Preventive Medicine Reports 15 (2019) 100919

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Drug Free Moms and Babies: Qualitative and quantitative program evaluation results from a rural Appalachian state

Christa L. Lilly[a,*], Alice M. Ruhnke[b], Janine Breyel[c], Amna Umer[d], Cassie E. Leonard[e]

[a] West Virginia University, School of Public Health, Department of Biostatistics, Morgantown, WV, United States of America
[b] The Grant Advantage, Charleston, WV, United States of America
[c] West Virginia Perinatal Partnership, Charleston, WV, United States of America
[d] West Virginia University, School of Medicine, Department of Pediatrics, Morgantown, WV, United States of America
[e] West Virginia University, School of Medicine, Department of Obstetrics and Gynecology, Morgantown, WV, United States of America

ARTICLE INFO

Keywords:
Pregnancy
Program evaluation
Substance use

ABSTRACT

The main objective of this study is to present qualitative and quantitative results of the Drug Free Moms and Babies (DFMB) Project pilot program. The program was designed to integrate and evaluate treatment and recovery services for pregnant and postpartum women with substance use disorders. Qualitative assessment was conducted via interviews regarding programmatic design components (four West Virginia sites; 2012–2018). The quantitative assessment utilized a survey that included information on patients' (N = 550) demographic, medical and substance use histories, health care services, and maternal and infant health outcomes. The qualitative results noted that program development for this population is time- and resource-intensive, and implementation requires collaborative team work. A dedicated staff position and team flexibility were critical towards programmatic success. For quantitative results, among the 393 participants that completed the program, urine drug screen data showed a significant reduction of non-prescribed positive screens from 81% (N = 178) positive in the first trimester to 22% (n = 86) positive at delivery, $p < 0.0001$. The DFMB program reached high-risk, medically underserved women, and was associated with reducing drug use among program completers.

1. Introduction

Substance use in pregnancy, particularly opioid use, increased in the past decade in the United States (Krans and Patrick, 2016). According to the Substance Abuse and Mental Health Service Administration (SAMHSA) 2016 data, 13.2% of women of childbearing age (15 to 44) and 6.3% of pregnant women used illicit drugs (Center for Behavioral Health Statistics and Quality, 2017).

Substance use in pregnancy is associated with increased morbidity and mortality for both mother and child (Behnke et al., 2013; Hudak et al., 2012). For the infant these include low birth weight, neonatal abstinence syndrome (NAS), postnatal growth deficiency, birth defects, preterm birth, and sudden infant death syndrome, depending on the substance (e.g., Minnes et al., 2011; Rayburn, 2007). Obstetrical complications, such as ectopic pregnancy, placenta previa, and postpartum hemorrhaging, have also been associated with substance use during pregnancy and may also impact maternal mortality (Minnes et al., 2011).

West Virginia (WV) also experienced a drastic rise in substance use in pregnancy in the past decade. WV has the highest age-adjusted drug overdose death rate in the nation, (Hedegaard et al., 2017) and the third highest prescribing rate of opioid analgesics (137.6 per 100 people) (Paulozzi et al., 2014). In 2009, an umbilical cord tissue study with samples from eight WV hospitals showed that nearly 20% of infants were antenatally exposed to licit/illicit drugs and alcohol, excluding nicotine (Stitely et al., 2010). WV faces challenges to access treatment of substance use disorder (SUD) in pregnancy due to issues related to rurality, poverty, and other health issues. More than half of the population lives in rural areas, (United States Census Bureau, 2010) where barriers to care are particularly pronounced due to travelling time and distances, lack of transportation services, as well as financial constraints (Sigmon, 2014). The coordination of addiction treatment services to other pregnancy-related care only further exacerbates these barriers.

Public health and policy experts note the extensive challenges of addressing the opioid crisis; siloed agencies make the full scope of the

* Corresponding author at: WVU, SPH, 1 Medical Center Drive, PO Box 9190, Morgantown, WV 26506-9190, United States of America.
E-mail address: cllilly@hsc.wvu.edu (C.L. Lilly).

https://doi.org/10.1016/j.pmedr.2019.100919
Received 22 January 2019; Received in revised form 1 May 2019; Accepted 4 June 2019
Available online 10 June 2019

problem difficult to recognize and address (McClure et al., 2018). Medication Assisted Treatment (MAT) is recommended for treatment of opioid use disorder in pregnancy (ACOG Committee on Health Care for Underserved Women, 2012) and access to and the demand for MAT exceeds the current need (Peles et al., 2013). WV, federal, and private funding efforts to address the epidemic have recently increased, and the question remains on how best to use this funding beyond Medicaid expansions to cover MAT services. The US Department of Health and Human Services (DHHS) through its State Opioid Response (SOR) grant program has awarded $1.5 billion dollars in the past few years to states and territories to expand access "to treatment that works, especially to MAT with appropriate social supports" (U.S.D.o.H.a.H.S, 2019). To address the significant problem of SUD in pregnancy, the WV Perinatal Partnership (West Virginia Perinatal Partnership, 2018) worked across agencies (including DHHS) and health care providers to create the Drug Free Moms and Babies (DFMB) Project as a model to systematically integrate maternity and behavioral health care to provide prevention, early intervention, treatment, and recovery services for pregnant and postpartum women with SUD. The DFMB program applied principles found in a Pay for Success public program financing mechanism. Specifically, it targeted a specific program across multiple agencies, supported solutions through cross-agency context, empowered an outcomes orientation for providers, and contributed to an evidence base that other decision-makers can use (McClure et al., 2018). The main goal of DFMB was to expand and improve efforts of practitioners; all patients received the standard of care for their substance of choice (including MAT for opioid use) and patients were treated for all SUD.

