Pregnancy Medical Home Pilot Program
Final Evaluation Report

As Required By:

H.B. 1605, 83rd Legislature, Regular Session, 2013
(§531.0996, Government Code)

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EXECUTIVE SUMMARY

This report presents findings and recommendations from the implementation and evaluation of a pregnancy medical home pilot program for women receiving medical assistance through a Medicaid managed care model in Harris County, as required by House Bill 1605, 83rd Legislature, Regular Session, 2013 (§531.0996, Government Code). Pregnancy medical homes are designed to improve maternal and infant health through coordinated, evidence-based maternity care management for women at risk of poor birth outcomes, such as preterm birth and low birthweight. On April 1, 2014, the Health and Human Services Commission (HHSC) selected The Center for Children and Women (The Center), a family-centered medical home operated by Texas Children's Health Plan (TCHP), as the pregnancy medical home pilot site.

To evaluate the effectiveness of the pregnancy medical home, HHSC Center for Analytics and Decision Support (HHSC CADS) coordinated with TCHP to obtain prenatal, delivery, and postpartum data for all TCHP Medicaid clients in Harris County with a live birth occurring between February 1, 2014, and December 31, 2016. Medical data were also obtained for the associated infants. Evaluators at HHSC CADS divided linked data for each mother-baby pair into an intervention group (clients receiving care at The Center) and a comparison group (clients receiving care at other Harris County clinics in the TCHP network). After constructing a matched sample (n=3,382) to adjust for demographic and risk differences between the groups, HHSC CADS compared pregnancy outcomes between mothers associated with The Center and those associated with other local clinics. To provide additional context, HHSC CADS also conducted a short survey with TCHP Medicaid prenatal care providers in Harris County (n=54).

Evaluation findings indicate that mothers receiving care at the pregnancy medical home had better outcomes than similar mothers at other local clinics on several important measures. Most notably, mothers associated with the pregnancy medical home were significantly less likely to go to the emergency department while pregnant, less likely to deliver by cesarean section, and less likely to have a newborn admitted to the neonatal intensive care unit. Each of these trends is associated with expected cost savings. Mothers receiving care at the pregnancy medical home also spent more time in prenatal care and were more likely to attend a postpartum visit. Nevertheless, despite achieving slightly better birth outcomes, the pregnancy medical home did not yield significantly lower rates of preterm birth or low birthweight, highlighting the difficulty of moving the mark on historically challenging public health problems with complex causes.

Survey results from TCHP Medicaid providers suggests one explanation for the relatively modest benefits associated with the pregnancy medical home may be the availability of similar services and protocols at comparison group clinics. Though pregnancy medical home clinics staff a greater variety of providers than other local clinics, many comparison group clinics follow practices that align with the pregnancy medical home model, such as conducting formal risk assessments, creating individual care plans, and prescribing 17 Alpha-Hydroxyprogesterone Caproate (17P) to patients with a history of preterm birth. In fact, many comparison group clinics self-identify as pregnancy medical homes.

Based on the positive outcomes and potential cost savings identified in this evaluation, HHSC recommends continuation of the pregnancy medical home model, as implemented by The Center. There is insufficient evidence at this time, however, to recommend statewide expansion of the model.

INTRODUCTION

House Bill (H.B.) 1605, 83rd Legislature, Regular Session, 2013, (§531.0996, Government Code) directs the Health and Human Services Commission (HHSC) to develop and implement a pregnancy medical home pilot program in Harris County. Participating medical homes must provide coordinated, evidence-based maternity care management to women who receive medical assistance through a Medicaid managed care model. In addition, HHSC must conduct an evaluation of the pilot program's impact on poor birth outcomes and issue recommendations as to whether it should be continued, expanded, or discontinued.

On April 1, 2014, HHSC selected The Center for Children and Women (The Center), a family-centered medical home operated by Texas Children's Health Plan (TCHP), as the pregnancy medical home pilot site. In coordination with TCHP, HHSC Center for Analytics and Decision Support (HHSC CADS) developed an evaluation plan and data sharing agreement to assess the performance of the program. This report presents findings and recommendations from the multi-year evaluation of the pregnancy medical home pilot program.

The remainder of this report is structured as follows. First, HHSC reviews the originating legislation. Next, the report presents a statistical profile of births in Texas and Harris County, and examines the prior research on adverse birth outcomes. The following section considers strategies for addressing adverse birth outcomes, including prenatal care and pregnancy medical homes. The report then describes the pregnancy medical home pilot program and outlines the evaluation design used in this study. A results section presents the evaluation's key findings. The report concludes with a discussion of strengths, limitations, and recommendations.

H.B. 1605

Effective September 1, 2013, H.B. 1605 requires HHSC to develop and implement a pilot program in Harris County to create pregnancy medical homes for women in the service area who receive medical assistance through a Medicaid managed care model. Per the legislation, each pregnancy medical home in the program must provide coordinated, evidence-based care through a maternity management team that:

> "(1) consists of health care providers, including obstetricians, gynecologists, family physicians or primary care providers, physician assistants, certified nurse midwives, advanced practice registered nurses, and social workers, in a single location; (2) conducts a risk-classification assessment for each pilot program participant on entry into the program to determine whether her pregnancy is considered high- or low-risk; (3) based on the assessment under Subdivision (2), establishes an individual pregnancy care plan for each participant; and (4) follows the participant throughout her pregnancy in order to reduce poor birth outcomes."

The bill also calls on HHSC to conduct an evaluation of the pilot program's effectiveness in reducing poor birth outcomes and submit recommendations as to whether the program should be

continued, expanded, or terminated. On January 1, 2015, an interim report was issued detailing the pilot program's progress. The reporting deadline for the final report was extended to September 1, 2017.

SCOPE OF THE PROBLEM

Texas has the fourth highest birth rate in the United States.[1] In 2015, more than 400,000 mothers gave birth in the state of Texas. Of these, approximately 73,000—or 18 percent—gave birth in Harris County. [2] Appendix A shows the sociodemographic characteristics of mothers who gave birth in Texas and Harris County in 2015. Compared to mothers in the rest of the state, Harris County mothers are slightly older, less likely to be White, and less likely to be married. Harris County mothers are also less likely to finish high school than their peers in other parts of the state.

In both Texas and Harris County, 97 percent of births are singletons and slightly more than half are male (51 percent). The method of delivery in Harris County is also similar to Texas at large; approximately 66 percent of deliveries are vaginal, with the remaining 34 percent occurring through cesarean section.[3]

State trends in various birth indicators have been mixed over the last decade. Rates of infant mortality, preterm birth, and smoking during pregnancy have all improved. Over the same period, however, there has been an increase in pre-pregnancy obesity, maternal diabetes, and maternal hypertension.[4] Low birthweight has remained relatively unchanged.

Adverse Birth Outcomes

Adverse birth outcomes are negative conditions associated with the birth of a newborn that carry a host of short- and long-term consequences. The two most cited adverse birth outcomes are preterm birth and low birthweight, each of which is linked to higher rates of infant mortality and a troublesome slate of health and developmental problems. Other adverse birth outcomes include postterm birth, high birth weight, congenital abnormalities (birth defects), and neurodevelopmental defects.[5] The following sections elaborate on preterm birth and low birthweight, two conditions that tend to co-occur and affect the Medicaid population at a disproportionate rate.

