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Marijuana Use among Pregnant Women in a High-Risk Population

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Abstract

Background: Marijuana is the most commonly used illicit substance in pregnancy, often used concurrently with tobacco, increasing the risk for prematurity and low birth weight. Programs such as Healthy Start and CenteringPregnancy® provide resources and prenatal care to women in underserved communities in hopes of improving birth outcomes.

Objective: Evaluate marijuana use in pregnant women living in Montgomery County, Ohio in the highest risk zip codes (45402, 45403, 45405, 45414, 45416, 45417, 45426) and determine if use at delivery is lower in women enrolled in CenteringPregnancy® compared to women who were not.

Methods: A secondary analysis of previously collected de-identified data examined marijuana use among 182 women who delivered their babies between January 2016 and April 2017. Outcomes of interest were tetrahydrocannabinol (THC) and gestational age at delivery. Variables included maternal age, race, zip code, education, and poverty level and type of insurance. Descriptive and inferential statistical analyses were performed.

Results: Black women with a high school education living below the poverty line had higher rates of THC at intake. There was no significant association between participation in CenteringPregnancy® and marijuana cessation by delivery; however, rates of cessation were higher among those in Healthy Start alone. Positive THC at intake increased odds of preterm birth and participation in CenteringPregnancy® decreased odds, although not statistically significant.

Conclusion: Participation in community based prenatal care programs may be beneficial in targeting high-risk, underserved populations to encourage cessation of illicit substances and improve birth outcomes. Further evaluation with a larger sample size is needed.

Keywords: Infant mortality, prematurity, prenatal care, disparities

Marijuana Use among Pregnant Women in a High-Risk Population

Infant mortality is an indicator of the health of a nation because of its association with many public health factors such as maternal health, access to quality medical care and socioeconomic disparities (MacDorman, Matthews, Mohangoo, & Zeitlin, 2014). Defined as the death of an infant before his or her first birthday, high infant mortality rates (IMR) continue to be a significant problem in the United States. The national IMR in 2015 was 5.9 deaths per 1,000 live births and Ohio had an IMR rate of 7.2 deaths per 1,000 live births (National Center for Health Statistics, 2017). The outcomes were worse in 2016 with an overall state IMR of 7.4 deaths per 1,000 births and 6.8 deaths per 1,000 births in Montgomery County, OH. When categorized by race, the IMR per 1,000 live births was 15.2 deaths of Black infants, 7.3 deaths of Hispanic infants and 5.8 deaths of White infants in 2016, highlighting the significant disparities which continue to exist (Ohio Department of Health [ODH], 2016).

Among the leading causes of the infant death in Ohio are birth defects, Sudden Infant Death Syndrome (SIDS) and obstetrical complications; but the most significant contributor to infant mortality is prematurity related conditions such as preterm birth, low birth weight, respiratory distress syndrome, and neonatal hemorrhage (ODH, 2016). Prematurity related conditions may not always be preventable, but there are many behavioral and lifestyle choices that can be made to decrease a woman's risk of delivering prematurely. Given that rates of prematurity are alarmingly high in Ohio, it is important to evaluate the factors contributing most to poor birth outcomes and what changes can be made.

Although some causes of infant mortality are inevitable, there are many that can be controlled and are the targets of initiatives that aim to decrease IMRs. One of the most common yet preventable factors contributing to prematurity related conditions is smoking. Smoking

cigarettes during pregnancy can not only lead to preterm birth and low birth weight babies but is also a risk factor for SIDS (Centers for Disease Control and Prevention [CDC], 2017c). Yet, many women continue to smoke during pregnancy. Further, more women are anticipated to engage in marijuana use during pregnancy, particularly as marijuana continues to be legalized in states throughout the U.S. (The American College of Obstetricians and Gynecologists [ACOG], 2017). Research suggests that the self-reported rates of marijuana use in pregnancy is anywhere from 2%-5% (ACOG, 2017). When considering women from disadvantaged and lower socioeconomic statuses (SES), the rates increase to 15%-28% (ACOG, 2017).

Per the Centers for Disease Control and Prevention (CDC, 2017b), more women are turning to marijuana use to ease nausea and/or other symptoms of pregnancy. However, little is known about the direct effects that marijuana can have on the health of the baby. Some studies suggest that marijuana use during pregnancy can affect attention, memory, problem-solving skills and behavior of children later in life (CDC, 2017a). Because of this uncertainty, it is recommended that women refrain from using marijuana during preconception, pregnancy and lactation (ACOG, 2017).

However, over the past decade, trends in the perception of low risk with marijuana use have steadily increased (Liu & Roman, 2017). Using results from the National Survey of Drug Use and Health, Liu and Roman (2017) compared perceived risk of marijuana use among women in 2005 to their perceived risk in 2015. Among pregnant women who used marijuana in the past 30 days, 65.4% in 2015 believed that using marijuana one to two times a week did not confer a risk of harm compared to 25.8% in 2005 and 62.6% of non-pregnant women in 2015 did not perceive a risk compared to 23.7% in 2005 (Liu & Roman, 2017). Given the uncertainty of its

effect on the developing fetus, it is alarming that public perception that marijuana use is not harmful continues to increase, particularly among pregnant women.

