0.99, 1.66)	0.056
Anxiety disorder	3,069	18.7	775	19.3	**1.12 (1.01, 1.24)**	**0.029**
Bipolar disorder	430	2.6	105	2.6	1.17 (0.93, 1.49)	0.186
Depressive disorder	3,016	18.4	719	17.9	**1.13 (1.02, 1.25)**	**0.023**
Personality disorder	229	1.4	57	1.4	1.22 (0.87, 1.70)	0.256
PTSD	480	2.9	112	2.8	1.25 (0.99, 1.59)	0.063
Psychotic disorder	100	0.6	32	0.8	0.91 (0.59, 1.41)	0.669
SUD diagnosis, yes vs no						
Alcohol use disorder	376	2.3	78	1.9	1.24 (0.93, 1.65)	0.136
Cannabis use disorder	1,139	7.0	289	7.2	1.03 (0.88, 1.20)	0.734
Opioid use disorder	146	0.9	29	0.7	1.34 (0.86, 2.10)	0.198
Stimulant use disorder	210	1.3	53	1.3	1.24 (0.87, 1.75)	0.232
Tobacco use disorder	2,255	13.8	496	12.4	**1.13 (1.00, 1.27)**	**0.049**

*Each psychiatric and SUD diagnosis examined in a separate multivariable GEE logistic model adjusted for age, self-reported race/ethnicity, neighborhood deprivation index, insurance payor, parity, length of pregnancy, calendar year, trimester at screening, and frequency of cannabis use.

†Early start assessment measured 2 weeks before to 6 months after screening date.

ADHD indicates attention-deficit/hyperactivity disorder; aOR, adjusted odds ratio; PTSD, posttraumatic stress disorder; SUD, substance use disorder.

[0.02–0.99] and 0.56 [0.32–1.00], respectively). Compared to individuals who self-reported monthly or less use, those with positive urine toxicology test but no reported cannabis use also had lower odds of AMRS treatment (aOR 0.38 [0.22–0.64]).

For each psychiatric disorder and SUD examined, no significant differences in odds of Early Start counseling were found between those with and without the condition (Table 4). For all psychiatric disorders, except personality or psychotic disorders, individuals with a diagnosis had at least two times the odds of having AMRS treatment compared to those without the condition. Pregnant individuals with any SUD diagnosis had greater odds of having any AMRS treatment compared to those without, with adjusted ORs (95% CIs) ranging from 4.3 (2.6–7.1) for cannabis use disorder to 70.6 (21.6–231.2) for opioid use disorder.

Compared to those with none of the seven psychiatric disorders, pregnant individuals with two or more had two times the odds of AMRS treatment (aOR 2.15 [1.27–3.62]) rather than no intervention (eTable 2, http://links.lww.com/JAM/A557). Compared to those with none of the five SUDs, those with one disorder had two times the odds (aOR 2.21 [1.26–3.88]), and those with two or more had 10 times the odds (aOR 10.60 [5.84–19.22]) of having AMRS treatment rather than no intervention. Lastly, compared to those with neither psychiatric disorders or SUDs, those with only psychiatric disorders had two times the odds, those with only SUDs had four times the odds, and those with both types of disorders had almost eight times the odds of AMRS treatment rather than no intervention.

DISCUSSION

In this large, population-based study of pregnant individuals who screened positive for prenatal cannabis use, based on substance use screening offered as part of a universal, comprehensive prenatal substance use program within obstetrics and gynecology departments, 80% of individuals completed a substance use assessment. Moreover, among those identified as needing counseling or treatment, 88% had at least one follow-up visit, primarily to Early Start counseling. Individuals with anxiety, depression or tobacco use disorders, and Medicaid insurance were more likely to complete the substance use assessment, whereas individuals 35 years and older, those who screened positive for prenatal cannabis use later in pregnancy, and those with children had lower odds of completing the assessment, consistent with prior research among individuals with prenatal substance use.[4] While no psychiatric or SUD diagnosis was predictive of attending Early Start counseling, nearly all were associated with higher odds of attending AMRS treatment, with greater number of comorbid of psychiatric disorders and/or SUDs associated with increasing odds of AMRS treatment.

