

A Cohort Comparison of Differences Between Regional and Buncombe County Patients of a Comprehensive Perinatal Substance Use Disorders Program in Western North Carolina

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BACKGROUND Pregnant patients from rural counties of Western North Carolina face additional barriers when accessing comprehensive perinatal substance use disorders care at Project CARA as compared to patients local to the program in Buncombe County. We hypothesized regional patients would be less engaged in care.

METHOD Using a retrospective cohort design, univariate analyses (χ^2 , t-test; $P < .05$) compared patients' characteristics, engagement in care, and delivery outcomes. Engagement in care, the primary outcome, was operationalized as: attendance at expected, program-specific prenatal and postpartum visits, utilization of in-house counseling, community-based and/or inpatient substance use disorders treatment, and maternal urine drug screen at delivery negative for illicit substances.

RESULTS Regional patients ($n = 324$) were more likely than Buncombe County patients ($n = 284$) to have opioid [209 (64.5%) versus 162 (57.0%)] or amphetamine/methamphetamine use disorders (25 [7.7%] versus 13 [4.6%]), but less likely to have cannabis use (19 [5.9%] versus 38 [13.4%]; $P = .009$) and concurrent psychiatric disorders (214 [66.0%] versus 220 [77.5%]; $P = .002$). Engagement at postpartum visits was the significantly different outcome between patients (110/221 [49.8%] versus 146/226 [64.6%]; $P = .002$).

LIMITATIONS Outcomes were available for 66.8% of regional and 79.6% of Buncombe County patients of one program in one predominately white, non-Hispanic region of the state.

CONCLUSION Contrary to our hypothesis, regional and Buncombe County women engaged in prenatal care equally. However, a more formal transition into the postpartum period is needed, especially for regional women. A "hub-and-spokes" model that extends delivery of perinatal substance use disorders care into rural communities may be more effective for engagement retention.

Substance use, substance misuse, and diagnosed disorders in pregnancy in the United States continue to be major public health concerns associated with significant risk for mothers and infants [1]. According to the 2017 National Survey on Drug Use and Health (NSDUH), 5% of women had diagnosed substance use disorders in the past year [2]. Among women of primary childbearing age, 18 to 25 years, the proportion was 12% [2]. Among pregnant women, the proportion of self-reported substance use in the past month increased from 2015 to 2017 by almost one-third, peaking at 16.6% [2, 3]. This increase in perinatal substance use disorders (PSUD) is particularly concerning as the majority of women do not obtain treatment during pregnancy [2]. Perinatal substance misuse increases risks of inadequate prenatal care, birth defects, poor fetal growth, stillbirth, preterm delivery, neonatal abstinence syndrome, relapse in the postpartum period, substantial parenting challenges, and involvement with child protective services [4-8].

All major medical associations recommend comprehensive perinatal substance use treatment for PSUD. This care includes maternity care, substance misuse treatment, medication for the treatment of opioid use disorders (OUD) as needed, behavioral health services, and coordinated care with linkage to community-based recovery and social sup-

port services. Ideally, such comprehensive services are integrated, multidisciplinary, trauma informed, and based on the principles of harm reduction [5, 9-13]. Comprehensive service models include "one-stop shops," offering all services in-house or collaborative care partnerships with closely coordinated agencies and providers [5].

The proportions of US women self-reporting substance use disorders in the past year are similar in rural and urban areas [2]. The data from treatment research is equivocal when comparing rural to urban utilization rates [14-17]. Obtaining comprehensive PSUD treatment in more rural areas can be quite difficult as services are scarce. The services that exist in regional, urban-based settings are often difficult to access and can be piecemeal [18-20]. Barriers to delivering and receiving comprehensive PSUD services are multiplex. In rural communities, providers often lack appropriate training, resources, and specialty backup sup-

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port needed to deliver or coordinate all necessary components of safe, high-quality, comprehensive care [21-24]. Furthermore, women accessing comprehensive PSUD care are often high utilizers of services [1]. Thus, significant expenses may be incurred when trying to start and run a comprehensive program [25]. Rural women seeking access to these services face their own barriers. Residing in isolated geographic landscapes can make travel distances to regionally based comprehensive programs quite long [26-28]. Transportation and child care can pose substantial barriers, too [15, 20]. Additionally, women's perceived acceptability of treatment for PSUD can be limited by their fears of stigma and potential involvement with child protective services, and establishing trusting relationships with providers is also fraught with fear [1]. These fears can be intensified in small, rural, close-knit communities [18, 29].