Preterm Birth

Births occurring before 37 weeks of gestation are considered preterm. In 2015, the preterm birth rate for the U.S. was 9.6 percent.[6] Rates of preterm birth were slightly higher in Texas (11.8 percent), and higher still in Harris County (12.2 percent).[7] The past decade has seen widespread declines in the preterm birth rate, both nationally and in Texas, though rates in Texas have consistently exceeded national rates over this period.[8]

The final weeks of gestation are critical for the development of an infant’s organs, particularly the brain, lungs, and liver.[9] Babies born too early are at higher risk for a number of health conditions, including breathing problems (apnea, respiratory distress syndrome), bleeding in the brain (intraventricular hemorrhage), heart problems (patent ductus arteriosis), intestinal problems

(necrotizing enterocolitis), vision problems (retinopathy of prematurity), liver problems (jaundice), lung problems (bronchopulmonary dysplasia), anemia, and infections.[10] Preterm birth has also been linked to long-term intellectual and developmental disabilities, such as attention deficit hyperactivity disorder, cerebral palsy, and autism.[11]

In some cases, preterm birth may even threaten an infant's survival. The infant mortality rate for late preterm babies (34-36 weeks of gestation) is four times the rate for term babies, a disparity that increases exponentially as the length of gestation shortens. Very preterm infants with less than 32 weeks of gestation, for example, have an infant mortality rate 88 times the rate of term babies.[12] Altogether, preterm births are a factor in more than one-third of infant deaths in the U.S.[13]

Low Birthweight

Low birthweight babies weigh less than 2,500 grams, or 5.5 pounds, at birth. Approximately 8.1 percent of U.S. babies born in 2015 were low birthweight.[14] The rate of low birthweight in Texas is slightly higher at 8.2 percent, and higher still in Harris County (8.5 percent).[15] Rates of low birthweight have remained relatively unchanged over the last decade, both in Texas and the U.S.[16]

There is considerable overlap between low birthweight and early delivery; approximately seven in ten low birthweight babies are also preterm.[17] Consequently, low birthweight infants are prone to many of the same health problems as preterm infants, including breathing problems (respiratory distress syndrome), bleeding in the brain (intraventricular hemorrhage), heart problems (patent ductus arteriosis), intestinal problems (necrotizing enterocolitis), and vision problems (retinopathy of prematurity).[18] Babies born below normal weight are also more likely to develop long-term conditions such as diabetes, heart disease, high blood pressure, metabolic syndrome, and obesity.[19]

Low birthweight is also a significant contributor to infant mortality. Recent data indicate that the mortality rate for low birthweight infants is approximately 25 times higher than for infants weighing 2,500 grams or more.[20] Those born with very low birthweight (less than 1,500 grams) are at especially high risk, with a mortality rate more than 100 times the rate of their counterparts weighing 2,500 grams or more. Very low birthweight babies are also considerably more likely to have poor developmental outcomes in childhood than those with only moderately low birthweight (1,500-2,499 grams).[21]

Economic Impact

Beyond the numerous health concerns and emotional stressors associated with adverse birth outcomes, they also carry substantial costs. The average medical cost for a premature baby in the first year of life is $54,194, more than 12 times the average cost for a healthy baby over the same period.[22] Part of the cost differential can be explained by a difference in health care utilization; premature and low birthweight infants spend an average of 15 days in the hospital, compared to 2 days for their healthy counterparts. Similarly, premature infants register an average of 20 outpatient and well-baby visits over the first year, compared to just 14 for healthy babies.[23]

Overall, studies show that the cost of maternity care is heavily concentrated in delivery and hospitalization, rather than the prenatal or postpartum periods; childbirth and hospitalization account for nearly three-quarters of Medicaid maternity care payments.[24] During delivery and hospitalization, two particularly costly responses to pregnancy-related complications and adverse birth outcomes are cesarean delivery and neonatal intensive care unit utilization.

Cesarean Section

Cesarean section, or C-section, deliveries are the most common surgical procedure in the United States and a major contributor to the cost of maternity care.[25] C-section deliveries can be scheduled in advance when a vaginal delivery poses risks, or performed in response to an unexpected complication during labor. Though the procedure is invoked to prevent or mediate adverse maternal and neonatal outcomes, use of the C-section has risen dramatically over the past two decades with little change in adverse outcomes, raising concerns that the method is overused and often unnecessary.[26] Moreover, many low-risk pregnancies delivered through C-section may be at greater risk of morbidity, mortality, and future pregnancy complications than if delivered through vaginal birth.[27] Nationally, Medicaid pays approximately 50 percent more for cesarean deliveries, which average $13,590 in maternity and newborn care compared to $9,131 for vaginal births.[28] Due to the inherent risks and costs of the procedure, public health officials have encouraged reductions in the rate of cesarean deliveries, particularly for low-risk pregnancies.[29] In response to the call for a reduction in cesarean deliveries and non-medically indicated early elective deliveries more broadly, Texas passed H.B. 1983, 82nd Legislature, Regular Session, 2011 (§32.0313, Human Resources Code). This statute allows Texas to potentially recoup payments to Medicaid providers for non-medically indicated deliveries prior to 39 weeks.

Neonatal Intensive Care Unit (NICU)

The neonatal intensive care unit (NICU) is a special hospital nursery for the care of sick or preterm infants. The NICU is typically categorized into four levels of care, including basic well newborn nursery care (level I), specialty care (level II), and subspecialty intensive care (levels III and IV).[30] Preterm and low birthweight infants are substantially more likely to spend time in the NICU, and do so at considerable cost. Prior research has noted that very low birthweight babies, despite totaling just 1.5 percent of all live births in the U.S., account for 30 percent of all newborn health care costs, including an annual sum of $13.4 billion in NICU expenses.[31] NICU costs per newborn are also high. Studies show that average Medicaid payments for newborns admitted to NICU total $13,875 for vaginal births and $19,971 for cesarean births—roughly four times the amount of Medicaid payments for newborn care at large.[32] These trends are mirrored in Texas Medicaid Managed Care, where the average inpatient hospital cost of a newborn admitted to NICU in fiscal year 2015 ($23,182) far exceeded the overall average cost of inpatient hospital newborn care ($4,048).[33]

Long-term Implications

For some, the economic burden of adverse neonatal conditions continues into adulthood with long-term disability and treatment implications—costs borne not only by affected individuals and their families, but also by public health programs, special education programs, and social services.[34] A 2007 study estimated the societal economic burden associated with preterm infants

in the U.S. at more than $26.2 billion annually, or roughly $52,000 per infant.[35] Intangible costs related to emotional distress and reduced quality of life for children and their caregivers are surely substantial as well.[36]

Risk Factors

Despite continued efforts on the part of researchers, policymakers, and health care providers, preterm birth and low birthweight remain persistent public health problems. Prior research points to several risk factors associated with preterm and low birthweight deliveries. Risk factors can be grouped into four categories, including sociodemographic factors, medical/pregnancy factors, behavioral factors, and environmental factors [Table 1]. Though the risk factors below provide a useful road map for prevention efforts, it is important to note that the biological causes of adverse birth outcomes are still not well understood. [37]