The results found here highlight the considerable success of a population-based prenatal substance use program embedded in obstetrics and gynecology settings to engage pregnant individuals who use cannabis in substance use assessment and counseling. Greater than 80% of individuals were engaged at each step in the program, from receipt of assessment to attending substance use counseling or treatment. Most, even those with prenatal cannabis use identified through urine toxicology testing, attended a substance use assessment. When recommended, 88% followed through with at least one Early Start counseling or AMRS visit. Success of the Early Start program in engaging pregnant individuals with cannabis use can be attributed to universal substance use screening for all pregnancies, which reduces screening bias, and the program's offer of unbiased access to substance use education, assessment, and counseling, especially early in pregnancy. Moreover, as a program fully integrated within prenatal care, Early Start reduces stigma and structural barriers to assessment and counseling. The small proportion of individuals with prenatal cannabis use who attended AMRS (and Early Start, in most cases) had a higher prevalence of most psychiatric disorders and SUDs as well as comorbid psychiatric or SUD diagnoses, underscoring the importance of specialized treatment programs, including detoxification, residential or rehabilitative facilities, and intensive

TABLE 3. Patient Characteristics Associated with Substance Use Counseling (Early Start) or Treatment (AMRS) Among Those Identified as Needing Substance Use Counseling or Treatment (n = 10,469)*

	Early Start Counseling (Only)		AMRS†		No Intervention		Early Start Counseling vs No Intervention		AMRS† vs No Intervention	
	n	%	n	%	n	%	aOR (95% CI)	*P* Value	aOR (95% CI)	*P* Value
Age, yr										
<18	326	3.6	3	2.7	37	2.9	1.12 (0.77, 1.62)	0.567	0.91 (0.26, 3.20)	0.881
18–24	3632	40.1	42	38.2	493	38.2	1.00 (0.86, 1.16)	0.998	0.99 (0.61, 1.59)	0.966
25–34	4141	45.7	52	47.3	584	45.3	Ref	–	Ref	–
>34	970	10.7	13	11.8	176	13.6	0.86 (0.71, 1.06)	0.152	0.84 (0.43, 1.62)	0.598
Race and ethnicity										
Asian/Pacific Islander	423	4.7	1	0.9	65	5.0	1.00 (0.74, 1.34)	0.998	**0.13 (0.02, 0.99)**	**0.049**
Black	2286	25.2	22	20.0	352	27.3	0.96 (0.80, 1.14)	0.609	**0.56 (0.32, 1.00)**	**0.049**
Hispanic	2486	27.4	25	22.7	360	27.9	0.99 (0.84, 1.18)	0.926	0.65 (0.38, 1.10)	0.108
White	3201	35.3	54	49.1	428	33.2	Ref	–	Ref	–
Other	673	7.4	8	7.3	85	6.6	1.07 (0.82, 1.40)	0.608	0.80 (0.35, 1.82)	0.597
NDI quartile										
1st	956	10.5	19	17.3	153	11.9	Ref	–	Ref	–
2nd	1523	16.8	18	16.4	223	17.3	1.07 (0.84, 1.37)	0.585	0.67 (0.33, 1.35)	0.263
3rd	2142	23.6	26	23.6	318	24.7	1.11 (0.89, 1.40)	0.355	0.73 (0.37, 1.42)	0.353
4th	3251	35.9	35	31.8	479	37.1	1.14 (0.91, 1.43)	0.263	0.73 (0.38, 1.41)	0.344
Missing	1197	13.2	12	10.9	117	9.1	1.45 (0.78, 2.68)	0.242	0.77 (0.13, 4.64)	0.774
Medicaid insured										
Yes	2549	28.1	25	22.7	342	26.5	**1.30 (1.12, 1.51)**	**0.001**	1.05 (0.62, 1.77)	0.869
No	6520	71.9	85	77.3	948	73.5	Ref	–	Ref	–
Parity										
0	4609	50.8	60	54.6	571	44.3	Ref	–	Ref	–
1	2460	27.1	28	25.5	409	31.7	**0.83 (0.71, 0.97)**	**0.018**	0.83 (0.51, 1.35)	0.459
≥2	1461	16.1	18	16.4	256	19.8	0.83 (0.69, 1.01)	0.069	0.96 (0.50, 1.85)	0.897
Missing	539	5.9	4	3.6	54	4.2	**1.40 (1.03, 1.91)**	**0.032**	0.76 (0.26, 2.21)	0.620
Trimester at ES assessment										
1st	4249	46.9	63	57.3	455	35.3	Ref	–	Ref	–
2nd	4136	45.6	41	37.3	551	42.7	**0.57 (0.49, 0.66)**	**<0.001**	**0.42 (0.27, 0.64)**	**<0.001**
3rd	684	7.5	6	5.5	284	22.0	**0.16 (0.13, 0.19)**	**<0.001**	**0.10 (0.04, 0.25)**	**<0.001**
Frequency of cannabis use										
≤ Monthly	1757	19.4	27	24.6	232	18.0	Ref	–	Ref	–
Weekly	1039	11.5	19	17.3	143	11.1	0.91 (0.72, 1.15)	0.424	1.04 (0.55, 1.97)	0.905
Daily	938	10.3	26	23.6	119	9.2	1.02 (0.79, 1.31)	0.892	1.77 (0.98, 3.19)	0.060
Unknown/positive urine‡	5335	58.8	38	34.6	796	61.7	0.85 (0.72, 1.01)	0.061	**0.38 (0.22, 0.64)**	**<0.001**