Western North Carolina (WNC) is the mostly rural region of the 18 westernmost counties of the state. Statistics are not available regarding the prevalence of PSUD and the proportion of women obtaining treatment in WNC. However, if we assume that the 2017 national prevalence of pregnant women reporting substance use in the past month is the same for WNC, then 16.6% of the 8,908 regional births may have involved perinatal substance use. Thus, as many as 1,479 infants in WNC may have been exposed in utero to substances in one year [2, 30].

Following the North Carolina mental health reform efforts of the early 2000s, WNC did not sustain a comprehensive PSUD model of care in the region [31]. Privatized and capitated, PSUD care became fragmented. Obstetrics and substance use disorders providers offered only their specialty-specific care. Case management was limited to patients with the highest need and/or the highest service utilizers. Most providers and patients struggled to coordinate care across widely dispersed community agencies with vastly different missions and capacities. However, as the opioid epidemic intensified and the rate of neonatal abstinence syndrome increased 500% in WNC counties [32], a regional, hospital-based OUD collaborative was developed. In 2012, the providers at the regional high-risk maternity care clinic joined the collaborative with the five-year objective of developing a regional, comprehensive PSUD program that was based on the collaborative care model.

The program, Project CARA: Care that Advocates Respect/Resilience/Recovery for All, delivers patient-centered consultative and full-spectrum PSUD care [33]. Consultative care involves referral by a regional maternity care provider seeking guidance; one to two patient visits; and the development of a patient-centered PSUD care plan for women who are stable in their recovery process. Many patients need more intensive, specialized PSUD care and are recommended to transfer their care full time to Project CARA. Other patients self-select care preferentially with Project CARA. Project CARA provides care coordination and warm handoffs to inpatient and community-based sub-

stance use disorders services, PSUD delivery preparedness education, child protective services prevention, social services, and legal aid. By 2018, pregnant women came from 20 western counties to access these PSUD services, with some patients traveling up to three hours.

While the program has provided access to PSUD care to women from WNC, Project CARA providers recognized the barriers many regional women continue to face. Our research sought to better understand the differences between Buncombe County patients—those residing in the same county as Project CARA—and regional patients—those residing in other WNC counties. Specifically, we examined differences in sociodemographics, pregnancy characteristics, substance use disorders and psychiatric diagnoses and their treatments, utilization of antenatal PSUD services, and outcomes at delivery. We hypothesized that patients from the outlying region would be less engaged in PSUD care than Buncombe County patients.

Methods

This project was a secondary analysis of data in our PSUD program database that contains maternal inpatient and outpatient, as well as infant inpatient medical record data for program patients from 2014 to present. The Mission Hospital Institutional Review Board (IRB) approved the development and use of the database for evaluation and research purposes.

For this project, we included all program patients residing in WNC with deliveries occurring in calendar years 2014-2017. Data utilized included: patients' county of residence, sociodemographic and pregnancy characteristics, substance use and other psychiatric diagnoses and treatments, utilization of the comprehensive PSUD services, and delivery outcomes.

County of residence was coded into one of two categories for comparison purposes. Patients residing in the same county as the program were referred to as "Buncombe County patients," and those residing in other WNC counties were "regional patients."

Sociodemographic and pregnancy characteristics included maternal age at delivery, self-reported race/ethnicity, insurance, and parity. Race/ethnicity was dichotomized into "white non-Hispanic women" and "women of color" to protect the anonymity of the few women of color in the program and region. Insurance was dichotomized as private or public (Medicaid/Medicare).

Concurrent PSUD and other psychiatric diagnoses and pharmacotherapy included: prevalence of diagnoses, use of medication for treatment of opioid use disorders, use of psychopharmacotherapy for other psychiatric disorders, and rates of substance use during pregnancy (self-reported and/or results of prenatal urine drug screening) including opioids, cannabis, and tobacco.

Comprehensive PSUD care utilization included: gestational age at initiation of PSUD care, number of prenatal

visits, attendance at a postpartum visit, and utilization of in-house PSUD counseling services or other community-based and/or inpatient substance use treatment.