1.1. DFMB model in four steps

Programs opting into the DFMB model had to implement four components. The first component included having a team that included (at a minimum) maternity care providers, behavioral health providers, and other community resources. The second component included the Screening, Brief Intervention, and Referral to Treatment (SBIRT) Model, which is a comprehensive, integrated, evidence-based approach to identify and treat individuals with SUD. Although used systematically across each site, specific components of SBIRT were adapted for each site's unique population and cultural characteristics. The third component included a two-year follow-up, including (but not limited to) peer recovery coaching, ongoing services from DFMB staff, and participation in social service programs. The fourth component required integration with local and statewide initiates to address SUD in pregnancy.

The main objective of this study was to present qualitative and quantitative results of the DFMB Project pilot program in four sites in the state of WV.

2. Material and methods

The DFMB began project development in 2011, with site funding starting in 2012. To evaluate program effectiveness the program included both quantitative and qualitative analyses. The quantitative and qualitative evaluations had different purposes, and were not intended as a mixed methods study. The evaluation was acknowledged by the local university Institutional Review Board as Non-Human Subjects Research, qualifying as an exemption by existing data with de-identification.

2.1. Qualitative methods and analysis

The purpose of the qualitative evaluation was to gain insight into the programmatic implementation. Qualitative methods were guided by a qualitative descriptive research design (Sandelowski, 2000) and included organizational characteristics of the four pilot sites' lead agencies and program design components. In-person semi-structured interviews with key program personnel occurred once per year. All staff in all sites (e.g., physicians, nurses, psychiatrists, recovery coaches or case managers) were identified and all chose to participate in the first year. In the second year, only site directors and physicians were invited to participate, and in the third year, only site directors. No incentives were provided. Interviews were combined for thematic coding. Interviews were at least an hour long, audio-recorded, and transcribed for accuracy. Interview guide is included in Appendix A. Interviews and coding were conducted by an expert in qualitative research methods.

2.2. Quantitative methods and analysis

The purpose of the quantitative evaluation was to describe the patients and outcomes. Site personnel entered de-identified participant information from medical records into a REDcap database (Harris et al., 2009), hosted by WV Clinical and Translational Science Institute, which included questions (Appendix B) about demographic characteristics, medical and substance abuse histories, quantity and depth of service, and select maternal and infant outcome data. Substances were grouped into seven categories including alcohol, tobacco, cannabis, stimulants (e.g., cocaine, methamphetamines, etc.), hallucinogens (e.g., LSD, PCP, DXM, etc.), opioids/narcotics (e.g., heroin, oxycodone, fentanyl, etc.), and other non-specified (e.g., depressants, inhalants, steroids). Some participant outcomes continue to be updated; only data entered prior to March 2018 are included in this study.

Descriptive statistics include N's and valid percentages for categorical data, and means and standard deviations for continuous data. Significant chi-square p-values are reported for differences in program completers and non-completers on demographic variables. Repeated measures analysis of the urine drug screen data used a generalized estimating equation (GEE) approach. Alpha was set to 0.05. All data management and analysis were conducted using SAS version 9.4 (SAS Institute Inc., 2013).

3. Results

3.1. Qualitative results

Two themes emerged related to program implementation during the coding of the transcribed interviews. Sub-codes within these two major themes were also noted.

3.1.1. First theme: implementation of SBIRT

3.1.1.1. Screening. Screening required the use of the state's maternal risk screening tool: the WV Prenatal Risk Screening Instrument (PRSI). Sites also engaged in other screening methods, including urine drug screens and utilization of validated screening tools to determine the comprehensive substance abuse, mental health, social, and additional medical needs of the patient. Women that screened positive for substance use were also screened for and, if appropriate, treated for co-occurring mental health disorders. The treatment teams worked collaboratively to assess progress and address areas in need of improvement for each individual.

3.1.1.2. Brief interventions. Brief interventions were conducted by medical staff, behavioral health staff, or other service providers. Motivational interviewing techniques were utilized by the clinicians during brief interventions.

3.1.1.3. Referral to treatment. Referral to treatment was tailored to each patient based upon individual needs. Each site attempted to locate and access SUD treatment service providers across the continuum of care (including MAT, intensive outpatient, residential, detoxification services, community support groups, Peer Recovery Coaching, etc.). DFMB programs also addressed the multiple complex needs of participants by helping them access a range of other state and community-based services, such as Medicaid, food assistance