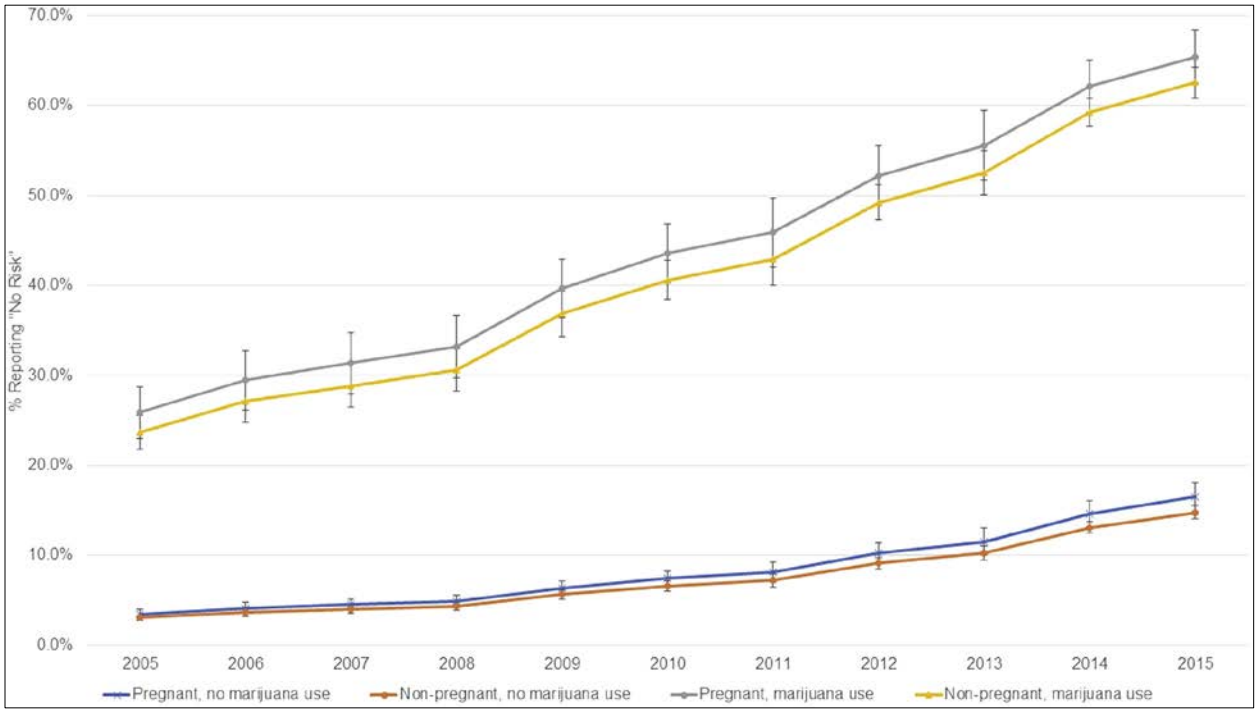

Figure 1: Increasing trends in perception of 'no risk' with marijuana use. Adapted from "Trends in perception of risk of regular marijuana use among US pregnant and nonpregnant reproductive-aged women," by Y. Liu & L. D. Roman, 2017.

Due to the worsening infant mortality rates in the State of Ohio and particularly in Montgomery County, $26.8 million was allocated for the implementation of several community based programs as solutions. The funds were allocated in Governor John Kasich's 2016 budget to be distributed over two years to programs, organizations and entities that provide care to women and infants most at risk (Bailey, 2016). One such program is Healthy Start, an Ohio Medicaid program designed to provide resources to uninsured children in families with an income up to 206% of the poverty line, insured children in families with an income up to 156% of the poverty line and pregnant women in families with an income up to 200% of the poverty

line (Ohio Department of Medicaid, n.d.). Those who qualify for the program are eligible to receive a variety of services and benefits to help them lead healthier lives. Nine counties, including Montgomery County, were selected to receive funds to support their community efforts at combating high infant mortality rates. The additional funds resulted in an expansion of the Healthy Start Program at Five Rivers Health Centers to include all patients of the Five Rivers Center for Women's Health and women in the highest risk communities in Montgomery County (Bailey, 2016; Five Rivers Health Centers, 2018).

CenteringPregnancy® is another program designed to help combat issues contributing to infant mortality and preterm birth among the highest risk populations. In this program, groups of eight to 12 women of similar gestational ages meet for 10 prenatal visits. Studies demonstrate that women who participate in a CenteringPregnancy® program have improved birth outcomes and infant birth weight as well as decreased chances of preterm delivery compared to women who do not participate in the program, especially among underserved, high risk populations (CenteringPregnancy®, 2016). Women receive increased support from their peers and are encouraged to make healthy decisions during pregnancy for themselves and their babies. The CenteringPregnancy® materials cover topics such as nutrition, common discomforts of pregnancy, stress management, what to expect in labor and delivery, breastfeeding and infant care (Centering Healthcare Institute, n.d.). A CenteringPregnancy® pilot program was implemented at the Five Rivers Health Centers because of legislation that passed in 2015. With the implementation of several programs, specifically the expansion of Healthy Start and introduction of CenteringPregnancy®, several groups of women from the highest risk zip codes in Montgomery County have been identified and enrolled in these programs in hopes of addressing the biggest factors contributing to infant mortality in this population.

Statement of Purpose

The purpose of this study was first to establish a baseline of marijuana use in pregnant women in Montgomery County, Ohio who were enrolled in the Expanded Healthy Start program at Five Rivers Center for Women's Health. Additionally, this study was being conducted to determine whether women enrolled in Expanded Healthy Start programs who were also receiving prenatal care through CenteringPregnancy® have higher rates of marijuana cessation at the end of the Centering program compared to women who are enrolled in Expanded Healthy Start alone. Lastly, this study sought to evaluate the impact group prenatal care such as CenteringPregnancy® can have on birth outcomes.

Literature Review

Marijuana is the most commonly used illicit drug in persons aged 12 and older (Ko, Farr, Tong, Creanga, & Callaghan, 2015). One in 25 women report marijuana use during pregnancy in the United States (CDC, 2017b). A study by Ko et al. (2015) determined that the women with higher rates of smoking marijuana while pregnant were non-Hispanic African American women between the ages of 18 and 25, who were unemployed or earned less than $20,000 per year, single, and uninsured. The women were also less likely to have attended high school (Mark, Desai, & Terplan, 2016). These women were also more likely to engage in other high-risk behaviors such as heavy or binge drinking, using other illicit drugs and smoking tobacco (Ko et al., 2015). Drug use was higher in the first trimester than third trimester and nearly half of the pregnant women used marijuana daily or twice a week in the year prior to the study (Ko et al., 2015). Despite the widespread prevalence, research on the effects of marijuana use during pregnancy has found differential results.