Primary and Secondary Outcomes

Our primary outcome was engagement in comprehensive PSUD care. We operationalized engagement with five indices: (1) Attendance at the expected number of antenatal visits (yes/no). The number of expected visits was based on the American College of Obstetricians and Gynecologists (ACOG) prenatal guidelines given the patient's gestational ages at PSUDs care initiation and delivery (one visit monthly for 28 weeks, twice a month until 36 weeks, then weekly until delivery) [34]. An actual number of prenatal visits equal to or greater than the expected number of visits was coded as "yes." Conversely, expected attendance was coded "no." (2) Participation in PSUD postpartum appointments (≥ 1 visits 4-8 weeks after delivery = yes; none = no). (3) Participation in in-house PSUDs counseling (≥ 1 visits = yes; 0 = no). (4) Participation in community-based and/or inpatient substance use disorders treatment (≥ 1 visits = yes; 0 = no). (5) Maternal urine drug screening (UDS) negative for illicit substances at delivery (yes/no). Results of maternal UDS were compared to prescribed medications as indicated in the inpatient record. Only the presence of non-prescribed substances screened positive was coded "positive UDS." The presence of prescribed medications indicated adherence to the PSUD care plan and was coded "negative UDS."

These indices were chosen to reflect that engagement in PSUD care as participation and retention in both perinatal care and substance use treatment and reduction of expo-

sure to addictive substances are associated with better outcomes for mothers and babies [5, 9-13, 34, 35].

Secondary outcomes included delivery at our local tertiary care hospital versus a different hospital, and for women delivering locally: results of UDS at delivery, rates of preterm delivery (< 37 weeks gestation), low birth weight (< 2500 grams), and breastfeeding at discharge from the hospital.

Data Analyses

Dichotomous variables were compared between Buncombe County versus regional patients using χ^2 analysis and are presented: frequency (percent). Continuous variables were compared using a t-test and are presented: means \pm SD. An *a priori* power analysis was not conducted as we used all eligible cases during the study time period. Analyses were conducted with SPSS v24 with $P < .05$.

Results

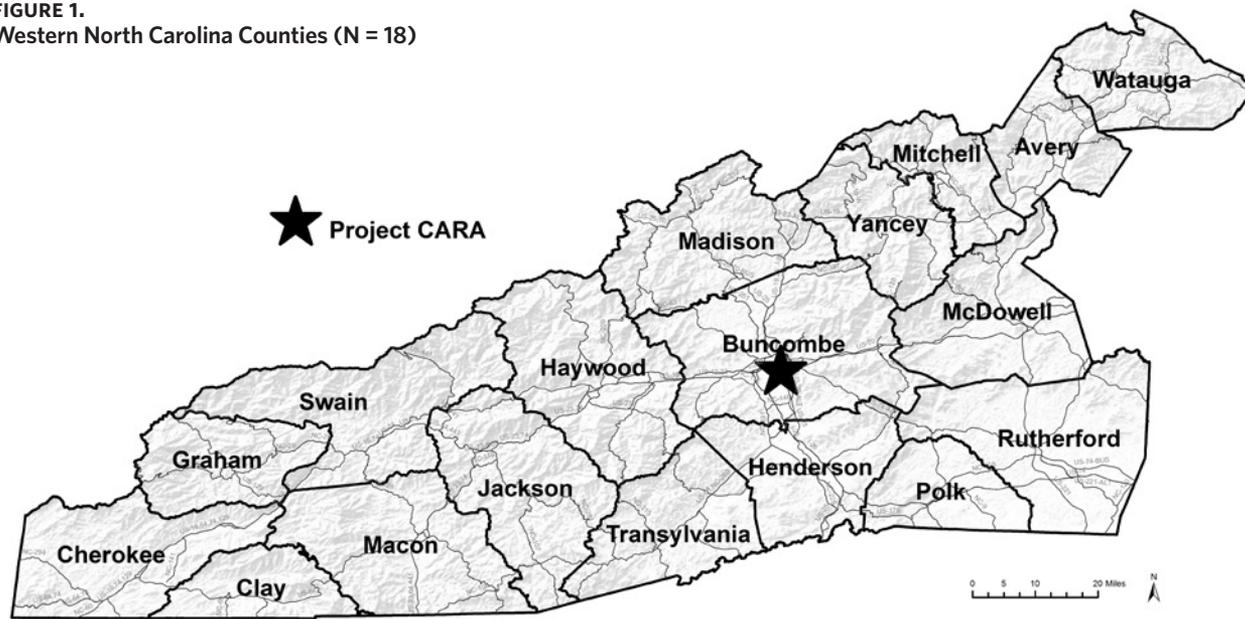
Data were analyzed for 608 patients who resided in WNC: 288 Buncombe County patients (46.5%) and 331 (53.5%) regional patients from 17 regional counties (Figure 1).