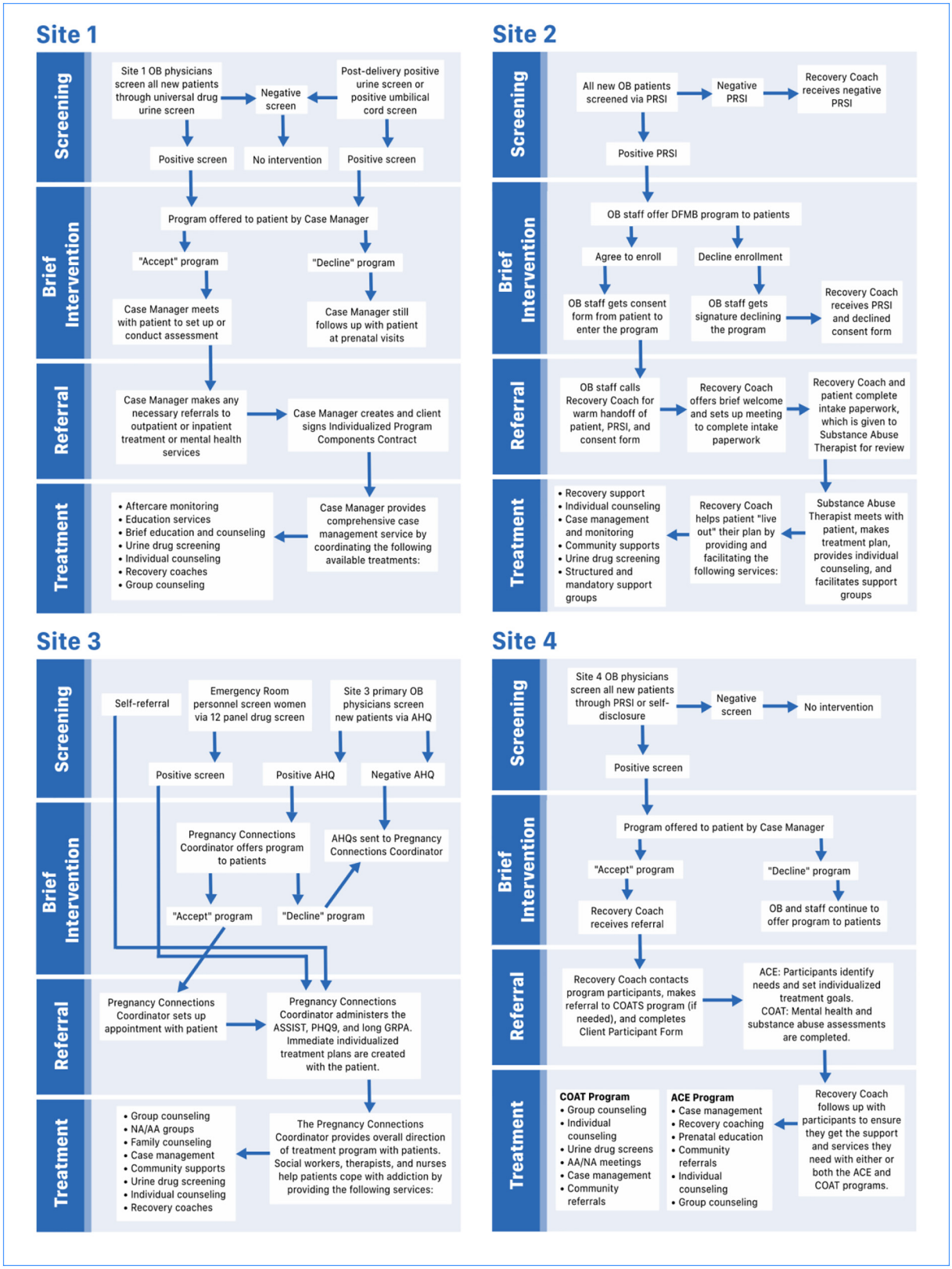

Fig. 1. Flow chart of the screening, brief intervention, and referral to treatment (SBIRT) in practice within the four West Virginia program sites (2012–2018).

nutrition, literacy, education, housing, transportation, childcare, workforce development, and other services.

3.1.1.4. Key personnel from each site identified unique elements of their programs. These are discussed in more detail below. SBIRT flowcharts, required for each site but adapted for the site's unique culture and participants, can be found in Fig. 1.

Site 1. The DFMB program was embedded in the Obstetrics and Gynecology (OB/GYN) physician clinic and integrated into the hospital. Universal urine drug screens were required for all new OB patients. The

Care Manager met with all OB patients to assess non-medical risk factors that could impact health outcomes and to provide supportive services. Brief intervention sessions educated patients on the impact of drug use (including marijuana and nicotine) on the health of mothers and babies.

Site 2. The highlight of this program was that it provided a "one-stop-shop" setting for medical and behavioral health services, and an onsite Recovery Coach provided supportive assistance. The program included MAT with extensive monitoring and case management services. The collaborative treatment team included the Recovery Coach, therapists, the psychiatrist, and a nurse who met frequently to monitor women in the program.

Site 3. Housed within the behavioral health unit of the delivery hospital, this DFMB site offered a structured outpatient treatment program, including MAT prescribed by a local OB/GYN. In addition to counseling and mental health screenings, the DFMB program provided extensive monitoring, case management, and health education services. There was a strong collaboration with the hospital's Mother-Baby unit.

Site 4. Integrated within the OB/GYN clinic of a large tertiary care center, this site's Patient Liaison provided individualized care and coordination based upon the results of the PRSI. The Patient Liaison provided services at places and times convenient to the participants, including at prenatal care appointments and in the community. The Patient Liaison worked closely with the hospital's behavioral health center, which provided treatment services, including MAT. Group meetings for participants, which helped meet their support group attendance requirements, were arranged to provide support and opportunity for social interaction free of stigma and judgment.