Table 1: Risk Factors for Adverse Birth Outcomes

	Preterm Birth Risk Factors	Low Birthweight Risk Factors
Sociodemographic Factors	• High/low maternal age [a] • Black race [a, d] • Low maternal income or socio-economic status (SES) [a, d]	• High/low maternal age [b] • Black race [b, d] • Low education/income [b, d]
Medical/Pregnancy Factors	• Intrauterine Infection [a, d] • Prior preterm birth [a] • Multiple pregnancy [a, d] • High blood pressure during pregnancy [a, d] • Diabetes [g] • Obesity [c]	• Intrauterine Infection [b, d] • Previous low birthweight baby [b] • Multiple pregnancy [d] • Chronic conditions (high blood pressure, diabetes, heart, lung, or kidney problems) [b, d] • Insufficient weight gain in pregnancy [b] • Problems with placenta [b, d] • Preterm labor [b]
Behavioral Factors	• Tobacco/alcohol/substance use [a, d] • Late prenatal care [a] • Stress [a]	• Tobacco/alcohol/substance use [b, d] • Inadequate prenatal care [e]
Environmental Factors	• Environmental tobacco smoke [d, f] • Lead exposure [d, e] • Air Pollution [d, e]	• Environmental tobacco smoke [d, f] • Lead exposure [d, e] • Air Pollution [d, e]

Sources: [a] Centers for Disease Control and Prevention. Division of Reproductive Health. (2016). Preterm Birth. Retrieved from https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm [b] March of Dimes. (2014). Low Birthweight. Retrieved from http://www.marchofdimes.org/complications/low-birthweight.aspx [c] Kormondy, M. and Archer, N. (2016). 2016 Healthy Texas Babies Data Book. Austin, TX: Division for Family and Community Health Services, Texas Department of State Health Services. [d] U.S. Environmental Protection Agency. (2013.) Adverse Birth Outcomes. America's Children and the Environment. Third Edition. [e] America's Health Rankings. (2016). 2015 Annual Report. Measure: Low Birthweight. Retrieved from http://www.americashealthrankings.org/explore/2015-annual-report/measure/birthweight#_ftn17 [f] Burris, H. H., Collins, J. W., & Wright, R. O. (2011). Racial/ethnic disparities in preterm birth: clues from environmental exposures. Current Opinion in Pediatrics, 23(2), 227–232. http://doi.org/10.1097/MOP.0b013e328344568f [g] Centers for Disease Control and Prevention. (2014). CDC Features. Check Your Knowledge: Diabetes and Pregnancy. Retrieved from https://www.cdc.gov/features/diabetespregnancy/

Sociodemographic factors

Sociodemographic disparities merit special consideration, in part because they have remained largely intractable over recent decades. Numerous studies have documented the link between poor birth outcomes and sociodemographic characteristics such as maternal age, race/ethnicity,

education, income, marital status, and nativity.[38] Of these, racial/ethnic disparities are the most pronounced.

Racial/Ethnic Disparities. The preterm birth rate among Black women in the U.S. is 48 percent higher than the rate among all other women.[39] This disparity is echoed in Texas, where Black women have a preterm birth rate 41 percent higher than other Texas women[40]—though the racial gap in Texas preterm birth rates has narrowed over the past decade.[41] Studies show that racial/ethnic disparities in the preterm birth rate persist even after accounting for confounding factors such as obesity, smoking, hypertension, socioeconomic status, and use of prenatal care.[42]

Higher preterm birth rates among Black women also translate to higher rates of infant mortality; in 2013, the infant mortality rate for Black women was more than twice the rate for White women.[43] Moreover, the racial gap in national infant mortality rates has more than doubled over the past decade.[44] Importantly, the majority of Black infants die from low birthweight and preterm birth, not congenital malformation (birth defects), as is the case for all other races.[45]

Medical/Pregnancy Factors

Preterm birth and low birthweight share many of the same medical or pregnancy-related risk factors. These include chronic or pregnancy-related conditions such as high blood pressure (preeclampsia), diabetes, intrauterine infections, or problems with the heart, lungs, or kidneys.[46] Women who fail to gain enough weight during the pregnancy, or who have complications with the placenta that limit the transfer of nutrients and oxygen, are also at higher risk for adverse birth outcomes. Preterm birth and low birthweight are also common among those with multiple pregnancies, or those with a history of preterm birth or low birthweight in prior pregnancies.[47]

Behavioral Factors

In some cases, maternal behaviors can also impact the probability of having a preterm or low birthweight infant. Tobacco, alcohol, illicit drugs, and prescription opiods have all been linked to higher rates of adverse birth outcomes.[48] Cigarette smokers give birth to low birthweight babies at nearly double the rate of non-smokers.[49] Texas performs relatively well on measures of smoking prior to and during pregnancy, in part because of the large number of births to Hispanic women, who are less likely to smoke than other races.[50] Harris County fares especially well on this measure; mothers in Harris County are less than half as likely to smoke during pregnancy as other mothers in Texas.[51] Prenatal care is also essential to the prevention of negative outcomes; women who fail to receive prenatal care are three times more likely to have a low birthweight baby than their counterparts who seek care, though part of this differential may be due to lower rates of prenatal care among women who are already prone to poor birth outcomes, such as those with lower incomes and unintended pregnancies.[52]

Environmental Factors

In addition to individual factors, a growing body of research suggests environmental contaminants may also play a role in preterm birth and low birthweight. Environmental tobacco smoke and lead have garnered the strongest evidence, though recent studies also point to a link between adverse birth outcomes and exposure to air pollutants such as particulate matter (PM), sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO), and polycyclic aromatic hydrocarbons (PAHs).[53] Importantly, exposure to dangerous contaminants is not equally

distributed among demographic subgroups; studies show harmful exposure is often correlated with poverty and minority status, compounding the impact of sociodemographic disparities tied to race/ethnicity, income, and education.[54]

Root Causes Still Unknown

Despite the inventory of risk factors outlined above, the root causes of preterm birth remain largely unknown. A recent study leveraging an unprecedented individual-level cross-country dataset with 4.1 million singleton pregnancies found that all known risk factors combined cannot account for 65 percent of the preterm births in high-income countries, including the United States.[55] Drawing on 21 known risk factors, including both individual-level and population-level indicators, researchers determined that prior preterm birth and preeclampsia (high blood pressure) were associated with the highest risk of preterm birth. Still, after accounting for all known risk factors, the study found that roughly two-thirds of preterm births within each country lack a plausible biological explanation. The authors contend that until researchers arrive at a better understanding of the underlying biological causes of preterm birth, the impact of policy and clinical interventions are likely to be limited.[56]

STRATEGIES FOR ADDRESSING ADVERSE BIRTH OUTCOMES

Prenatal Care

In the effort to reduce poor birth outcomes, few intervention strategies are as widely cited as early and regular prenatal care. Typical prenatal care consists of a series of regular checkups and prenatal tests to help promote a safe and healthy pregnancy. In addition to monitoring for any issues that may arise, prenatal care providers also act as a resource, answering questions and providing guidance on topics related to nutrition, lifestyle, and environmental exposure during the pregnancy. Mothers are encouraged to start prenatal care in the first trimester, or as soon as they learn that they are pregnant; women who are planning to become pregnant are encouraged to seek preconception care. For low-risk pregnancies, prenatal visits are scheduled every four to six weeks during the first seven months, then gradually increase in frequency during the final months. Older mothers, or mothers with high-risk pregnancies, are advised to attend more frequently. In addition to providing care during the pregnancy, prenatal care often serves as a door to continuous health care and other services, especially for adolescents and low-income women.[57]