*All patient characteristics examined in one multivariable GEE multinomial logistic model.

†AMRS can also include Early Start counseling.

‡Includes individuals who had a urine toxicology screen positive for cannabis use and reported no prenatal cannabis use on the questionnaire

aOR indicates adjusted odds ratio; NDI, neighborhood deprivation index.

outpatient programs, in serving patients with more complex SUDs.[28,29] Overall, findings highlight the capacity of the Early Start program to address the majority of counseling or treatment needs of pregnant individuals with prenatal cannabis use.

Results also point to opportunities to improve linkage to Early Start substance use assessment and counseling. More than 4000 pregnant individuals identified with prenatal cannabis use over 10 years did not attend an assessment appointment. If they had engaged in assessment, upward of 2400 (60%), based on results here, may have been recommended for additional substance use counseling or treatment. Older individuals, those identified later in pregnancy (due to later engagement in prenatal care) and those with children were least likely to be assessed, consistent with previous findings among individuals with prenatal substance use.[4] Moreover, individuals identified through urine toxicology testing, from Asian/Pacific Islander or Black racial/ethnic backgrounds, assessed later in pregnancy, or who had children were also least likely to attend counseling or treatment. Racial/ethnic inequities in prenatal SUD treatment likely underscore the need to address cultural and systemic barriers to treatment,[30–32] while individuals who do not wish to report prenatal cannabis use may be less likely to attend treatment. Early Start screening is offered at entrance to prenatal care, suggesting that individuals who enter prenatal care later in pregnancy and those with children likely face other barriers (eg, lack of childcare, financial hardship, stigma, fear of impact on parental rights and custody).[17] Efforts to engage these individuals may include providing childcare or flexible visit options. Despite California's efforts to eliminate substance use-related consequences for pregnant individuals, public health messaging and preconception education may be warranted to reduce stigma and fear of consequences related to prenatal cannabis use and encourage early engagement with prenatal care.

Beyond integrated prenatal substance use programs, like Early Start, prenatal cannabis use prevention and treatment programs are limited.[28,33] Outside of KPNC, nearly half of individuals with prenatal substance use do not receive appropriate care (ie, counseling, specialized inpatient or outpatient treatment)

TABLE 4. Patient Psychiatric and SUD Diagnoses Associated with Substance Use Counseling (Early Start) or Treatment (AMRS) Among Those Identified as Needing Substance Use Counseling or Treatment (n = 10,469)*