3.1.2. Second theme: implementation strategies and challenges

The second overarching theme that emerged from the interviews identified successful implementation strategies, program challenges, and innovative service models.

3.1.2.1. Establishing programs took more time than anticipated. Although discrete pieces of the model were in existence prior to the implementation of the DFMB program, activities such as assembling and integrating the team members, hiring new staff, establishing the SBIRT model, building relationships with new and different providers, and collecting and reporting the outcome data was far more time consuming than expected.

> *"We thought because the need was so high, the program would take off immediately. But we learned that it takes some time to put all the pieces in place."* Site 3 staff

3.1.2.2. A dedicated staff position was needed to effectively run the programs. Because establishing a DFMB program was time-consuming, a dedicated staff person to provide extensive monitoring and coordination was essential. Effective programs worked collaboratively with the community; developing and maintaining those relationships took time and dedication. Collaboration with community resources was critical to effectively meeting the multiple needs of the participants.

> *"We tried to use the time of current staff to address the needs of our moms with addictions, but found that without a dedicated staff person, women were falling through the cracks."* Site 3 staff

3.1.2.3. A collaborative treatment team needed to be developed, nurtured, and maintained to provide effective services. A schedule for the treatment team to meet regularly and frequently to monitor program participants was a key component to programs' successes.

> *"We're trying to work as a team better because that really is our work and we've come a long way. The communication is much better than it had been, but it still has a long way to go. And it's just—we need to be a team."* Site 2 physician

3.1.2.4. Barriers to treatment existed in the programs. Programs encountered a number of obstacles trying to keep women engaged in services, especially through the two-year postpartum period. Transportation and childcare were common barriers to treatment. Patients often missed appointments. These problems were exacerbated by communication difficulties. Address and/or phone changes, lack of home phones, and cell phones that ran out of minutes or had sparse service coverage in rural areas were common. DFMB program staff were required to be innovative and flexible; they found that using communication options preferred by patients (such as social media messaging and text messaging) beneficial.

> *"I think another thing that would make it work better is if there was some sort of dedicated means of transportation to get these people in here. They have one transportation van for the whole facility."* Site 2 staff

3.1.3. Successes

Despite these challenges, success stories occurred across all sites:

> *"One patient came to us by word-of-mouth. She had been incarcerated, was pregnant, and CPS was involved in her life. She was taking several drugs, including benzos, Subutex, and roxies. We sent her to Pregnancy Connections and she joined the program immediately. She had a difficult pregnancy with bed rest and preterm labor. But she is now clean and has all of her kids. Pregnancy Connections helped her with transportation and connected her to Patchwork to work on her GED. She has a relationship with her mother now and her legal issues are clearing up. She is a real success story."*-Site 3 staff

> *"One woman came to therapy, was doing what she needed to do, and was consistently starting to have negative drug screens. Once she had her baby, she stopped seeing me. I was worried she went back to using after the baby was born. Then one day at the store, she saw me and said, 'You saved my life.' She told me how she stopped seeing the guy she was seeing, was still going to NA meetings, and was making some positive changes in her life. And I thought to myself—wow. I didn't know how much this really impacted her."*-Site 1 Staff

3.2. Quantitative results

3.2.1. Demographics

A total of 597 entries were entered between January 2012 and March 2018 for the four original pilot sites of the DFMB program. Of these entries, 47 individuals had a repeat pregnancy and had been previously enrolled in the program. The results includes 550 unique individuals and first pregnancy outcomes for 47 previous participants. Demographics overall and by site are given in Table 1. Although the majority (n = 311, 64%) entered prenatal care in their first trimester, only half (n = 265, 51%) entered the DFMB program during their first trimester.

3.2.2. Substance use and treatment

Prescribed drug and substance use history, both prior to and during current pregnancy, are included in Table 2. Prior to the current pregnancy, the majority of participants reported tobacco use (n = 481, 91%), cannabis use (n = 405, 83%), and non-prescribed opioid use (n = 398, 75%). Although the percentages decreased, this trend continued during the current pregnancy and prior to enrollment into the program (79% tobacco, 54% cannabis, and 65% opioid/narcotic use). Many of the women reported using more than one substance during pregnancy (76%). When asked specifically what opioid/narcotics were used, most women reported more than one type over the span of pregnancy (an example list: Roxicodone, Hydrocodone, Hydromorphine, Oxycodone, heroin, 'pain pills', 'cough syrup').

Table 1
Patient demographics for 550 individual participants, Overall and by Site in West Virginia, 2012–2018. Results suppressed for small cell sizes (n < 5).