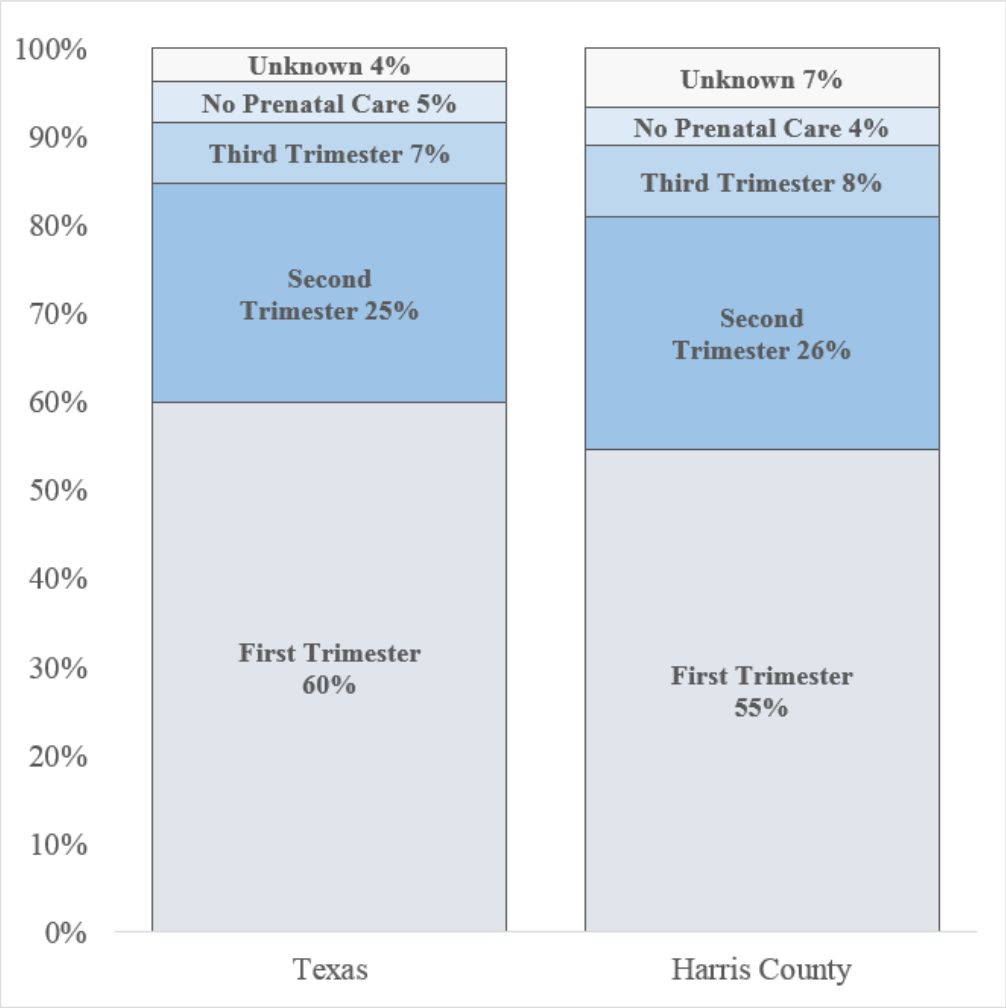
Prenatal care has long been recognized as an indispensable tool in the effort to improve birth outcomes. Mothers who receive inadequate prenatal care are at much greater risk of having a preterm delivery[58] or giving birth to an infant that is small for gestational age.[59] Attending prenatal care early has also been shown to substantially increase birth weights, particularly for uncomplicated pregnancies.[60] Other studies have linked prenatal care visits to reductions in maternal smoking,[61] which is itself a predictor of adverse birth outcomes. The Medicaid program is also associated with improved birth outcomes, including lower rates of infant mortality and low birthweight.[62] One study suggests Medicaid may be particularly beneficial to the birth outcomes of Black women as a result of access to care.[63]

Ultimately, however, the impact of prenatal care on birth outcomes may be constrained by factors that precede a mother's first prenatal visit. Some contend that while prenatal care has an essential role to play in mediating the effects of negative risk factors, it may come too late to substantially reduce the incidence of adverse birth outcomes. Preparing for a healthy pregnancy can require preconception behavioral changes that take months to achieve. Before becoming pregnant, women are advised to stop smoking and drinking, ensure immunizations are up to date, begin taking folic acid supplements, achieve an optimal weight, and manage chronical medical conditions.[64] Given that roughly half of pregnancies are unplanned, many mothers may unknowingly continue harmful behaviors into the critical early stages of fetal development.[65] For some, birth defects may have already developed by the time of the first prenatal visit 10 or 12 weeks into the pregnancy.[66] To help counter these risks, public health experts recommend that prospective mothers attend preconception care before becoming pregnant to begin addressing issues of substance abuse, weight reduction, or changes in treatment regimens. Still, preconception care cannot nullify the impact of fixed factors such as race/ethnicity or age, raising challenges for broader efforts to reduce the incidence of adverse birth outcomes.[67]

Prenatal Care in Texas

Nearly all Texas mothers seek prenatal care, and the majority do so within the first trimester. Mothers in Harris County tend to start prenatal care slightly later than mothers in other parts of the state [Figure 1]. As with other pregnancy-related indicators, prenatal care utilization varies by race/ethnicity. Black women in Texas are nearly 20 percentage points less likely than White women to start prenatal care within the first trimester (not shown).[68]

Figure 1: When Prenatal Care Began, 2015



Source: Texas Department of State Health Services, Center for Health Statistics. Texas Health Data. Birth Data, 2015. [Texas, N=403,439; Harris County, N=73,427].

17P

During the pregnancy, prenatal care providers might propose treatments or therapies to reduce the risk of poor birth outcomes for high-risk women. For mothers with a history of preterm birth, one of the more promising treatment options for the prevention of recurrent preterm birth is a synthetic progestogen shot called 17 Alpha-Hydroxyprogesterone Caproate, or 17P. Progestogen acts as an inhibitor on uterine contractility and is thought to reduce the risk of preterm birth by prolonging gestation.[69] A compounded version of 17P has been widely available through compounding pharmacies since 2003, though availability was expanded in 2011 when the Food and Drug Administration approved a non-compounded form under the brand name Makena™.[70] Shots of 17P are initiated in the second trimester from week 16 through week 26, and continue until week 37 or delivery, whichever comes first. The 17P shot is clinically indicated for women with a singleton pregnancy and a history of singleton spontaneous live preterm birth; it is not intended for use with multi-fetal pregnancies or if a previous preterm birth was medically

indicated.[71] The HHSC provides a monthly file to all health plans, including The Center, to assist them in identifying women who might be candidates for 17P.