The effects of marijuana on the body are due to tetrahydrocannabinol (THC), a small, highly lipophilic molecule that is rapidly distributed to the brain and fat from the lungs when inhaled or the gastrointestinal tract when ingested (ACOG, 2017). Many of the effects of its use during pregnancy have been observed in animal studies due in part to limitations of conducting human studies, as well as the presence of other confounding factors. Animal models have demonstrated how THC readily crosses the placenta and produces fetal plasma levels that are nearly 10% of maternal levels (ACOG, 2017).

An increasing number of studies have been focusing on learning more about the effects THC may have in pregnant women. In humans, there are two primary cannabinoid receptors—CB_1 and CB_2. CB_1 receptors are present early in pregnancy, by weeks 5-11 of gestation (Harkany et al., 2017). The receptors release endocannabinoids-- neurotransmitters which are important for the development and communication of neurons (Harkany et al., 2007). These neurotransmitters affect areas of the brain that play a role in pleasure, memory, thinking, concentration, movement, coordination and sensory and time perception (National Institute on Drug Abuse [NIDA], 2018). The endocannabinoid system is also important for regulation of hormone secretion in relation to reproductive functions and response to stress, as well as energy homeostasis. Additionally, the endocannabinoid system has activity in the food intake center of the central nervous system (CNS) and GI tract, regulating the central and peripheral mechanisms of food intake, synthesis of fats, turnover in liver and adipose tissue and metabolism of glucose in muscle cells (Komorowski & Stepien, 2007). These are essential functions in the adult but are particularly important in the developing fetus.

The structure of THC is like endocannabinoids naturally found in the body, which allows the molecule to bind to and activate cannabinoid receptors, subsequently disrupting normal

mental and physical functions (NIDA, 2018). Therefore, the use of marijuana in pregnancy can negatively affect normal development of the neurological pathways in the fetus, leading to difficulties with cognitive, motor and social abilities (Harkany et al., 2007). Research demonstrates that marijuana smoke also causes fivefold higher serum carbon monoxide levels when compared with tobacco, which may contribute to impaired gas exchange between the mother and fetus in utero (Conner et al., 2016). Other animal studies showed low birth weight in the offspring of animals exposed to high doses of THC in pregnancy (Marroun et al., 2009). In the infant, marijuana can cause an exaggerated startle response and difficulty acclimating to new stimuli. Long term effects may be seen in adolescents who may struggle with hyperactivity, inattention and slower cognitive function (Harkany et al., 2007).

Despite these findings, another systematic review determined that marijuana use alone was not a significant risk factor for preterm birth and low birth weight (Conner et al., 2016). However, studies suggest that women using marijuana are also more likely to be using other substances shown to be harmful to the baby. One meta-analysis determined that THC was associated with stillbirth at 20 weeks of gestation and beyond, however it is possible that those effects were confounded by concurrent use of tobacco (ACOG, 2017).

Another important factor to consider is the amount and frequency of marijuana use. After adjusting for confounding factors, one retrospective cohort study found that there was an increased risk of small for gestational age babies (< 2500 g) and admission to the neonatal intensive care unit (NICU) in women who used marijuana at least once a week (Warshak et al., 2015). These results reiterate the recurrent theme in the literature that marijuana use alone may not significantly contribute to adverse birth outcomes. However, when consumed in large amounts, there is risk of harm to the infant. Additionally, there is strong epidemiological

evidence to suggest an association between substance use in general and adverse birth outcomes (Ko et al., 2015).

A retrospective study by Mark, Desai, and Terplan (2016) determined that in women who tested positive for marijuana use at the initiation of their prenatal care, the vast majority stopped using by the time of delivery. This result was attributed to receiving education about changing their behavior during their prenatal care. These researchers also found, in contrast to other studies, that the number of low birth weight infants was not different between women who used marijuana and women who did not. Again, this finding is attributed to confounding factors present in the other studies. These factors include lack of control for variations in prenatal care received, discrepancies in socioeconomic status between the marijuana use and non-marijuana use groups and concurrent use of other substances (Mark et al., 2016). Given that low SES is itself a risk factor for adverse birth outcomes, the Mark et al. (2016) study controlled for this factor by comparing groups within the same SES and all the women received prenatal care, which has been shown to reduce illicit drug use in pregnancy.

Although there are discrepancies in the literature regarding the effects of marijuana use on the developing fetus, there is emerging research that points to a risk. The risk of adverse birth outcomes has driven the current recommendations regarding marijuana use in pregnancy, which are to encourage women not to use or to stop using the drug if they are currently. This risk is especially important among underserved communities, where the women are more likely to be engaging in other risky behaviors that could pose a threat to the fetus, increasing the risks for adverse birth outcomes and infant mortality. It is for these reasons that this study is being conducted in Montgomery County, OH.

Methods

A secondary analysis of pre-existing de-identified data was conducted to examine rates of marijuana use among pregnant women enrolled in Healthy Start and CenteringPregnancy®. The study was exempt from review by the Wright State University Institutional Review Board (IRB) because the data was already collected and de-identified prior to receiving it for analysis (see Appendix A). The research questions included:

1. Are the rates of marijuana use lower at the completion of a CenteringPregnancy® program compared to women who are enrolled in Healthy Start alone?
2. Is there an association between marijuana use and preterm birth?
3. What role do community programs such as CenteringPregnancy® and Healthy Start play in improving birth outcomes?

Data was collected by medical staff at Five Rivers Centers for Women's Health. A detailed history was obtained from all women presenting for their initial OB visit and a thorough physical exam was conducted along with a routine urine drug screen (UDS). The UDS screened for common substances such as benzodiazepines, barbiturates, methamphetamines, opiates, oxycodone, 3,4-Methylenedioxymethamphetamine (MDMA), cocaine, methadone and THC. Intakes and UDS were done by nurses or medical assistants. The history and physical exams were conducted by certified nurse midwives. A repeat UDS was conducted at the time of delivery by a nurse on the labor and delivery floor. A consent did not need to be signed as this was part of the routine OB intake visit.

For this analysis, confidential data was retrieved by the clinical data analyst from the Epic electronic medical records and the Go Beyond WellFamily Database System in which all clinical patient encounters and/or phone conversations were recorded. The de-identified data set

was then provided for secondary analysis. The Healthy Start and CenteringPregnancy® staff included three community health workers, a data analyst, high risk nurse educator, licensed social worker, certified nurse midwives, dietician and two Brighter Futures home visiting nurses.