Variable	N	(Valid percent)	Sites			
			Site 1 (N = 196)	Site 2 (N = 150)	Site 3 (N = 124)	Site 4 (N = 80)
Trimester entering prenatal care (N = 488)						
1	311	(63.7%)	148 (75.5%)	77 (64.2%)	56 (46.3%)	30 (58.8%)
2	137	(28.1%)	34 (17.4%)	33 (27.5%)	53 (43.8%)	17 (33.3%)
3	40	(8.2%)	14 (7.1%)	10 (8.3%)	12 (9.9%)	4 (7.8%)
Trimester entering DFMB program (N = 524)						
1	265	(50.6%)	156 (79.6%)	50 (35.2%)	44 (37.6%)	15 (21.7%)
2	177	(33.8%)	31 (15.8%)	57 (40.1%)	54 (46.2%)	35 (50.7%)
3	82	(15.7%)	9 (4.6%)	35 (24.7%)	19 (16.2%)	19 (27.5%)
Race (N = 550)						
White	512	(93.1%)	182 (92.9%)	145 (96.7%)	119 (96.0%)	66 (82.5%)
Ethnicity (N = 535)						
Non-Hispanic	533	(99.6%)	–	–	–	–
Insurance (N = 536)						
Private/other	40	(7.5%)	29 (14.8%)	5 (3.5%)	–	5 (6.8%)
Medicaid	496	(92.5%)	167 (85.2%)	137 (96.5%)	123 (99.2%)	69 (93.2%)
Income (N = 455)						
< $15 k	309	(67.9%)	66 (33.7%)	132 (95.0%)	110 (93.2%)	–
15 k– < 25 k	81	(17.8%)	68 (34.7%)	5 (3.6%)	7 (5.9%)	–
25 k– < 35 k	48	(10.6%)	46 (23.5%)	–	–	–
35 k– < 75 k	17	(3.7%)	16 (8.1%)	–	–	–
Education (N = 500)						
Less than HS diploma	165	(33.0%)	46 (23.5%)	46 (35.1%)	61 (49.2%)	12 (24.5%)
HS diploma or GED	255	(51.0%)	135 (68.9%)	63 (48.1%)	37 (29.8%)	20 (40.8%)
Technical training/some college	74	(14.8%)	13 (6.6%)	22 (16.8%)	24 (19.4%)	15 (30.6%)
College or greater	6	(1.2%)	–	–	–	–
Marital status (N = 517)						
Never married	355	(68.7%)	137(69.9%)	97 (74.6%)	76 (61.3%)	45 (67.2%)
Married	92	(17.8%)	34 (17.4%)	23 (17.7%)	21 (16.9%)	14 (20.9%)
Widowed/divorced/separated	70	(13.5%)	25 (12.7%)	10 (7.7%)	27 (21.8%)	8 (11.9%)
Cohabitation, non-married (N = 426)						
Cohabitating	254	(59.6%)	784 (52.2%)	49 (43.8%)	85 (84.2%)	36 (69.2%)
Planned pregnancy (N = 509)						
Yes	71	(14.0%)	46 (23.5%)	9 (6.9%)	9 (7.3%)	7 (11.7%)
Intention to breastfeed (N = 354)						
Yes	225	(63.6%)	138 (70.4%)	44 (52.4%)	22 (64.7%)	21 (52.5%)
Variable	**Mean (SD)**	**Range**				
Maternal age						
N = 549	26.3 (5.2)	16–43	25.6 (5.9)	26.2 (4.4)	26.9 (4.9)	26.8 (4.9)
Number in household						
N = 505	3.1 (1.2)	1–8	2.7 (1.0)	3.3 (1.6)	3.6 (1.1)	2.9 (1.0)
Number of living children						
N = 383	1.9 (1.2)	0–8	1.7 (1.2)	1.6 (1.0)	2.8 (1.2)	1.6 (1.0)

Treatment both total and by site are included in Table 3. Patients were being seen for a wide variety of substances, but typically were undergoing treatment for drug use and not alcohol (n = 472, 96%), and were being treated by a combination of MAT (n = 290, 53%) and counseling (n = 303, 55%).

3.2.3. Referrals and outcomes

The most commonly reported service referrals were WIC (n = 323, 64%), AA/NA (n = 298, 58%), external mental health services (n = 45, 65%), home visitation services (n = 178, 37.6%), and transportation (n = 138, 26.8%).

Participants who completed the full two years post-partum, stayed through delivery, or were still in the program at the time of evaluation are identified as program completers (n = 393, 71.5%). Those who did not complete the program (n = 157, 28.5%) were more likely to have entered in their second trimester (45% v. 29%, p = 0.0034), have Medicaid insurance (98% v. 90%, p = 0.01), have less than a high school education (43% v. 29%, p = 0.007), be in the bottom reported income bracket (94% v. 58%, p < 0.0001), and to have an unplanned pregnancy (95% v. 83%, p = 0.0009). For all who left prior to the full two years post-partum (n = 317, 59%), n = 124 (40%) were due to noncompliance, n = 128 (41%) were lost to follow-up, and n = 60 (19%) were referred to higher level of care.

For program completers, the percentages of positive urine drug screens steadily declined from 81% in the first trimester to 22% at delivery. Across all time points, we saw a statistically significant increase in negative drug screens for participants, GEE estimate of time = 0.63 (95% CI 0.03, 0.58), Z = 25.68, p < 0.0001.

4. Discussion

The pilot program results suggest that the DFMB program provides essential treatment and referral services to a high-risk, impoverished, medically-underserved population. SUD during pregnancy was addressed across multiple agencies with the goal of providing comprehensive care to pregnant women. Prior to this program, pregnant women were often either ignored by providers, put on wait-lists to be seen, or treated by a lone, over-burdened physician within the community. This study filled the gap in existing programming by focusing on getting pregnant women the treatment they needed by a collaborative team in a timely manner.