Sociodemographic and Pregnancy Characteristics

Buncombe County and regional patients were very similar in regard to sociodemographic and pregnancy characteristics (Table 1). Most patients were white, in their mid to late twenties, utilizers of public insurance, and had previously delivered one or more children.

Regional patients came more frequently for consultative care than Buncombe County patients. Regional patients opting to establish ongoing care with Project CARA were more

FIGURE 1. Western North Carolina Counties (N = 18)



Source: Colburn JL. Western North Carolina Counties [map]. Asheville, NC; 2019. Using: ArcGIS Desktop: Release 10.7.1. Redlands, CA: Environmental Systems Research Institute.

TABLE 1.
Patients' Sociodemographics, Pregnancy Characteristics, Diagnoses, and
Pharmacotherapy by Residency

	Residence		P
	Buncombe County (n = 284) N (%)	Regional (n = 324) N (%)	
Age (years) Mean ± SD	27.3 ± 4.6	27.6 ± 4.8	0.310
Race/Ethnicity			0.316
White, Non-Hispanic Women	228 (80.3)	275 (84.9)	
Women of Color	30 (10.6)	25 (7.7)	
Women of Unreported Status	26 (9.2)	24 (7.4)	
Insurance Type			0.168
Public (Medicaid and/or Medicare)	267 (94.0)	295 (91.0)	
Private	17 (6.0)	29 (9.0)	
Parity			0.248
Primiparous	92 (34.4)	91 (28.1)	
Multiparous	192 (67.6)	233 (71.9)	
Multiple Gestation	3 (1.1)	10 (3.1)	0.084
Obtained prenatal care elsewhere prior to Project CARA	77 (27.1)	208 (64.2)	<0.001
Obtained consultative care only at Project CARA	15 (5.3)	64 (19.8)	<0.001
First antenatal visit at Project CARA <14 weeks gestation	117 (60.2)	102 (31.5)	<0.001
Substance use diagnoses			0.009
Polysubstance	45 (15.8)	53 (16.4)	
Opioid	162 (57.0)	209 (64.5)	
Amphetamine/Methamphetamine	13 (4.6)	25 (7.7)	
Cocaine	15 (5.3)	8 (2.5)	
Benzodiazepines	2 (0.7)	1 (0.3)	
Alcohol	7 (2.5)	9 (2.8)	
Cannabis	38 (13.4)	19 (5.9)	
Hallucinogens	2 (0.7)	0	
Opioid misuse in pregnancy			0.011
No	84 (29.6)	67 (20.7)	
Yes	200 (70.4)	257 (79.3)	
Utilized prescribed medication for treatment of opioid use disorders	N = 200	N = 257	0.001
Methadone	99 (49.5)	87 (33.9)	
Buprenorphine	62 (31.0)	126 (49.0)	
None	39 (19.5)	44 (17.1)	
Cannabis use in pregnancy			<0.001
No	170 (59.9)	242 (74.7)	
Yes	114 (40.1)	82 (25.3)	
Tobacco use in pregnancy			0.698
No	62 (21.8)	75 (23.1)	
Yes	222 (78.2)	249 (76.9)	
Other psychiatric disorders			0.002
No	64 (22.5)	110 (34.0)	
Yes	220 (77.5)	214 (66.0)	
Utilized prescribed psycho-pharmacotherapy for treatment of psychiatric disorders	N = 220	N = 214	0.703
No	113 (51.4)	106 (49.5)	
Yes	107 (48.6)	108 (50.5)	

Notes. Abbreviations: SD is standard deviation.
 Project CARA stands for Project CARA: Care that Advocates Respect/Resilience/Recovery for All.
 Analyses utilized t-test for age and chi square for all other variables

likely to transfer care from regional providers during their second trimester of pregnancy.

Concurrent PSUDs and Psychiatric Diagnoses and Pharmacotherapy

A majority of both Buncombe County and regional patients were diagnosed with OUD. Buncombe County patients were diagnosed more frequently with cocaine or cannabis use disorders. More regional patients were diagnosed with amphetamine and/or methamphetamine disorders (Table 1).