Studies of 17P are largely positive,[72] though some uncertainties remain.[73] A widely cited randomized controlled trial conducted in 2003 found that 17P significantly reduced rates of recurrent preterm delivery for high-risk mothers with a history of spontaneous preterm delivery.[74] Since that time, several meta-analyses have reached similar conclusions.[75] Researchers have also investigated the use of 17P as a method of delaying delivery in cases with arrested preterm labor (i.e., maintenance tocolysis), finding that 17P is associated with longer gestation and higher birthweight, but no difference in neonatal outcomes.[76]

Medical Homes

The medical home, or patient-centered medical home (PCMH), is a model of health care delivery where "treatment is coordinated through [the patient's] primary care physician to ensure they receive the necessary care when and where they need it, in a manner they can understand."[77] The medical home is defined by care that is comprehensive, patient-centered, coordinated, accessible, and committed to quality and safety.[78] Providers who adopt the PCMH model may choose to become formally certified or recognized by an accrediting body, many of which provide guidance on applying the model.[a]

Proponents of the medical home acknowledge that implementation may come with increased upfront costs, but contend that these costs will be offset by future savings resulting from lower utilization and improved quality of care. Prior research on the effectiveness of medical homes varies,[79] but is largely positive despite substantial differences in model implementation.[80] One of the most consistent findings from medical home evaluations is a reduction in health care costs associated with unnecessary utilization, particularly in emergency department (ED) visits, inpatient hospitalizations, and hospital readmissions.[81]

Pregnancy Medical Homes

Pregnancy medical homes are a relatively recent development drawing on many of the same concepts employed by patient-centered medical homes in the primary care setting. Pregnancy medical homes are designed to improve maternal and infant health through coordinated, evidence-based maternity care management for women at risk for poor birth outcomes.[82] Specifically, pregnancy medical homes aim to lower rates of preterm birth, low birthweight, and caesarean section deliveries.

An early pioneer of the pregnancy medical home is Community Care of North Carolina (CCNC), which launched the Pregnancy Medical Home program in April 2011 in partnership with the North Carolina Divisions of Medical Assistance and Public Health.[83] The CCNC Pregnancy

[a] Accrediting bodies include the Accreditation Association for Ambulatory Health Care (AAAHC), The Joint Commission, the National Committee for Quality Assurance (NCQA), and the Utilization Review Accreditation Commission (URAC).

Medical Home program serves the pregnant Medicaid population through 14 local networks, each with an Obstetrics (OB) team made up of physicians, nurse coordinators, and pregnancy care managers. Participating providers must complete a standardized risk assessment for each pregnant Medicaid recipient and coordinate a plan of care with the pregnancy care manager. As an incentive to participate, providers in North Carolina who join the pregnancy medical home program receive a number of benefits, including financial incentives and program support services [Appendix B].

A 2015 news release from CCNC notes a 0.5 percent statewide decline in the rate of low birthweight infants following the inception of the pregnancy medical home program in 2011. Though encouraging, it is difficult to know whether this decline is statistically meaningful or a direct result of the program. To date, HHSC could not identify any rigorous studies examining the effect of CCNC's pregnancy medical home model on adverse birth outcomes. Still, actuarial studies have estimated that other CCNC medical home programs have saved the state millions of dollars per year in Medicaid costs, resulting primarily from care management reductions in ED utilization, hospital admissions, and hospital readmissions.[84]

CURRENT STUDY

The Center for Children and Women

On April 1, 2014, HHSC selected The Center for Children and Women (The Center), a family-centered medical home operated by Texas Children's Health Plan (TCHP), as the pregnancy medical home pilot site. Texas Children's Health Plan is a managed care organization (MCO) that administers Medicaid and Children's Health Insurance Program (CHIP) services throughout the eastern part of the state. The TCHP network consists of numerous providers, including The Center in Harris County. Unlike other clinics, however, The Center operates under a full-risk financial model in which they receive a per member per month (PMPM) capitated payment from TCHP. The Center's population is comprised of approximately 60 percent Medicaid and 40 percent CHIP clients; only TCHP Medicaid clients are included in this study. The Center has two locations, both of which are participating in the pilot study. The first location, Greenspoint, began serving clients in August 2013; the second location, Southwest Houston, opened in November 2014.

The Center meets the statutory requirements for a pregnancy medical home outlined in H.B. 1605, including a maternity care management team comprised of various provider types, such as obstetricians, gynecologists, family physicians, physician assistants, nurse midwives, advanced practice registered nurses, and social workers. All services are provided within a single location. In addition, The Center administers pregnancy risk assessments and individual pregnancy care plans as part of its coordinated maternity care management. Pregnancy risk assessments are entered into an electronic form modeled after the pregnancy risk screening tool developed by CCNC. Pregnancy care plans are based on standardized perinatal guidelines developed and updated collaboratively with the Baylor College of Medicine Division of Maternal-Fetal Medicine.[85]

In addition to the features required by H.B. 1605, The Center also offers a range of specialty services, including pharmacy, optometry, nutrition counseling, behavioral health, lab tests, and dental services. Another feature of the Center is the ability to operate extended hours through a nurse triage schedule (7am-7pm, Monday–Friday; 9am-3pm, Saturday), which helps cater to walk-in appointments. The Center is also unique in its ability to provide an elevated level of care through extensive outpatient services, including the capacity to administer IV fluids on site. In addition, The Center offers intense monitoring for mothers with diabetes, including regular counseling with a registered dietician and the option of participating in Centering Pregnancy, a form of group-based prenatal care usually only available to low-risk mothers. Finally, The Center places a strong clinical focus on the use of 17P. These features, in combination with those required by legislation, are intended to provide a level of care beyond standard prenatal care, with the goal of reducing poor birth outcomes.

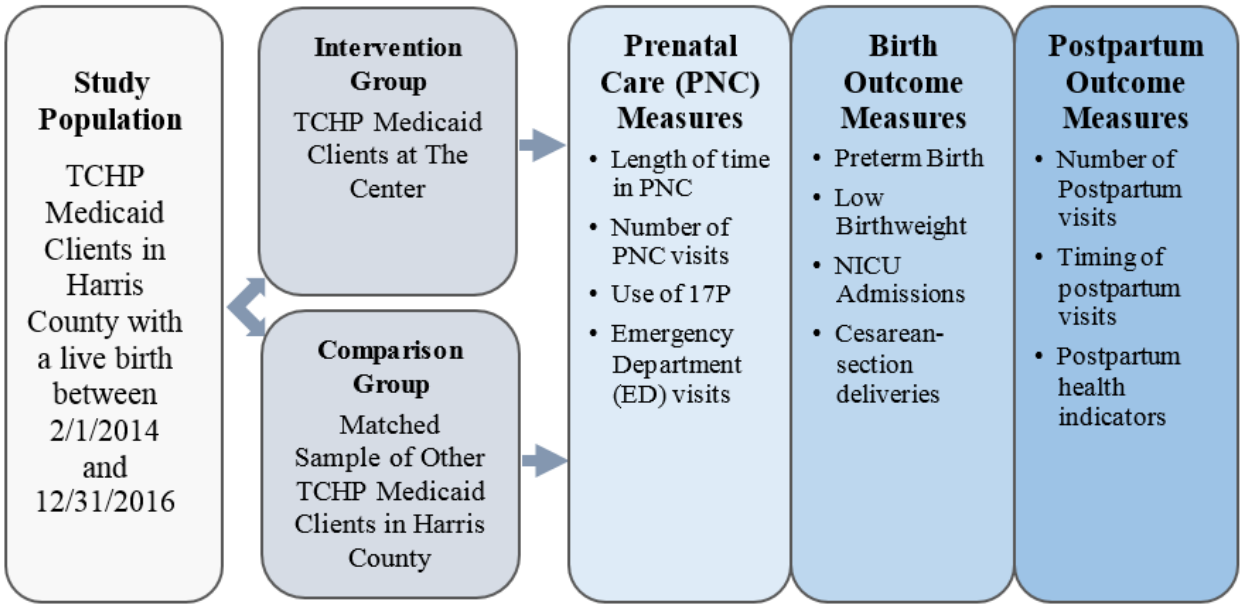
Evaluation Design

The goal of this evaluation is to explore the efficacy of a pregnancy medical home model for Medicaid clients by assessing the effectiveness of the pilot program in reducing poor birth outcomes. Figure 2 below shows the quasi-experimental design used in this study.