"Before I felt like we didn't have a really good system to help the moms who were addicted or having problems, and now I feel like we have a system that actually addresses the problem. In the past, we hardly ever

Table 2
Prescription and substance use prevalence, all programs in West Virginia, 2012–2018.

Prescribed drug	N	(Valid percent)	Site 1 (N = 196)	Site 2 (N = 150)	Site 3 (N = 124)	Site 4 (N = 80)
SSRIs	44	(8.5%)	7 (3.6%)	22 (16.1%)	2 (1.7%)	13 (19.1%)
Other anti-depressants	12	(2.3%)	1 (0.5%)	8 (6.0%)	0	3 (4.4%)
Benzodiazepines	28	(5.4%)	15 (7.7%)	3 (2.2%)	4 (3.5%)	6 (8.8%)
Sleep aids	16	(3.1%)	3 (1.5%)	12 (9.0%)	1 (0.9%)	0
Anti-convulsants	6	(1.2%)	1 (0.5%)	3 (2.3%)	1 (0.9%)	1 (1.5%)
Opioids for pain relief	22	(4.4%)	12 (6.2%)	5 (3.8%)	2 (1.8%)	3 (4.4%)
Opioids for medication assisted treatment	276	(53.0%)	46 (23.5%)	95 (69.3%)	78 (66.7%)	57 (80.3%)
Non-opioid pain relievers	29	(5.7%)	6 (3.1%)	15 (11.4%)	4 (3.5%)	4 (5.9%)
Anti-psychotic drugs	16	(3.1%)	3 (1.5%)	8 (5.8%)	0	5 (7.4%)
Smoking cessation drugs	31	(6.0%)	13 (6.6%)	9 (6.7%)	0	9 (13.2%)
Substance use history (prior to pregnancy)						
Alcohol	286	(72.7%)	14 (7.3%)[a]	108 (87.8%)	106 (92.2%)	58 (95.1%)
Tobacco use	481	(91.1%)	177 (90.3%)	129 (93.5%)	107 (88.4%)	68 (93.2%)
Cannabis use	405	(82.5%)	138 (70.8%)	121 (96.0%)	94 (81.7%)	52 (94.6%)
Stimulant use	194	(39.8%)	11 (5.6%)	82 (68.9%)	50 (44.6%)	51 (85.0%)
Hallucinogen use	41	(8.9%)	0	23 (20.5%)	5 (4.5%)	13 (32.5%)
Opioid use (non-prescribed)	398	(74.7%)	72 (36.7%)	142 (97.9%)	113 (94.2%)	71 (98.6%)
Substance use during pregnancy						
Alcohol	56	(11.7%)	10 (5.1%)	39 (33.9%)	3 (2.6%)	4 (7.7%)
Tobacco use	416	(79.1%)	122 (62.6%)	123 (89.8%)	106 (87.6%)	65 (89.0%)
Cannabis use	265	(54.0%)	12 (63.7%)[b]	94 (74.0%)	20 (18.0%)	28 (46.7%)
Stimulant use	78	(16.2%)	9 (4.6%)	33 (28.2%)	10 (9.3%)	26 (41.3%)
Hallucinogen use	2	(0.4%)	0	1 (0.9%)	0	1 (1.8%)
Opioid use (non-prescribed)	340	(64.6%)	46 (23.7%)	133 (93.0%)	101 (86.3%)	60 (83.3%)
Polysubstance use[c]						
More than one illicit substance	209	(38.9%)	32 (16.4%)	110 (74.3%)	28 (23.3%)	39 (52.7%)
More than one substance	408	(75.6%)	110 (56.4%)	136 (91.3%)	96 (79.3%)	66 (88.0%)

[a] Site 1 defined as substance abuse rather than any use.
[b] Site 1 N = 126 received brief intervention for Cannabis Use and stopped during first semester.
[c] Number of women reporting during pregnancy use of more than one classification of drugs (e.g., Alcohol, Tobacco, Cannabis, Stimulant, Hallucinogen, Opioid/narcotic). Does not include more than one type within the same classification area.

Table 3
Treatment and outcomes both overall and by site in West Virginia, 2012–2018.