The majority of all patients used tobacco products during pregnancy (77.5%). Cannabis use during pregnancy was more prevalent among Buncombe County patients. Seven of 10 Buncombe County patients and eight of 10 regional patients used opioids during their pregnancy.

Differences were noted in the type of medication for treatment of OUD during pregnancy. More frequently, Buncombe County patients were prescribed methadone while regional patients were prescribed buprenorphine.

The majority of patients had a concurrent psychiatric diagnosis. The prevalence was higher among Buncombe County patients than regional patients. The proportion of women prescribed psychopharmacotherapy was similar.

Primary and Secondary Outcomes

Data on outcomes were available for 226 (79.6%) Buncombe County and 221 (66.8%) regional patients ($P = .002$; Figure 2). Excluded from these analyses were women who had PSUD consultative care only, had an early termination of the pregnancy, transferred care to other pro-

viders or were lost to follow-up during pregnancy, or delivered at another hospital.

Engagement in comprehensive PSUD care. Only one of the five indices of engagement was significantly different between Buncombe County and regional patients (Table 2). The rate of attendance at the postpartum visit was significantly higher among Buncombe County than regional patients.

Slightly more regional patients used PSUD counseling services (+4.8%). The rate of negative maternal urine drug screens at delivery favored regional patients by 2.5%. Maternal urine drug screens at delivery were positive for non-prescribed substances including cannabis (68 [34.0%]); benzodiazepines (29 [14.5%]); opioids (29 [14.5%]); amphetamine/ methamphetamine (22 [11.0%]); cocaine (11 [5.5%]); and barbiturates (10 [5.0%]).

Use of community-based and/or inpatient substance use treatment services and attendance at expected prenatal visits varied little (1.6% and 1.5%, respectively).

Delivery outcomes. Slightly more babies were delivered early (+1.7%) or at low birth weights (+2.6%) among regional patients than Buncombe County patients. Slightly more babies of regional patients were breastfed at discharge from the hospital (+2.0%). None of these differences were statistically significant (Table 2).

Conclusion

Contrary to our hypothesis, pregnant women from the rural region of WNC engaged in comprehensive PSUD care at the same rate as women who lived locally in Buncombe