	Early Start Counseling (Only)		AMRS†		No Intervention		Early Start Counseling vs No Intervention		AMRS† vs No Intervention	
	n	%	n	%	n	%	aOR (95% CI)	*P* Value	aOR (95% CI)	*P* Value
Psychiatric diagnosis, yes vs no										
ADHD	229	2.5	9	8.2	31	2.4	0.96 (0.66, 1.42)	0.854	**2.98 (1.39, 6.42)**	**0.005**
Anxiety disorder	1643	18.1	40	36.4	244	18.9	1.05 (0.89, 1.23)	0.559	**2.42 (1.58, 3.70)**	**<0.001**
Bipolar disorder	210	2.3	13	11.8	33	2.6	0.83 (0.56, 1.22)	0.344	**4.10 (2.04, 8.27)**	**<0.001**
Depressive disorder	1679	18.5	44	40.0	226	17.5	1.16 (0.98, 1.36)	0.083	**3.06 (2.02, 4.64)**	**<0.001**
Personality disorder	111	1.2	3	2.7	16	1.2	1.01 (0.57, 1.76)	0.985	1.82 (0.49, 6.77)	0.370
PTSD	238	2.6	12	10.9	40	3.1	0.91 (0.63, 1.32)	0.631	**3.84 (1.89, 7.77)**	**<0.001**
Psychotic disorder	50	0.6	1	0.9	10	0.8	0.78 (0.40, 1.54)	0.477	1.20 (0.16, 9.22)	0.859
SUD diagnosis, yes vs no										
Alcohol use disorder	200	2.2	17	15.5	25	1.9	0.98 (0.63, 1.51)	0.910	**7.06 (3.60, 13.86)**	**<0.001**
Cannabis use disorder	607	6.7	28	25.5	95	7.4	0.98 (0.77, 1.25)	0.887	**4.28 (2.58, 7.10)**	**<0.001**
Opioid use disorder	66	0.7	19	17.3	4	0.3	2.75 (0.96, 7.92)	0.061	**70.64 (21.58, 231.17)**	**<0.001**
Stimulant use disorder	103	1.1	14	12.7	15	1.2	1.16 (0.65, 2.08)	0.617	**13.71 (6.21, 30.27)**	**<0.001**
Tobacco use disorder	1261	13.9	43	39.1	157	12.2	1.18 (0.97, 1.43)	0.093	**4.38 (2.86, 6.70)**	**<0.001**

*Each psychiatric and SUD diagnosis examined in a separate multivariable GEE multinomial logistic model adjusted for age, self-reported race/ethnicity, neighborhood deprivation index, insurance payor, parity, length of pregnancy, calendar year, trimester at ES assessment, and frequency of cannabis use.

†AMRS can also include Early Start counseling.

AMRS indicates Addiction Medicine and Recovery Services; ADHD, attention-deficit/hyperactivity disorder; PTSD, posttraumatic stress disorder; SUD, substance use disorder.

during pregnancy.[34] For the small percent of pregnant individuals who do engage, the proportion identifying cannabis use as a reason for treatment has increased significantly in recent years,[28] with medical cannabis laws associated with a 33% increase in substance use treatment for pregnant individuals.[35] Ultimately, less than a third of pregnant individuals who engage complete treatment as recommended.[33] However, successful engagement in substance use counseling or treatment for prenatal cannabis use has important implications for prenatal outcomes. In another study of this Early Start population, prenatal cannabis use was found to be associated with adverse neonatal outcomes.[14] Although research demonstrating program effectiveness is needed, improving the reach of Early Start screening, assessment, and counseling for prenatal cannabis use could lead to reductions in maternal morbidity and negative birth outcomes, including preterm labor, placental abruption and stillbirth.[19,20,36,37]

Strengths and Limitations

This study took place within a large, integrated health care system in California, where prenatal substance use and infant exposure (without other safety concerns) are not mandated for reporting, and findings may not generalize to patients without insurance or to those outside of California. Even in a state without mandated reporting of prenatal cannabis use, the sensitivity of self-reported use is low and a majority of individuals with prenatal cannabis use were identified by toxicology testing.[22] Although a combination of self-report and urine toxicology testing is optimal for identifying prenatal cannabis use,[22] routine toxicology testing is not recommended in states (~20) with mandated reporting or in settings that penalize perinatal substance use.[24,38] Prenatal cannabis use is often a continuation of use prior to pregnancy and our study was unable to determine whether cannabis use initiation came before or after development of psychiatric or SUDs. Moreover, the duration that cannabis is detectable in urine after last use varies depending on heaviness of use and may not represent use during pregnancy. This study is limited to EHR data and could not capture other patient factors that may contribute to participation in Early Start or whether individuals sought out care outside of KPNC. This study included 1 year of data post-COVID-19, which may not fully reflect current state of health care following unprecedented COVID-era changes. Study strengths include a large sample size of pregnant individuals identified with prenatal cannabis use, based on universal self-reported and toxicology screening as part of a comprehensive prenatal substance use program.