The study population for this evaluation includes all TCHP Medicaid clients in Harris County with a live birth occurring between February 1, 2014, and December 31, 2016. This population is comprised of an intervention group, which includes clients receiving prenatal care at The Center (i.e., pregnancy medical home model), and a comparison group, which includes clients receiving prenatal care through other local providers in the TCHP network (i.e., standard of care model). Clients self-select into one of the two groups when seeking prenatal care (i.e., assignment is nonrandom). To evaluate the effectiveness of the pregnancy medical home, propensity score modeling is used to develop a matched sample of intervention and comparison group pregnancies. This method is used to correct for preexisting differences between the groups [A detailed description of this technique is included in Appendix F]. Cases in the matched sample are then compared across multiple points in time, including the prenatal, birth, and postpartum periods.

Figure 2 lists several outcome measures for each period. Prenatal care measures reflect the extent of assessment, treatment, and care provided to pregnant mothers in each group. Birth outcome measures are the primary interest of this study, and are used to examine differences in rates of preterm birth, low birth weight, NICU admissions, and other perinatal complications in each group. Finally, postpartum outcomes are assessed through the number and timing of postpartum visits, as well as various measures of maternal health.

Figure 2: Pregnancy Medical Home Evaluation Design



In addition to the quasi-experimental study described above, this study also incorporates background information gathered through a survey of TCHP Medicaid prenatal care providers in Harris County. The provider survey offers important context regarding practices and policies at The Center and other TCHP providers, with the intention of highlighting where medical homes differ from standard of care and aiding in the interpretation of findings from client-level data.

Data

This evaluation draws on two data sources. The majority of the report uses medical encounter data provided by TCHP. These data cover a study period of approximately three years and ten months (May 1, 2013–March 1, 2017), and include prenatal and postpartum care for all TCHP Medicaid clients in Harris County with a live birth between February 1, 2014, and December 31, 2016. The final analytic sample includes 23,712 unique mothers and 24,913 unique mother-baby pairs. Findings from the encounter data are complemented by information from a short survey of TCHP Medicaid prenatal care providers in Harris County. A detailed description of the data sources used in this report can be found in Appendix C. A diagram showing construction of the analytic file is included in Appendix D. A full list of variables and their associated definitions is included in Appendix E.

Analytic Strategy

To assess the effectiveness of the pregnancy medical home, this evaluation uses propensity score modeling is to construct a matched (1:1) case-control sample of intervention and comparison group pregnancies (n=3,382). This approach, described in more detail in Appendix F, attempts to correct for preexisting differences between the two groups of mothers by pairing each mother in the intervention group with a similar mother in the comparison group. The matched sample allows for a comparison between two groups of mothers that are characteristically similar, except for the location of prenatal care.

RESULTS

This section presents the study's main findings by phase of care. Overall, while mothers receiving maternity care at The Center fared significantly better than the matched comparison group on several important outcomes, The Center did not always prove beneficial. Table 2 presents a summary of the evaluation's primary findings. Additional details are provided in the sections that follow.

Table 2: Summary of Primary Findings from the Pregnancy Medical Home Pilot Program

	Findings Associated with The Center	
Prenatal Care Outcomes	• More time in prenatal care • Lower emergency department (ED) utilization	• Fewer prenatal visits • Greater number of prenatal diagnoses
Birth Outcomes	• Lower rate of C-section deliveries • Lower rate of NICU admissions	• Higher rate of postterm birth, abnormal fetal heart rate, and anemia during delivery
Postpartum Care Outcomes	• More likely to attend a postpartum visit • Lower rate of postpartum anemia	• More likely to receive long-acting reversible contraception (LARC) • More likely to receive a breast pump

Note: Outcomes reported here are those that attain statistical significance in matched sample comparisons.

Prenatal Care Outcomes

Table 3 presents prenatal care outcomes for the intervention and matched comparison groups. On average, mothers at The Center attended 8.6 prenatal visits, one fewer than similar mothers at other local clinics. Despite attending fewer prenatal visits, mothers at The Center spent significantly more time in prenatal care. Mothers associated with the pregnancy medical home spent an average of 20 weeks in prenatal care, approximately 5 days longer than their counterparts in other local clinics.

Table 3. Prenatal Care Outcomes, Matched Sample

	The Center (Intervention)	**Matched Sample of Other TCHP Providers (Comparison)**
N	*1,691*	*1,691*
Number of Prenatal Visits (Range 1-38)		
1-4	19.0%*	16.0%
5-8	34.8%***	24.9%
9-12	28.2%*	31.6%
13-16	12.8%***	18.6%
17+	5.3%***	9.0%
Mean	*8.6***	*9.8*
Time in Prenatal Care (Range 1-282 days)		
1-4 weeks	3.4%**	5.4%
5-8 weeks	6.0%*	7.9%
9-12 weeks	7.5%*	9.8%
13-16 weeks	12.3%	10.5%
17-20 weeks	16.7%**	13.3%
21-24 weeks	18.8%	19.1%
25-28 weeks	19.9%	18.9%
29-32 weeks	11.4%	10.4%
33-36 weeks	4.0%	4.2%
37-40 weeks	0.2%	0.5%
41 + weeks	0.0%	0.1%
Mean (Days)	*140.7***	*135.5*
First Trimester Care		
≥ 27 weeks in Prenatal Care	20.2%	19.2%
First Trimester Care (ICD-10 only)[‡]	9.3%	7.8%

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: ***p<0.001, **p<0.01, *p<0.05. Continuous variables tested using paired t-tests. Dichotomous variables and levels of categorical variables tested using McNemar's test. The unit of analysis is the mother-baby pair. Mothers giving birth to multiple babies during the study period are duplicated for each unique birth.
Note: [‡] An estimated 51.9% of the matched sample received prenatal care under the ICD-10 coding scheme.

Despite logging fewer prenatal visits during the pregnancy, mothers at The Center received more diagnoses than similar mothers treated elsewhere [Table 4]. It is unclear whether the number of diagnoses for patients at The Center reflects a greater number of health complications or simply more thorough examination and documentation by health professionals at the pregnancy medical home.

Findings from the matched sample indicate that mothers in both groups were eligible for 17P—and received 17P treatment—at similar rates [Table 4]. The Center did appear to have a significant effect on ED utilization, however. Compared to similar mothers in other local clinics, mothers at The Center were 7 percentage points less likely to visit an ED while pregnant.[b]

Table 4. Prenatal Care Outcomes, Matched Sample (Cont.)