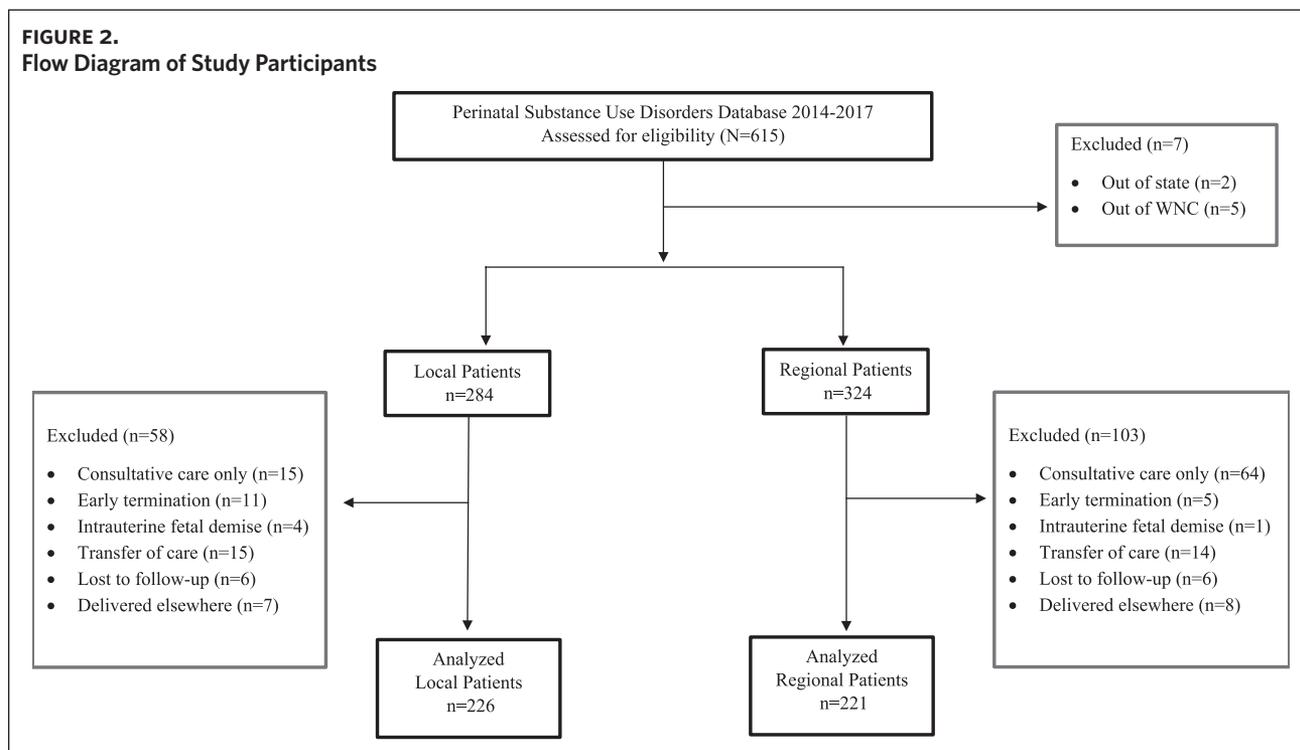


TABLE 2.
Primary and Secondary Outcomes by Residency: Engagement in Comprehensive PSUD Care

	Residence		P
	Buncombe County (n = 226) N (%)	Regional (n = 221) N (%)	
Primary Outcomes: Engagement			
Attended expected number of visits at Project CARA ^a	150 (66.4)	150 (67.9)	0.735
Attended postpartum visit at Project CARA	146 (64.6)	110 (49.8)	0.002
Utilized perinatal substance use disorder counseling at Project CARA	95 (42.0)	99 (44.8)	0.556
Utilized community-based and/or inpatient substance use disorder treatment	72 (31.9)	67 (30.3)	0.725
Maternal urine drug screen at delivery			0.517
Negative	109 (48.2)	112 (50.7)	
Positive	106 (46.9)	94 (42.5)	
None documented	11 (4.9)	15 (6.8)	
Secondary Outcomes: Delivery			
Preterm delivery (<37 weeks)	35 (15.5)	38 (17.2)	0.625
Low birth weight (<2500 grams) ^b	39 (17.4)	46 (21.0)	0.337
Breastfeeding at discharge ^c	145 (66.4)	147 (68.4)	0.810

Notes. Project CARA stands for: Care that Advocates Respect/Resilience/Recovery for All
 All analyses utilized Chi square.

^aExpected visits: Calculated expected number of visits using gestational age at first appointment with Project CARA and gestational age at delivery per ACOG expected visit schedule. ACOG recommends visits every four weeks for the first 28 weeks, every two weeks until 36 weeks, and every week after 36 weeks until delivery. Compared actual number of visits to expected number of visits. [34]

^bBirth weight was available for babies of 224 Buncombe County and 219 regional patients.

^cBreastfeeding at discharge was available for 223 Buncombe County and 215 regional patients.

County. It was only in the postpartum period that we found a difference in engagement. Fewer regional patients remained engaged and attended their PSUD postpartum visits with Project CARA.

Pregnancy is often described as a period of high motivation to engage in substance use treatment [29, 36]. Project CARA provides a supportive environment in which to obtain PSUD care and to develop the trusting relationships required for recovery. The postpartum period, however, is complicated for new mothers not only by a general shift of focus from the pregnant mother to the infant, but also by the demands of a newborn who may be dealing with the symptoms associated with PSUD [37]. Furthermore, access to care for recipients of NC Medicaid for pregnancy ends approximately 60 days after delivery, resulting in a loss of access to medical care and wraparound support services including transportation vouchers [38]. These factors typically mean that patients end their supportive relationships with the providers of Project CARA. Many transition out of antenatal care and into the postpartum period without the support of their PSUD providers.

The postpartum period, now prioritized as the “fourth trimester” [35], is an important time for all mothers. For women with PSUD, the postpartum period may be more critical as it is associated with increased risk of relapse and the sequela [4, 6, 8]. Across North Carolina and the nation, 90% of women reported attending their postpartum visit [39]. However, only 65% of Buncombe County patients and 50% of regional patients came to their PSUDs post-

partum appointment. We speculate that if regional women could access PSUD care and develop trusting relationships with care providers in their home communities, more women would remain engaged in PSUD postpartum care. Furthermore, if engaged with providers who also offer comprehensive well-woman care in the peripartum period, care should not have to be transitioned elsewhere. More formal processes within Project CARA for helping patients transition into the postpartum phase and remain engaged in PSUD care may be beneficial to many of our patients.