Inclusion and Exclusion Criteria

All participants were women living in the Montgomery County, OH zip codes with the highest risk of preterm delivery (45402, 45403, 45405, 45414, 45416, 45417 and 45426). Every woman who presented to the clinic for prenatal care was offered the opportunity to enroll in CenteringPregnancy®; however, only women from the highest risk zip codes were offered the opportunity to enroll in the Healthy Start Program as that was the target population previously identified. Women who were not offered the opportunity to enroll in Healthy Start and/or CenteringPregnancy® included those with a high-risk, complicated pregnancy who needed more intensive care throughout their pregnancies. Non-English speaking patients were also not offered the opportunity to enroll and participate in CenteringPregnancy® as there were no group leaders who could speak other languages.

Analysis Plan

Frequencies and percentages were used to describe the demographics of the study participants. Independent variables included in the analysis were maternal age, race (categorized into Black, White and other), highest level of education (recoded into three categories: <high school, high school degree, some college or more), socioeconomic status by measure of poverty level (below, at or above the poverty line) and type of insurance (recoded into five categories: Care Source, United Healthcare, Community Plan, Medicaid and Private/other), and zip code of residence. Dependent variables were positive THC at intake and delivery and gestational age at delivery. Using the World Health Organization's definition of preterm being between 32 and 37

weeks and term birth being 37 weeks to less than 42 weeks, gestational age at delivery was re-coded into preterm and term. There were no data points less than 32 weeks (very preterm) or 42 weeks or greater (post-term). There were 182 participants included in the analysis.

One woman tested positive for cocaine at intake but it is unclear as to whether she also tested positive for THC. Based on the literature which suggests that women using marijuana are also likely to be using other substances, cocaine was counted as a yes with regards to positive THC at intake and no for negative THC at delivery.

Results

Descriptive Analysis

Table 1 describes the study population by zip code. There were 182 participants in this study. Overall, most of the women were Black (n = 144, 79%), had at least a high school degree and lived below the poverty line. The 45417-zip code had the largest proportion of participants (n = 54). Mean maternal age overall was 24.76 ± 5.37 years old with the youngest participant being 15 years old and the oldest participant being 41 years old. The mean gestational age at delivery was 38.63 weeks ± 1.62 weeks. The minimum gestational age was 32.3 weeks (0.5%) and the maximum gestational age was 41.4 weeks (0.5%). Many of the women delivered at term (37 weeks or greater). Forty women were enrolled in CenteringPregnancy® and Healthy Start and 142 women were enrolled in Healthy Start alone.

Table 1

Characteristics of Study Population, by Zip Code

Independent Variable *n*(%)	**45402 (*N*=18)**	**45403 (*N*=28)**	**45405 (*N*=34)**	**45414 (*N*=25)**	**45416 (*N*=4)**	**45417 (*N*=54)**	**45426 (*N*=19)**
Maternal Age Mean ± SD	26.89±8.17	25.57±4.59	25±5.31	22.2±3.84	27.5±5	24.72±5.07	24.05±5.22
Race							
Black (*n*=144)	18 (100)	8 (28.6)	30(88.2)	18(72)	4(100)	47(87)	19(100)
White (*n*=35)	0	18(64.3)	4(11.8)	7(28)	0	6(11.1)	0
Other (*n*=3)	0	2	0	0	0	1(1.9)	0
Education Level							
<HS Degree (*n*=41)	4 (22.2)	7 (25)	6 (17)	4 (16)	1 (25)	16(29.6)	3(15.8)
HS Degree (*n*=74)	8 (44.4)	8 (28.6)	11(32.4)	14 (56)	1 (25)	21(38.9)	11(57.9)
Some college or more (*n*=67)	6 (33.3)	13 (46.4)	17 (50)	7 (28)	2 (50)	17(31.5)	5(26.3)
Poverty Level							
Below	14 (77.8)	20 (71.4)	22(64.7)	21 (84)	4(100)	37 (68.5)	11 (57.9)
At	3 (16.7)	6 (21.4)	12(35.3)	4 (16)	0 (0)	15 (27.8)	8 (42.1)
Above	1 (5.6)	2 (7.1)	0 (0)	0 (0)	0 (0)	2 (3.7)	0 (0)
Insurance							
Care Source	17 (94.4)	21 (75)	31(91.2)	18 (72)	4(100)	51 (94.4)	16 (84.2)
UHCC	1 (5.6)	1 (3.6)	1 (2.9)	0 (0)	0	2 (3.7)	0 (0)
Buckeye	0	2 (7.1)	0 (0)	2 (8)	0	0 (0)	1 (5.3)
Medicaid	0	1 (3.6)	1 (2.9)	3 (12)	0	1 (1.9)	0 (0)
Private or other	0	3 (10.7)	1 (2.9)	2 (8)	0	0 (0)	2 (10.5)
Centering (*n*=40)							
Yes	3 (16.7)	4 (14.3)	5 (14.7)	11 (44)	0 (0)	12 (22.2)	5 (26.3)
No	15 (83.3)	24 (85.7)	29(85.3)	14 (56)	4(100)	42 (77.8)	14 (73.7)
Preterm Delivery (*n*=21)	1(5.6)	1(3.6)	4(11.8)	3(12)	0	7(13)	5(26.3)
Term Delivery (*n*=161)	17(94.4)	27(96.4)	30(88.2)	22(88)	4(100)	47(87)	14(73.7)

Note: Centering= CenteringPregnancy®; under insurance, "other" includes Paramount and SFS.

Table 2 shows the rates of positive THC tests at intake. Sixty women (33%) tested positive for THC at intake; one woman tested positive for cocaine (0.5%). Given the likelihood that the cocaine user was also using THC, the cocaine data point was included in the positive THC outcome, bringing the total number of women who tested positive to 61. The cocaine test was negative at delivery so likewise, that data point was included in the negative test outcome.