	The Center (Intervention)	**Matched Sample of Other TCHP Providers (Comparison)**
N	*1,691*	*1,691*
Number of Prenatal DX (Range 1-53)		
1-4	12.6%***	26.1%
5-8	30.0%	27.9%
9-12	28.4%***	20.4%
13-16	15.8%**	12.7%
17+	13.1%	12.9%
Mean	*10.3****	*9.2*
Prenatal Treatment Utilization		
Estimated Eligibility for 17P	6.2%	6.5%
Receive 17P	3.8%	3.3%
Estimated Rate of 17P Among Eligible Mothers[‡]	61.8%	50.8%
ED Utilization	24.0%***	30.8%

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: ***p<0.001, **p<0.01, *p<0.05. Continuous variables tested using paired t-tests. Dichotomous variables and levels of categorical variables tested using McNemar's test. The unit of analysis is the mother-baby pair. Mothers giving birth to multiple babies during the study period are duplicated for each unique birth.
Note: [‡] Calculated among subsample of mothers eligible for 17P (Intervention, n=105; Comparison, n=110).

[b] In more advanced analyses, mothers at the pregnancy medical home were associated with 33 percent lower odds of ED utilization during the prenatal period [OR=0.67, p<0.0001; Full results presented in Appendix G].

Birth Outcomes

Table 5 below presents the birth outcomes of intervention and comparison group pregnancies. Babies associated with The Center were significantly more likely to be born through vaginal delivery, and less likely to be delivered by C-section. Babies born to intervention group mothers were also significantly less likely to spend time in the NICU, particularly at higher levels of care. In fact, babies associated with The Center were roughly half as likely as babies in the matched comparison group to be admitted to NICU levels III and IV.[c]

Despite these favorable outcomes, babies associated with The Center did not have significantly lower rates of preterm birth or low birthweight than their counterparts at other local clinics.[d] Several adverse birth outcomes were significantly more likely among the pregnancy medical home population, including late or postterm births,[e] and abnormal fetal heart rate [Table 5]. Mothers associated with the Center were also significantly more likely to be diagnosed with anemia during the delivery, despite having statistically similar rates of antepartum anemia during the prenatal period (not shown).

Table 5. Birth Outcomes, Matched Sample

	The Center (Intervention)	**Matched Sample of Other TCHP Providers (Comparison)**
N	*1,691*	*1,691*
Delivery Method		
Vaginal	65.6%***	59.3%
Cesarean	31.3%***	38.7%
Unknown	3.1%*	2.0%
Single/Multiple Pregnancy		
1	98.3%**	96.9%
2	1.6%**	3.0%
3	0.1%	0.1%

[c] In more advanced analyses, intervention group babies were associated with 30 percent lower odds of being admitted to the NICU at any level [OR=0.70, p=0.0004; Full results presented in Appendix G].

[d] In more advanced analyses, babies born to intervention group mothers were associated with 19 percent lower odds of being preterm; however, these results only attained significance at the p<0.10 level in multivariate models (OR=0.81, p=0.077). Babies born to intervention group mothers were also associated with 11 percent lower odds of being low birthweight, however these results were not significant (OR=0.89, p=0.279). Full results presented in Appendix G.

[e] Late births occur between 41 weeks, 0 days and 41 weeks, 6 days; postterm births occur at or beyond 42 weeks. The Center has a policy prohibiting non-medically necessary inductions; mothers are only induced at 41 weeks of gestation. The extent to which clinics in the comparison group follow this practice is unknown.

Table 5. Birth Outcomes, Matched Sample (Cont.)

	The Center (Intervention)	**Matched Sample of Other TCHP Providers (Comparison)**
N	*1,691*	*1,691*
NICU Level of Care		
NICU Admission (Levels II-IV)	13.3%***	17.4%
Continuing Care (Level II)	7.9%	6.9%
Intermediate Care (Level III)	3.8%***	7.3%
Intensive Care (Level IV)	1.5%**	3.1%
Days in NICU (Range 0-280)		
1	2.1%	2.2%
2	2.7%	2.7%
3	1.1%*	2.1%
4	1.2%	0.7%
5-9	1.5%**	3.0%
10-19	1.6%**	3.1%
20+	3.1%	3.4%
Mean	*2.9***	*3.8*
Weight and Gestational Age		
Low Birthweight	12.4%	13.4%
Preterm	9.9%	11.5%
Growth Retardation	1.0%	1.2%
Small/Light for Gest Age	2.7%	2.0%
Large/Heavy for Gest Age	6.2%	6.4%
Late or Postterm	4.7%***	2.4%
Adverse Birth Outcomes		
Delivery Anemia	36.3%***	21.3%
Abnormal Fetal Heart Rate	21.6%***	14.7%

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: ***p<0.001, **p<0.01, *p<0.05. Continuous variables tested using paired t-tests. Dichotomous variables and levels of categorical variables tested using McNemar's test. The unit of analysis is the mother-baby pair. Mothers giving birth to multiple babies during the study period are duplicated for each unique birth.

Postpartum Care Outcomes

After the delivery, mothers associated with the Center were significantly more likely to attend a postpartum visit than similar mothers at other local clinics [Table 6]. The majority of intervention group mothers who attended a postpartum visit did so three to five weeks after the delivery, likely a reflection of clinic-level protocols to schedule the first follow-up visit in a time frame that maximizes compliance with Healthcare Effectiveness Data and Information Set (HEDIS) Quality measures, which recommend a postpartum visit between 21 and 56 days after the delivery [Table 6].[86]

During the postpartum period, mothers associated with the pregnancy medical home were significantly less likely to be diagnosed with anemia (despite experiencing the condition at higher rates during delivery), but did not significantly differ from the matched comparison group with regard to more serious conditions such as severe maternal morbidity (e.g., blood transfusions, disseminated intravascular coagulation, heart failure during a procedure /surgery, hysterectomy, or operations on the heart/pericardium). Table 6 also shows that mothers associated with the pregnancy medical home were more likely than their counterparts to receive long-acting reversible contraception (LARC) via an intrauterine device (IUD) or subdermal contraceptive implant within 80 days of giving birth. Mothers receiving care at The Center were also significantly more likely to receive a breast pump than similar mothers elsewhere.