We also found that significantly more patients from the regional counties did not establish care with Project CARA, but rather, came for consultation and care planning. With the support of a specialized PSUD care plan, these patients may have been able to continue their supportive relationships with their local providers throughout the pregnancy and into the postpartum phase.

Limitations to the generalization of these results include a lack of outcomes data for patients who did not establish care or left care with Project CARA and those patients who did not deliver locally. We do not have data sharing agreements with other providers and hospitals. The lack of data from regional providers may have resulted in an underestimation of the proportion of patients who received postpartum care other than PSUD program-specific postpartum care. All eligible patients with data from the duration of the study were included in analyses, but the sample size (n = 447) precluded adequate power for outcomes differences of ≤ 3.6%, including negative maternal UDS at deliv-

ery and neonatal delivery outcomes. Conversely, multiple between-group comparisons may have resulted in spurious findings (e.g., PSUD postpartum visit attendance). Further, the retrospective evaluation of one regional program may limit generalizability to other PSUD programs in other regions.

We speculate that there are other women living in WNC who would benefit from PSUD consultation and/or care. Given the number of births in the region over four years and the 2017 national prevalence of substance use and disorders in pregnancy, we speculate that many more women in WNC might have benefitted (Table 3). We estimate that over the four-year period of the study, we may have provided care for only 39% of Buncombe County and 22% of regional patients potentially with PSUD (Table 3). ACOG and the American Society of Addiction Medicine recommend universal screening (verbal or written) at multiple points during pregnancy and the postpartum period, with brief intervention and referral to treatment (Screening, Brief Intervention, Referral to Treatment: SBIRT) for all women with PSUD [5, 9, 11, 40]. While it is evident that referring regional providers are screening, perhaps other providers of maternity care are not. And while we are not the only substance use treatment program in WNC, we are the only comprehensive PSUD program.

Future Directions

To extend the capacity of our comprehensive PSUD program to help women of WNC obtain care and establish needed trusting provider-patient relationships, we propose the implementation of a PSUD hub-and-spokes model [41]. Project CARA will serve as the hub—the PSUD experts—to support spokes—regional practices of maternity care providers (e.g., family medicine physicians, obstetricians-gynecologists, certified nurse midwives, and nurse practitioners/physician assistants) trained to provide SBIRT, licensed to prescribe buprenorphine for the treatment of OUD, and partnered with local agencies for wraparound services. This model will add services to Project CARA's offerings including maternity care provider education and training, technical

support, and the option of shared care for regional patients. Shared care patients would obtain maternity care primarily with their community-based providers after the PSUD consultation, and they will return periodically to the hub for additional, specialized care from the PSUD team.

A hub-and-spokes model as envisioned would leverage the experience and expertise of the Project CARA program while increasing access to PSUD care across the 18-county region. Service delivery under this model would facilitate smooth postpartum transitions back to local care for transferred patients and reduce the number of transferred patients. The model would also serve as a supportive mechanism for creating collaborations and a network of support for rural providers caring for this subset of pregnant women.

Our research highlights the importance of creating a supportive postpartum transition process and expanded access to PSUD care across the WNC region. Expansion of Project CARA via the hub-and-spokes model has potential to accomplish both objectives and improve health care for the women of WNC. NCMJ

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Potential conflicts of interest. The authors report no relevant conflicts of interest.

TABLE 3.
Estimated Proportion of Buncombe County and Regional Patients Served by Project CARA over Four Years

	Residence	
	Buncombe County N (%)	Regional N (%)
Total deliveries in North Carolina in 2014-2017 ^a	12,092	24,297
Estimated proportion with substance use in pregnancy ^b	2,007 (16.6)	4033 (16.6)
Estimated proportion with perinatal substance use disorder ^c	726 (6.0)	1,458 (6.0)
Estimated proportion of WNC women with perinatal substance use disorder served by Project CARA	284/726 (39.1)	324/1,458 (22.2)

Notes. WNC is Western North Carolina; Project CARA stands for: Care that Advocates Respect/Resilience/Recovery for All

^aNorth Carolina births [30]

^b16.6% of US pregnant women reported substance use within the past month in 2017 [2].

^c6% of US women reported substance use disorder diagnosis within the past year in 2017 [2].

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