Eleven of the 61 women (18%) who tested positive for THC at intake participated in CenteringPregnancy®. Of the women who tested positive for THC at intake, 53 (86.9%) were Black and eight (13.1%) were White. Of the 53 Black women and eight White women who tested positive for THC at intake, only 10 Black and one White woman were enrolled in CenteringPregnancy®. Forty-nine (80.3%) of the women who tested positive for THC were below the poverty line and 11 women (18%) were at the poverty line. At delivery, 21 women still tested positive for THC. Of those, six women (28.6%) were enrolled in CenteringPregnancy®.

Table 2

Positive THC by Characteristics

	THC at Intake (*n*=61)	**THC at Delivery (*n*=21)**
Race		
Black	53 (86.9)	20 (95.2)
White	8 (13.1)	1 (4.8)
Other	0	0
Education		
<HS	16 (26.2)	5 (23.8)
HS	25 (41)	11 (52.4)
Some College or more	20 (32.8)	5 (23.8)
CenteringPregnancy®		
Yes	11 (18)	6 (28.6)
No	50 (82)	15 (71.4)
Poverty		
Below	49 (80.3)	16 (76.2)
At	11 (18)	5 (23.8)
Above	1 (1.6)	0

Note: Results reported as *n*(%).

Table 3 describes the rates of preterm birth within this population by demographic characteristics. There were 21women who delivered preterm, and the majority were Black women (19) and women with at least a high school degree (16). The 45426-zip code had the

largest percentage of its participants deliver preterm compared to the other zip codes (26.3%). Still, most of the women delivered at term (88.5%).

Table 3

Birth Outcomes by Variables

	Preterm Birth (*n*=21)	**Term Birth (*n*=161)**
Race		
Black	19 (90.5)	125 (77.6)
White	2 (9.5)	33 (20.5)
Other	0	3 (1.9)
Education		
<High School	5 (23.8)	36 (22.4)
High School Degree	10 (47.6)	64 (39.8)
Some College or more	6 (28.6)	61 (37.9)
Poverty Level		
Below	13 (61.9)	116 (72)
At	7 (33.3)	41 (25.5)
Above	1 (4.8)	4 (25.5)
Zip Code		
45402	1 (5.6)	17 (94.4)
45403	1 (3.6)	27 (96.4)
45405	4 (11.8)	30 (88.2)
45414	3 (12)	22 (88)
45416	0 (0)	4 (100)
45417	7 (13)	14 (87)
45426	5 (26.3)	14 (73.7)

Note: Results reported as *n*(%).

Inferential Analysis

A cross-tabulation was used to compare the relationship between participation in CenteringPregnancy® and the presence of THC at delivery. A Chi-square test was conducted to determine if there was an association between participation in CenteringPregnancy® and a negative THC test result at delivery (results not shown). The conditions of the Chi-square test were not satisfied as one of the cells had an expected count less than five. As such, the likelihood ratio was used with a value of 0.570 and asymptotic significance of 0.450. Alpha was set at 0.05. Given that the likelihood ratio significance level was greater than 0.05, there was no statistically

significant association between participation in CenteringPregnancy® and a negative THC result at delivery. The odds of a negative THC result, given participation in CenteringPregnancy®, were lower than for those who did not participate in the program [odds ratio (OR) = 0.67, 95% confidence interval (CI) = 0.24-1.86] (Table 4). However, these results are not statistically significant either.

Table 4

THC at Delivery Based on Participation in CenteringPregnancy®

	THC at Delivery			
CenteringPregnancy	**No**	**Yes**	**OR**	**CI**
Yes	34 (21.1)	6 (28.6)	0.67	0.24-1.86
No	127 (78.9)	15 (41.4)		

Note: Frequencies reported as *n*(%); odds ratio is unadjusted.

Bivariate analyses were also conducted to examine the association between THC at delivery and the other independent variables (age, race, poverty and education level, type of insurance). There were no statistically significant associations between these variables and THC at delivery. Of note, however, is that the likelihood for Black women to test positive for THC at delivery is more than five times the likelihood for White women to test positive (results in Table 5). Odds ratios and confidence intervals could not be calculated for poverty level and type of insurance as some cells had zero value. Instead, the likelihood ratios were used because the conditions of the Chi-square test were not satisfied. Again, there were no statistically significant associations between poverty level (p = .502) or type of insurance (p = .447) and positive THC at delivery. An independent sample t-test was used to evaluate the association between age and THC at delivery; however, there was no statistically significant association between age and positive THC at delivery, $t(180)=1.21$, p = .227.

Table 5

Associations Between Demographic Characteristics and THC at Delivery

	THC at Delivery			
	Yes	**No**	**OR**	**CI**
Race				
White	1	34	1.00	
Black	20	124	5.34	0.64-41.58
Other	0	3	0	0
Education				
HS	11	63	1.00	
<HS	5	36	0.92	0.28-2.98
Some College or other	5	62	0.49	0.16-1.52

Table 6 demonstrates the rates of preterm births within the sample that tested positive for THC at intake and those that participated in CenteringPregnancy®. A Chi-square test was conducted to determine if there was association between positive THC at intake and preterm birth; however, the results were not statistically significant. The odds of preterm birth given a positive THC result at intake was 1.57 [CI=0.622-3.96]. While these results suggest an increased likelihood of preterm birth among those positive for THC, they are not statistically significant. A Chi-square test was also performed to determine if there was an association between participating in CenteringPregnancy® and preterm birth. The conditions of the test were not satisfied so the likelihood ratio was evaluated. Again, there was no statistically significant association between participation in CenteringPregnancy® and delivering preterm. The odds for delivering preterm appear to be lower for those who participated in CenteringPregnancy® than those who did not participate in CenteringPregnancy® [OR=0.34, CI=0.08-1.53]. While these results are suggestive, they are not statistically significant.

Table 6

Preterm Birth Based on Positive THC at Intake and Participation in CenteringPregnancy®

	Preterm Birth			
THC at Intake	Yes	No	OR	CI
Yes	9 (42.9)	52 (32.3)	1.57	0.622-3.96
No	12 (57.1)	109 (67.7)		
CenteringPregnancy				
Yes	2 (9.5)	38 (23.6)	0.34	0.08-1.53
No	19 (90.5)	123 (76.4)		

Note: Frequencies reported as *n*(%); percentage reported as % within gestational age at delivery; unadjusted odds ratios are reported.