Variable	Total	Site 1 (N = 196)	Site 2 (N = 150)	Site 3 (N = 124)	Site 4 (N = 80)
Enrolled in substance abuse Tx program					
Yes	495 (91.7%)	190 (97.4%)	150 (100%)	94 (78.3%)	61 (81.3%)
If in program, is it for:					
Drugs	472 (95.6%)	182 (95.8%)	137 (91.3%)	93 (100%)	60 (98.4%)
Alcohol	8 (1.6%)	4 (2.1%)	3 (2.0%)	–	–
Both	14 (2.8%)	4 (2.1%)	10 (6.7%)	–	–
Treatment type:					
Medication-assisted	290 (52.7%)	39 (19.9%)	102 (68.0%)	89 (71.8%)	60 (75.0%)
Counseling	303 (55.1%)	69 (35.2%)	106 (70.7%)	84 (67.7%)	44 (55.0%)
Intensive out-patient	62 (11.3%)	6 (3.1%)	–	51 (41.1%)	–
Brief Intervention	373 (67.8%)	158 (80.6%)	124 (82.7%)	90 (72.6%)	–
Program completers[a] (those who did not leave prior to delivery)	393 (71.5%)	189 (96.4%)	68 (45.3%)	74 (59.7%)	62 (77.5%)
Positive drug screens[a,b]					
First trimester (N = 220)	178 (80.9%)	147 (96.1%)	8 (33.3%)	14 (58.3%)	9 (47.4%)
Second trimester (N = 331)	153 (46.2%)	85 (47.2%)	20 (40.8%)	23 (40.4%)	25 (55.6%)
Third trimester (N = 393)	98 (24.9%)	53 (28.0%)	18 (26.5%)	9 (12.2%)	18 (29.0%)
At delivery (n = 393)	86 (21.9%)	52 (27.5%)	12 (17.7%)	4 (5.4%)	18 (29.0%)
Cord tested positive[a]	150 (47.6%)	57 (30.5%)	9 (26.5%)	55 (96.5%)	29 (78.4%)
If positive, was it for[a]					
Prescribed only	90 (63.4%)	26 (45.6%)	–	51 (92.7%)	13 (46.4%)
NAS (N = 289)[a]					
Yes	122 (42.2%)	51 (27.6%)	8 (88.9%)	47 (83.9%)	16 (41.0%)
Birth outcome (N = 393)[a]					
Live, term birth	328 (83.5%)	180 (95.2%)	54 (79.4%)	59 (79.7%)	35 (56.5%)
Live, preterm birth	32 (8.1%)	10 (5.3%)	4 (5.9%)	9 (12.2%)	9 (14.5%)

[a] For those who completed the program through delivery.
[b] First and second trimester numbers do not include positive drug screens prior to program entry.

knew about these addicted women until they hit the unit at delivery. It was worse to deal with the fall out than it is to address the problem up front."-Site 1 nurse

Qualitative results suggested that programmatic SBIRT use, long-term follow-up care, and reliance on key partners for use of service and community resources were important improvements to existing standard of care. While sites could and did adapt services to their particular participants' needs, common elements were essential for program success. Main lessons learned revealed that program development may be time-intensive, but the inclusion of a collaborative team was important. A dedicated staff position along with team flexibility were critical elements of programmatic success. While many similarities across sites existed (e.g., SBIRT use, referral systems), many differences existed as well (e.g., location of clinic, specific substances addressed, local community resources that differed by site). These differences may have resulted in diversity in how participants flowed through the program; however, the program design and required program components were fairly universal, and we believe this resulted in consistent successes across the sites. Developing this comprehensive array of services for DFMB participants helped programs adhere to several Principles of Effective Treatment (National Institute on Drug Abuse (NIDA), 2018). This included acknowledging that no single treatment was appropriate for everyone, effective treatment attends to multiple needs of the individual, medications are an important element of treatment for many especially when combined with behavioral therapies, and that many individuals with SUD also have other mental health disorders.

Outcome successes are seen among the 328 live, term births where the majority (52%) of infants did not have a positive drug screen in the umbilical cord tissue. A significant decrease in positive drug screens over time was seen among participants who remained in the program until delivery. Unfortunately, not all the positive infant cord tissue screens were for MAT only, which is the ultimate goal of the project. As expected, some relapses occurred; we believe those not positive for MAT only were partially related to the many patients who continued cannabis use.

4.1. Strengths and weaknesses

Results are presented using both qualitative and quantitative analysis; the use of both of these methods strengthens our depth of understanding about the program and outcomes. Inherent within these methods are limitations for generalizability of results to other programs. Moreover, the study lacked a control group (e.g. non-completers or those who declined treatment); it should be noted that obtaining such data is difficult. We strove to minimize attrition bias by including outcomes data for participants who dropped out prior to the full two years post-partum but after delivery. However, the 28% of participants who dropped out prior to delivery had lower SES status than those who stayed at least until delivery, suggesting the results can only be generalized to those with slightly higher SES and were motivated to stay at least until delivery.

4.2. Public health implications

Results provide a wealth of implications for agencies wishing to utilize funding for treating pregnant and post-partum women with SUD. The results suggest that consistent with current public health perspectives, there is no single easy "fix" to the epidemic (Pitt et al., 2018). Agencies and providers should recognize that social and economic barriers (Dasgupta et al., 2018) are often the reason for the patient not receiving prenatal care, SUD treatment, or dropping out from the treatment. Results also demonstrated the importance of obtaining a detailed demographic and family history; for example, we observed high smoking rates with evidence that there were often other smokers in the home. This reflects the difficulty and resistance providers may encounter when discussing smoking cessation efforts. Although the DFMB program included tobacco cessation, this is often not emphasized given the difficulties of addressing all SUD.

Quantitative findings show that there were statistically- and clinically-significant sustained reductions in urine drug screens positive for substances over the course of the pregnancies among program completers. These findings contribute to the outcomes orientation for providers and expand the available evidence base of utilizing and unifying funding efforts across multiple agencies to combat this important public health issue.

5. Future research and conclusion

In summary, the DFMB program is a coordinated statewide effort, reaching a high-risk, medically-underserved population to provide a framework for programs in treating pregnant and post-partum women with SUD. The use of SBIRT within the DFMB program was useful for describing common and unique components among the four sites, and interviews with key personnel revealed some common barriers and innovative solutions. DFMB program has the potential to expand for better statewide coverage, and should include efforts targeting smoking and cannabis use during pregnancy. In terms of outcomes, DFMB should expand by getting women into DFMB and prenatal care sooner, and reducing the number of women who drop out from the program prior to the two years post-partum. The number of readmissions shows opportunities for expanding birth control education and options. Other explorations of the data is also necessary; for example, examining demographic factors associated with reductions in positive urine drug screens and other positive maternal and child outcomes.