CONCLUSIONS

Among pregnant individuals with prenatal cannabis use, a comprehensive prenatal care substance use program that offers universal substance use screening, assessment and counseling, engaged most pregnant individuals in need of substance use assessment and intervention. However, opportunities to improve gaps in care remain.

REFERENCES

1. Alshaarawy O, Anthony JC. Cannabis use among women of reproductive age in the United States: 2002–2017. *Addict Behav*. 2019;99:106082.
2. Havens JR, Simmons LA, Shannon LM, et al. Factors associated with substance use during pregnancy: Results from a national sample. *Drug Alcohol Depend*. 2009;99(1–3):89–95.
3. Board A, D'Angelo DV, von Essen BS, et al. Polysubstance use during pregnancy: The importance of screening, patient education, and integrating a harm reduction perspective. *Drug Alcohol Depend*. 2023;247:109872.
4. Young-Wolff KC, Tucker L-Y, Armstrong MA, et al. Correlates of pregnant women's participation in a substance use assessment and counseling intervention integrated into prenatal care. *Matern Child Health J*. 2020;24:423–431.
5. Young-Wolff KC, Tucker L-Y, Alexeeff S, et al. Trends in self-reported and biochemically tested marijuana use among pregnant females in California from 2009-2016. *JAMA*. 2017;318(24):2490–2491.
6. Paul SE, Hatoum AS, Fine JD, et al. Associations between prenatal cannabis exposure and childhood outcomes: Results from the ABCD study. *JAMA Psychiatry*. 2021;78(1):64–76.