A McNemar's test was conducted to determine if there was a statistically significant difference in THC test results at intake and delivery. The difference in test results (THC at intake and delivery) was evaluated separately between those who participated in CenteringPregnancy® and those who did not. Overall, there was a statistically significant decrease in the proportion of women testing positive for THC at delivery as compared to intake. However, this significance is seen among the proportion of women who did not participate in CenteringPregnancy® ($p = .001$) rather than the women who did participate in CenteringPregnancy® ($p = .18$).

Table 7

Difference in THC Rates from Intake to Delivery

Centering		
	Delivery	
Intake	Yes	No
Yes	4	7
No	2	27

No Centering		
	Delivery	
Intake	Yes	No
Yes	14	36
No	1	91

Test Statistics [a]	
	Intake & Delivery
N(Centering)	40
Exact Sig. (2-tailed)	.18[b]
N (no Centering)	142
Exact Sig (2-tailed)	.001[b]

[a]McNemar test
[b]Binomial distribution used

Based on the bivariate analyses, there were no statistically significant associations between the independent variables (age, race, education level, type of insurance, and level of poverty) and THC at delivery or CenteringPregnancy®, likely due to sample size. However, given the trends in the literature of marijuana use during pregnancy being associated with African American women with less than a high school education and living in poverty, a

binomial logistic regression was performed to determine if THC at delivery could be predicted by the primary independent variable of interest, CenteringPregnancy®, controlling for the other variables of race, education and poverty level. After adjusting for race, education and poverty level, the likelihood of testing positive for THC at delivery were 1.38 times higher for those in CenteringPregnancy® than those who were not in the program (Table 8). The likelihood of testing positive for THC at delivery were more than five times higher for Black women compared to White women. The likelihood of testing positive for THC at delivery was lower for women with some college education or more and only slightly lower for women who had less than a high school degree compared to women with a high school degree. The likelihood of positive THC at delivery by poverty level was excluded because the final model was unable to predict an association as some categories had no values.

Table 8

Logistic Regression Model for Positive THC at Delivery Based on Independent Variables

Variables	aOR	95% CI
Centering (Yes vs. No)	1.38	0.49-3.93
Race		
White		
Black	5.34	0.68-41.58
Other	0	--
Education		
HS degree		
<HS	0.92	0.283-2.981
Some college or more	0.49	0.156-1.521

Note: Reference for race was White, education was HS degree; aOR= adjusted odds ratio.

Discussion

According to the results, Black women with a high school education living below the poverty line had higher rates of marijuana use among this study population. This corroborates the results previous studies have demonstrated (Mark et al., 2016). Although not statistically

significant, the results suggested a higher potential for testing positive for THC at delivery among women in CenteringPregnancy® compared to women not in CenteringPregnancy®. There was a decrease in marijuana use from intake to delivery among the subset of the population participating in CenteringPregnancy®, but not as significant as in the group that was not in CenteringPregnancy®. This finding is in contrast to previous studies which found that prenatal care decreased the use of illicit drug use in pregnancy (Mark et al., 2016). One possible explanation is that although all the women are high risk by way of their zip code of residence, the women enrolled in both CenteringPregnancy® and Healthy Start are at an even higher risk than the other women. This may also be due to race. Among those who tested positive for THC at intake and enrolled in CenteringPregnancy®, 90.9% were Black. This is also corroborated with the finding that Black women were about five times more likely to test positive for THC at delivery than White women. Perhaps there are more barriers to overcome for marijuana cessation to occur among Black women enrolled in CenteringPregnancy®. It is also plausible that although the group setting for CenteringPregnancy® is beneficial for discussing topics such as healthy nutrition and stress management, the additional services provided by Healthy Start, such as home visits, may be more beneficial for addressing issues of illicit substance use.

Additionally, the suggestion that the odds of preterm birth are higher among those who tested positive for THC at intake is consistent with some findings in the literature regarding substance use and adverse birth outcomes (Ko et al., 2015). It is difficult to say if this association is solely due to marijuana use because the use of other illicit substances was not included in this study and could not be controlled. These findings, at the very least, suggest that marijuana use may not be entirely harmless, especially because it is known that use of this substance often occurs concurrently with other substances (Ko et al., 2015). Without knowing the other social

history of the women, the strength of the association between marijuana use and increased risk of preterm birth cannot be evaluated with any certainty.

On the contrary, the suggestion that the odds of preterm birth are lower among women receiving prenatal care through CenteringPregnancy® (2016) is also consistent with the literature. Additionally, birth outcomes in this population, although high-risk, were favorable (88.5% term births). This goes to show that group prenatal care is in fact beneficial, especially among minority women of lower SES. This finding supports the necessity of this program and others like it to continue its work in educating and encouraging women to be as healthy as possible throughout their pregnancies.

Recommendations for Practice and Public Health

Overall, group prenatal care is recommended as it provides a lot of support and resources to the women who need it the most. This non-traditional approach to prenatal care is unique in that it allows for more time to address specific concerns the women have and does so in a non-threatening environment. However, there is still room for improvement. The topics covered in the materials provided by the Centering Healthcare Institute are relevant for any group of pregnant women, regardless of location. Still, it may be necessary to better tailor some of the sessions to each specific target population. For example, this target population in Montgomery County, OH may need a session specifically dedicated to the potential risks of marijuana use during pregnancy, whereas groups in other communities may not. It is also recommended that, when available, women from high risk communities enroll in both CenteringPregnancy® and Healthy Start. It appears that each organization is beneficial in different ways so participation in both would have a synergistic effect in tackling multiple issues and helping these women in the most effective way.

It will also be of the utmost importance in public health practice going forward to change the culture/perception of marijuana use, particularly among pregnant women. As more knowledge is gained regarding the risks marijuana use may have on adverse birth outcomes, it will be vital for groups such as CenteringPregnancy® to strongly encourage cessation. Despite insignificance, the findings of this study suggest a risk of preterm birth when using marijuana. Therefore, it is still best to recommend that women do not engage in use of marijuana or any other illicit drugs during pregnancy, in congruence with the ACOG recommendations.