Given positive outcomes, the DFMB program is in the process of expanding to other sites throughout the state. Results suggest specific recommendations that programs can follow for improved DFMB program outcomes; a manual is available that incorporates SBIRT and themes outlined here.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2019.100919.

Financial support

The funding for the project came from the West Virginia Bureau for Public Health, West Virginia Bureau for Behavioral Health and Health Facilities, and the Claude Worthington Benedum Foundation. Support for the project was also provided by NIH WVCTSI award 2U54GM104942-02.

Paper presentation information

Select findings were presented at American Public Health Association's 2018 meeting in San Diego, CA, Nov. 10–14.

Declaration of Competing Interest

The authors declare there is no conflict of interest.

Acknowledgments

We wish to thank the participating sites, program providers and data entry personnel, and patients for their participation in the program, particularly Greenbrier Physicians, Inc., Shenandoah Valley Medical Systems, Thomas Memorial, and West Virginia University Medicine, for their substantial contributions to this work. We additionally thank other members of the program evaluation team, including Kelly Gurka and Meagan Stabler, along with the Perinatal Partnership leadership, especially Amy Tolliver, Director, and Stefan Maxwell, MD, Chair, Substance Use in Pregnancy Committee for their contributions to the project.

References

ACOG Committee on Health Care for Underserved Women, 2012. ACOG Committee opinion no. 524: opioid abuse, dependence, and addiction in pregnancy. Obstet. Gynecol. 119, 1070–1076.

Behnke, M., Smith, V.C., Committee on Substance Abuse, Committee on Fetus Newborn, 2013. Prenatal substance abuse: short- and long-term effects on the exposed fetus. Pediatrics 131, e1009-24.

Center for Behavioral Health Statistics and Quality, 2017. 2016 National Survey on Drug Use and Health: Detailed Tables. Substance Abuse and Mental Health Services Administration, Rockville, MD.

Dasgupta, N., Beletsky, L., Ciccarone, D., 2018. Opioid crisis: no easy fix to its social and economic determinants. Am. J. Public Health 108, 182–186.

Harris, P.A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., Conde, J.G., 2009. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J. Biomed. Inform. 42, 377–381.

Hedegaard, H., Warner, M., Minino, A.M., 2017. Drug Overdose Deaths in the United States, 1999–2015. NCHS Data Brief. pp. 1–8.

Hudak, M.L., Tan, R.C., Committee On, D., Committee On, F., Newborn, American Academy of, P, 2012. Neonatal drug withdrawal. Pediatrics 129, e540-60.

Krans, E.E., Patrick, S.W., 2016. Opioid use disorder in pregnancy: health policy and practice in the midst of an epidemic. Obstet. Gynecol. 128, 4–10.

McClure, D., Mitra-Majumdar, M., Fass, J., 2018. Rethinking the Opioid Crisis: Using Seven Pay for Success Principles to Better Understand and Address the Crisis. Urban Institute.

Minnes, S., Lang, A., Singer, L., 2011. Prenatal tobacco, marijuana, stimulant, and opiate exposure: outcomes and practice implications. Addict. Sci. Clin. Pract. 6, 57–70.

National Institute on Drug Abuse (NIDA), 2018. Principles of Drug Addiction Treatment: A Research-Based Guide, Third edition. National Institute on Drug Abuse ,.

Paulozzi, L.J., Mack, K.A., Hockenberry, J.M., 2014. Variation among states in prescribing of opioid pain relievers and benzodiazepines—United States, 2012. J. Saf. Res. 51, 125–129.

Peles, E., Schreiber, S., Adelson, M., 2013. Opiate-dependent patients on a waiting list for methadone maintenance treatment are at high risk for mortality until treatment entry. J. Addict. Med. 7, 177–182.

Pitt, A.L., Humphreys, K., Brandeau, M.L., 2018. Modeling health benefits and harms of public policy responses to the US opioid epidemic. Am. J. Public Health 108, 1394–1400.

Rayburn, W.F., 2007. Maternal and fetal effects from substance use. Clin. Perinatol. 34 (559–71), vi.

Sandelowski, M., 2000. Whatever happened to qualitative description? Res. Nurs. Health 23, 334–340.

SAS Institute Inc, 2013. SAS 9.4. Inc., S.I, Cary, NC.

Sigmon, S.C., 2014. Access to treatment for opioid dependence in rural America: challenges and future directions. JAMA Psychiatry 71, 359–360.

Stitely, M.L., Calhoun, B., Maxwell, S., Nerhood, R., Chaffin, D., 2010. Prevalence of drug use in pregnant West Virginia patients. W. V. Med. J. 106, 48–52.

U.S.D.o.H.a.H.S, 2019. HHS Releases Additional $487 Million to States, Territories to Expand Access to Effective Opioid Treatment; 2019 SOR Grants Will Total $1.4 Billion.

United States Census Bureau, 2010. Census Urban and Rural Classification and Urban Area Criteria: Lists of Population, Land Area, and Percent Urban and Rural in 2010 and Changes from 2000 to 2010.

West Virginia Perinatal Partnership, 2018. wvperinatal.org.