7. Committee Opinion No. 722: Marijuana use during pregnancy and lactation. *Obstet Gynecol*. 2017;130(4):931–932.
8. Metz TD, Allshouse AA, Hogue CJ, et al. Maternal marijuana use, adverse pregnancy outcomes, and neonatal morbidity. *Am J Obstet Gynecol*. 2017; 217(4):478.e1–478.e8.
9. National Academies of Sciences, Engineering, and Medicine. *The Health Effects of Cannabis and Cannabinoids. The Current State of Evidence and Recommendations for Research [Internet]*. Washington, DC: National Academies Press, 2017: https://nap.nationalacademies.org/catalog/24625/the-health-effects-of-cannabis-and-cannabinoids-the-current-state.
10. Ryan SA, Ammerman SD, O'Connor ME, Committee on Substance Use and Prevention, Section on Breastfeeding. Marijuana use during pregnancy and breastfeeding: Implications for neonatal and childhood outcomes. *Pediatrics*. 2018;142(3):e20181889.
11. Sharapova SR, Phillips E, Sirocco K, et al. Effects of prenatal marijuana exposure on neuropsychological outcomes in children aged 1-11 years: A systematic review. *Paediatr Perinat Epidemiol*. 2018;32(6):512–532.
12. Marchand G, Masoud AT, Govindan M, et al. Birth outcomes of neonates exposed to marijuana in utero: A systematic review and meta-analysis. *JAMA Netw Open*. 2022;5(1):e2145653.
13. El Marroun H, Tiemeier H, Franken IHA, et al. Prenatal cannabis and tobacco exposure in relation to brain morphology: A prospective neuroimaging study in young children. *Biol Psychiatry*. 2016;79(12):971–979.
14. Avalos LA, Adams SR, Alexeeff SE, et al. Neonatal outcomes associated with in utero cannabis exposure: A population-based retrospective cohort study. *Am J Obstet Gynecol*. 2024;231(1):132.e1–132.e13.
15. Prevention CfDCa. 2021 *Youth Risk Behavior Survey data*. 2021. Accessed Feb 18, 2023. https://www.cdc.gov/healthyyouth/data/yrbs/yrbs_data_summary_and_trends.htm. Accessed March, 29, 2024
16. Committee Opinion No. 722: Marijuana use during pregnancy and lactation. *Obstet Gynecol*. 2017;130(4):e205–e209.
17. Choi S, Rosenbloom D, Stein MD, et al. Differential gateways, facilitators, and barriers to substance use disorder treatment for pregnant women and mothers: A scoping systematic review. *J Addict Med*. 2022;16(3):e185–e196.
18. Armstrong MA, Lieberman L, Carpenter DM, et al. Early Start: An obstetric clinic-based, perinatal substance abuse intervention program. *Qual Manag Health Care*. 2001;9(2):6–15.
19. Armstrong MA, Gonzales Osejo V, Lieberman L, et al. Perinatal substance abuse intervention in obstetric clinics decreases adverse neonatal outcomes. *J Perinatol*. 2003;23(1):3–9.
20. Goler NC, Armstrong MA, Taillac CJ, et al. Substance abuse treatment linked with prenatal visits improves perinatal outcomes: A new standard. *J Perinatol*. 2008;28(9):597–603.
21. Young-Wolff KC, Chi FW, Campbell CI, et al. Association of psychiatric and substance use disorders with cannabis use and cannabis use disorders during early pregnancy in northern California. *Addiction* 2024;119(11): 1987–1997.
22. Young-Wolff KC, Sarovar V, Tucker L-Y, et al. Validity of self-reported cannabis use among pregnant females in Northern California. *J Addict Med*. 2020;14(4):287–292.
23. Sherman BJ, McRae-Clark AL. Treatment of cannabis use disorder: Current science and future outlook. *Pharmacotherapy*. 2016;36(5):511–535.
24. Jarlenski M, Hogan C, Bogen DL, et al. Characterization of U.S. state laws requiring health care provider reporting of perinatal substance use. *Womens Health Issues*. 2017;27(3):264–270.
25. Vandenbroucke JP, von Elm E, Altman DG, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and elaboration. *Ann Intern Med*. 2007;147(8):W163–W194.
26. Kotelchuck M, Cheng ER, Belanoff C, et al. The prevalence and impact of substance use disorder and treatment on maternal obstetric experiences and birth outcomes among singleton deliveries in Massachusetts. *Matern Child Health J*. 2017;21(4):893–902.
27. Messer LC, Laraia BA, Kaufman JS, et al. The development of a standardized neighborhood deprivation index. *J Urban Health*. 2006;83: 1041–1062.
28. Washio Y, Mark K, Terplan M. Characteristics of pregnant women reporting cannabis use disorder at substance use treatment entry. *J Addict Med*. 2018; 12(5):395–400.
29. Brown QL, Shmulewitz D, Sarvet AL, et al. Cannabis use, cannabis use disorder and mental health disorders among pregnant and postpartum women in the US: A nationally representative study. *Drug Alcohol Depend*. 2023; 248:109940.
30. Jordan A, Quainoo S, Nich C, et al. Racial and ethnic differences in alcohol, cannabis, and illicit substance use treatment: A systematic review and narrative synthesis of studies done in the USA. *Lancet Psychiatry*. 2022;9(8): 660–675.
31. Salameh TN, Hall LA, Crawford TN, et al. Racial/ethnic differences in mental health treatment among a national sample of pregnant women with mental health and/or substance use disorders in the United States. *J Psychosom Res*. 2019;121:74–80.
32. Suntai Z. Substance use among women who are pregnant: Examining treatment completion by race and ethnicity. *J Subst Abuse Treat*. 2021;131: 108437.
33. Kitsantas P, Gimm G, Aljoudi SM. Treatment outcomes among pregnant women with cannabis use disorder. *Addict Behav*. 2023;144:107723.
34. Wolfe EL, Guydish JR, Santos A, et al. Drug treatment utilization before, during and after pregnancy. *J Subst Use*. 2007;12(1):27–38.
35. Meinhofer A, Witman A, Murphy SM, et al. Medical marijuana laws are associated with increases in substance use treatment admissions by pregnant women. *Addiction*. 2019;114(9):1593–1601.
36. Taillac C, Goler N, Armstrong MA, et al. Early start: An integrated model of substance abuse intervention for pregnant women. *Perm J*. 2007;11(3):5–11.
37. Gabrhelík R, Mahic M, Lund IO, et al. Cannabis use during pregnancy and risk of adverse birth outcomes: A longitudinal cohort study. *Eur Addict Res*. 2021;27(2):131–141.
38. The American College of Obstetricians and Gynecologists. Policy Priorities: Substance Use Disorder in Pregnancy. Accessed May 17, 2024: https://www.acog.org/advocacy/policy-priorities/substance-use-disorder-in-pregnancy; 2024.