Finally, it is recommended for this program to be implemented in neighboring communities that need to improve their birth outcomes but do not yet have programs such as CenteringPregnancy® and Healthy Start. All in all, organizations that focus on group prenatal care and a biopsychosocial/multi-disciplinary approach to prenatal care appears to be a step in the right direction for addressing issues that women in underserved, high-risk communities are facing.

Limitations

There are several notable limitations to this study. The first limitation is the small sample size. Because there were only 182 participants in the study and only 40 of whom participated in CenteringPregnancy®, it was difficult to have enough power to determine statistical significance. The results were suggestive of an association between participation in CenteringPregnancy® and decreased likelihood of preterm birth. It was also suggestive of an increased risk of preterm birth with positive THC at intake and increased likelihood of testing positive for THC at delivery with participation in CenteringPregnancy®; however, this is inconclusive because of the lack of statistical significance.

Additionally, the frequency, amount and duration of marijuana use was unknown. Although there was a decrease in positive THC at delivery overall, it is unknown at what point in the pregnancy the women stopped using the drug, which could be important to determining potential effects to the baby.

Another limitation is that non-English speaking women were excluded from the study because there was no CenteringPregnancy® group for women unable to speak English at the time this data was collected. Given that Hispanic infants also have high IMRs, it would be important for future studies to include Spanish-speaking women and try to identify potential solutions to the issues facing that population. Since the time the data for this analysis was collected, however, a Spanish CenteringPregnancy® group has been started at the Center for Women's Health.

Although a logistic regression model was utilized to decipher an association between the independent variables and outcome, tobacco use was unknown. This would have been an important variable to include in the data set to eliminate it as a potential confounding factor. Another possible limitation is the fact that all of the women were enrolled in Healthy Start. It is difficult to make true comparisons between a CenteringPregnancy® only group and Healthy Start only group as there was overlap for some participants. This overlap is good in terms of increasing the amount of resources and support the women were receiving; however, because specific differences between groups could not be detected, it is difficult to assess which facets of each program are effective and which could be improved to better meet the women's needs. Still, this study provides baseline data that both groups can utilize to continue to improve their programs and work together to combat the issues women face that pose a threat to their birth outcomes.

Conclusion

Overall, although the results were inconclusive because of lack of significance, strides were made in terms of evaluating the effectiveness of group prenatal care on improving birth outcomes within a high-risk population. Future studies with a larger sample size are needed to evaluate the effects that group prenatal care such as CenteringPregnancy® can have on reducing the prevalence of illicit drug use among high-risk women.

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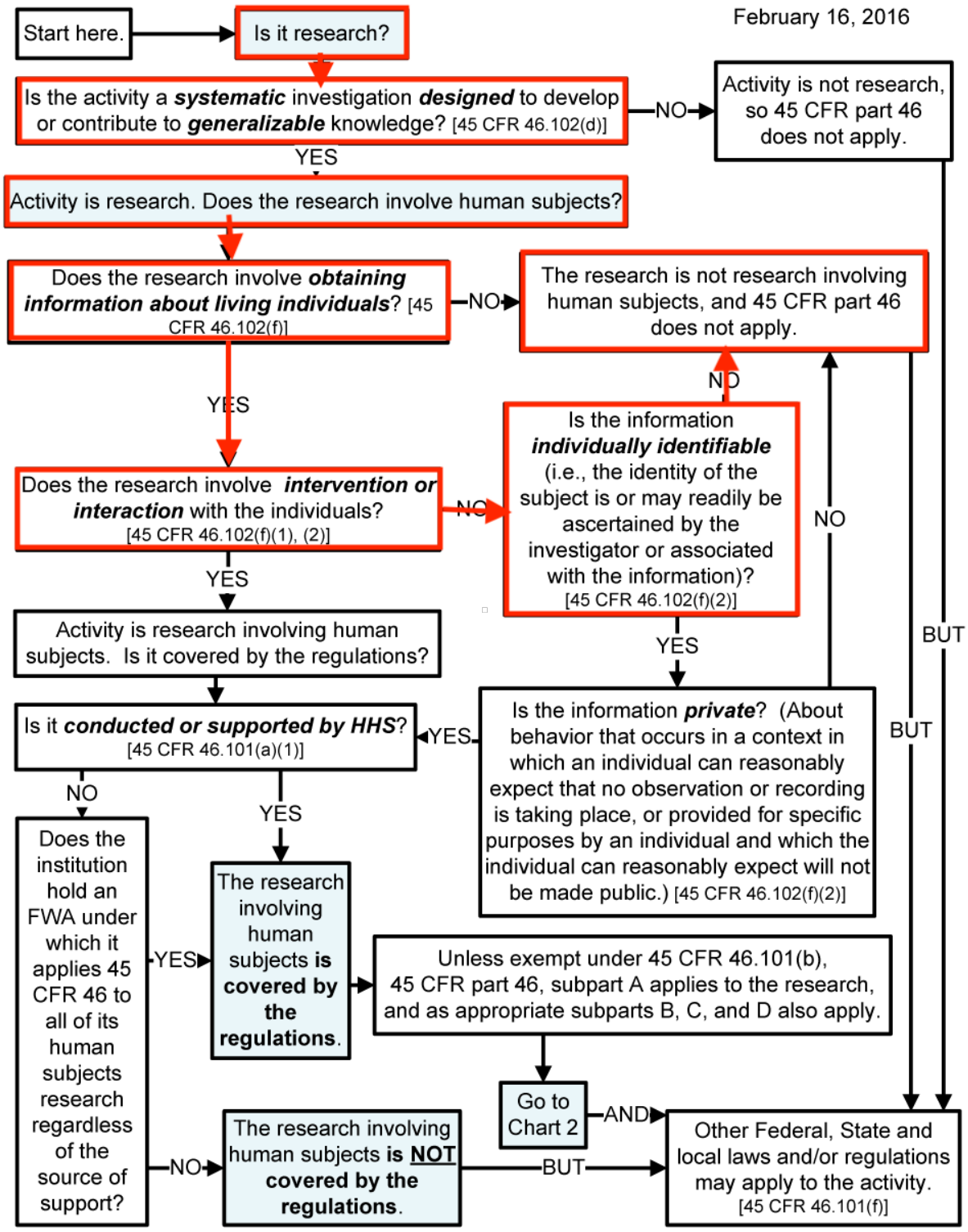
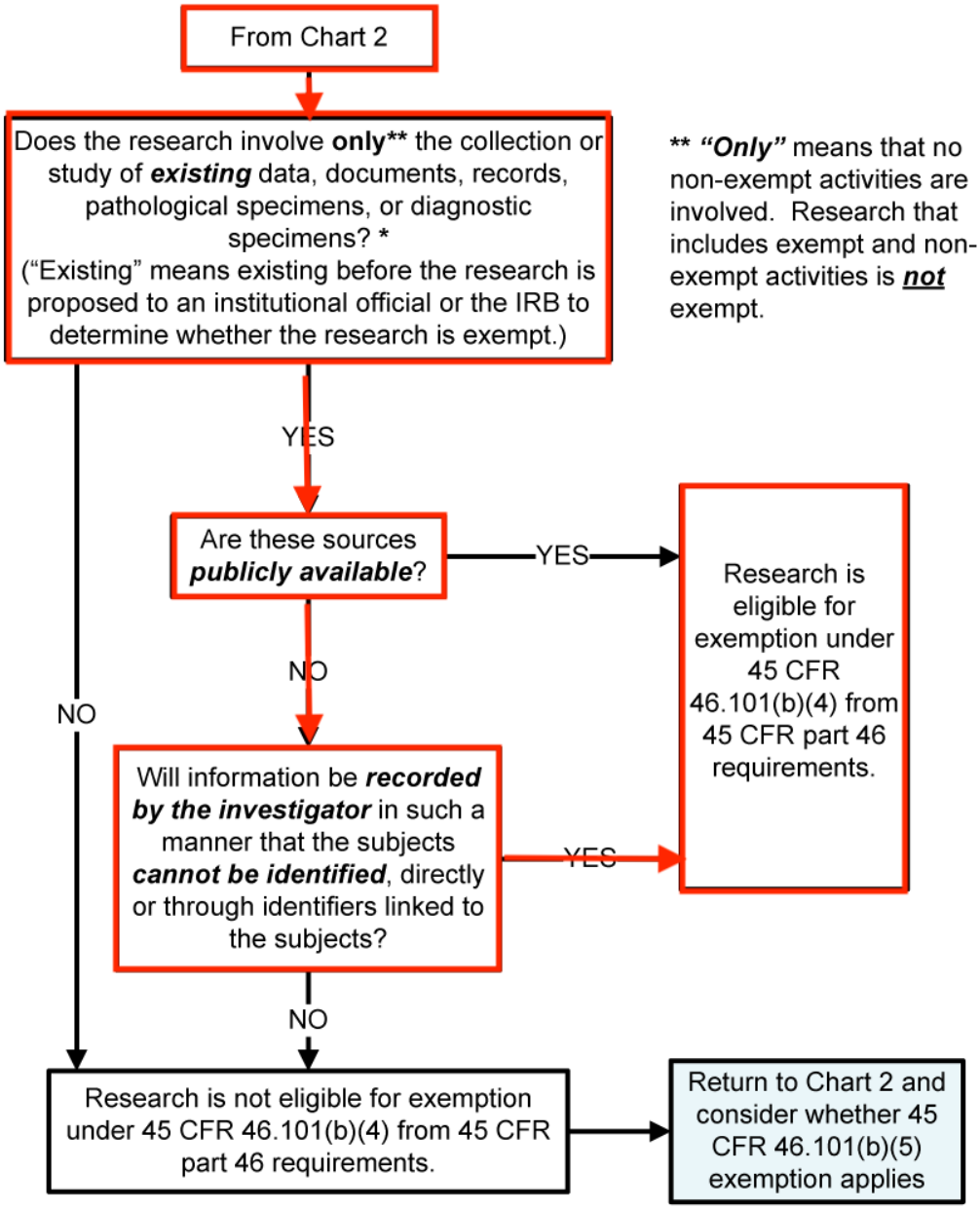
Appendix A: Human Subjects Regulations Decision Chart

Charts taken from https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts/index.html





* Note: See **OHRP** guidance on research use of stored data or tissues and on stem cells at http://www.hhs.gov/ohrp/regulations-and-policy/guidance/guidance-on-research-involving-stem-cells/index.html, and on coded data or specimens at http://www.hhs.gov/ohrp/regulations-and-policy/guidance/research-involving-coded-private-information/index.html for further information on those topics.

February 16, 2016

Appendix B: List of Competencies Met in Integrative Learning Experience

Wright State Program Public Health Competencies Checklist

Identify and describe the 10 Essential Public Health Services that serve as the basis for public health performance.
Assess and utilize quantitative and qualitative data.
Apply analytical reasoning and methods in data analysis to describe the health of a community.
Describe how policies, systems, and environment affect the health of populations.
Communicate public health information to lay and/or professional audiences with linguistic and cultural sensitivity.
Address population diversity when developing policies, programs, and services.
Engage with community members and stakeholders using individual, team, and organizational opportunities.
Make evidence-informed decisions in public health practice.
Evaluate and interpret evidence, including strengths, limitations, and practical implications.
Demonstrate ethical standards in research, data collection and management, data analysis, and communication.
Explain public health as part of a larger inter-related system of organizations that influence the health of populations at local, national, and global levels.

Concentration Specific Competencies Checklist

Population Health Concentration
Explain a population health approach to improving health status
Use evidence-based problem solving in the context of a particular population health challenge.
Demonstrate application of an advanced qualitative or quantitative research methodology.
Demonstrate the ability to contextualize and integrate knowledge of a specific population health issue.
Evaluate population health programs or policies that are designed to improve the health of the population, reduce disparities, or increase equity.