Table 6. Postpartum Care Outcomes, Matched Sample

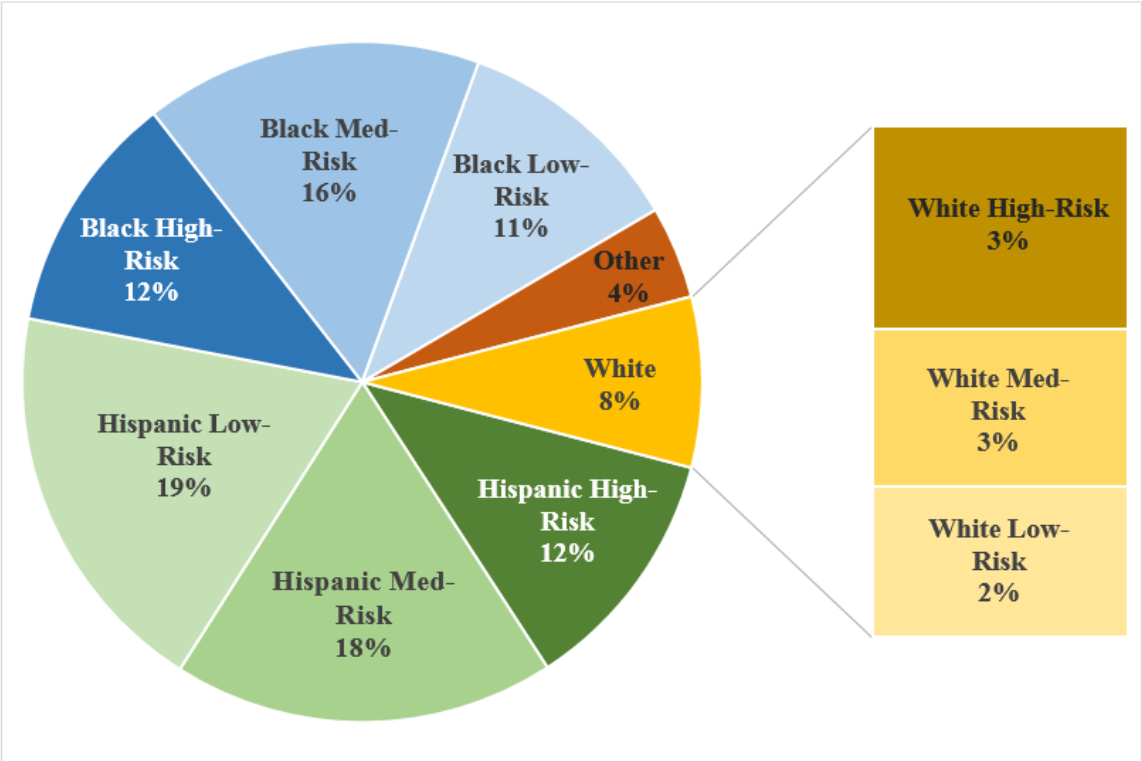
	The Center (Intervention)	Matched Sample of Other TCHP Providers (Comparison)
N	*1,691*	*1,691*
# of Postpartum Visits (Range 0-12)		
0	31.7%*	35.3%
1	46.7%***	40.1%
2	18.0%	19.4%
3	3.4%	4.5%
4 +	0.3%	0.8%
Mean	*0.9*	*1.0*
Days to First Postpartum Visit (Range 4-60)		
0-7	3.3%	3.6%
8-14	4.1%***	8.3%
15-21	6.1%**	8.9%
22-28	22.5%***	15.6%
29-35	16.4%***	8.7%
36-42	5.6%	7.0%
43-49	5.6%*	7.6%
50-56	2.8%	2.9%
57-60	0.4%*	1.0%
No Postpartum Visit/Outliers	33.3%*	36.5%
Mean (Non-missing)	*28.4*	*27.9*
Timeliness of Postpartum Care		
Visit 21-56 Days After Delivery	56.1%***	44.1%
Adverse Postpartum Outcomes		
Postpartum Anemia	0.4%***	3.3%
Severe Maternal Morbidity	1.3%	1.5%
Postpartum Treatment Utilization		
LARC	14.8%***	9.3%
Breast Pump CPT	5.7%***	1.8%

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: ***p<0.001, **p<0.01, *p<0.05. Continuous variables tested using paired t-tests. Dichotomous variables and levels of categorical variables tested using McNemar's test. The unit of analysis is the mother-baby pair. Mothers giving birth to multiple babies during the study period are duplicated for each unique birth.

Primary Outcomes by Race-Risk Category

To examine whether the pregnancy medical home is more effective for some groups of mothers than others, this section divides the sample into separate categories based on race/ethnicity and weighted risk score [Figure 3].[f] The following analysis evaluates the effect of The Center on four primary outcomes—ED utilization, NICU admission, preterm birth, and low birthweight—for mothers in each of the risk-race categories shown below.

Figure 3. Distribution of Race-Risk Categories, Matched Sample

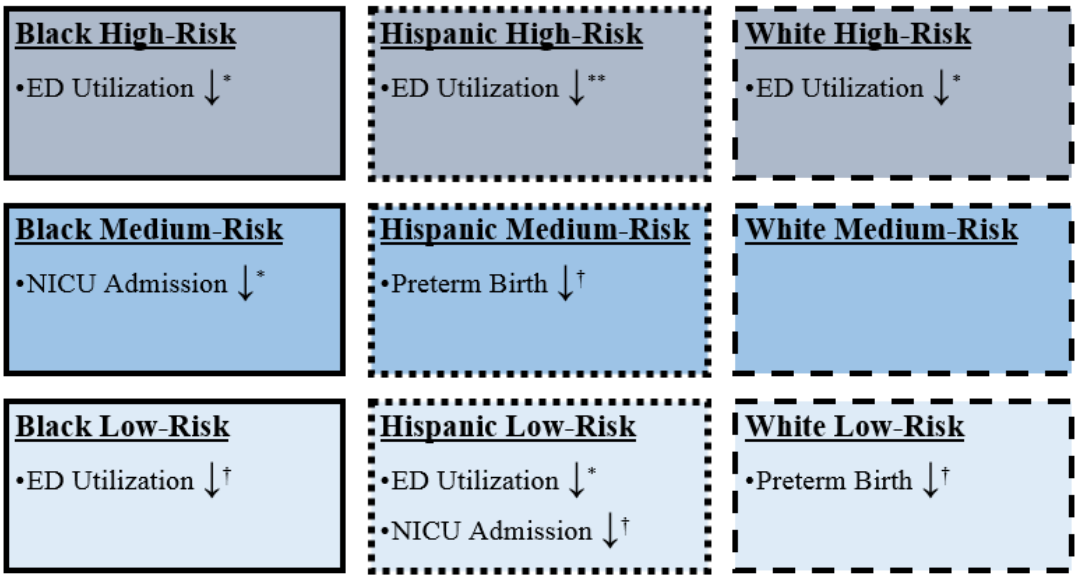


Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: Risk categories are based on weighted risk scores. See footnote [f] for additional details. The unit of analysis is the mother-baby pair. Mothers giving birth to multiple babies during the study period are duplicated for each unique birth.

[f] Weighted risk scores are based on the number and severity of high-risk diagnoses a mother receives during the prenatal period. To create the weighted risk score, a list of 155 high-risk pregnancy diagnosis codes were ranked by severity by a maternal-fetal medicine specialist on a scale of 1 to 4 (4 = most severe). Points were assigned to each diagnosis, based on the rank (e.g., a rank of one equals one point). The weighted risk score is the sum of the points for each high-risk diagnosis received during the prenatal period. Weighted risk scores were used to define three categories of risk: Low-Risk (score = 0), Medium-Risk (score = 1-3), and High-Risk (score ≥ 4). For example, a woman with preexisting controlled hypertension would receive a score of 2, indicating medium-risk; if she were to develop gestational diabetes during the pregnancy, this would result in an additional diagnosis code with a score of 2, bringing her total weighted risk score to 4 (high-risk).

Error! Reference source not found. below provides a summary of primary outcomes associated with The Center, by race-risk category [Associated statistics are included in Appendix H]. Overall, the pregnancy medical home model has the most consistent effect on ED utilization, which is significantly lower for high-risk mothers of all races, as well as Black and Hispanic low-risk mothers. The Center is also associated with significantly lower rates of NICU admission for Black medium-risk and Hispanic low-risk mothers. The pregnancy medical home model appears to have a small effect on preterm birth rates as well, particularly for Hispanic medium-risk and White low-risk mothers. There are no significant differences between intervention and matched comparison mothers in rates of low birthweight.

Figure 4: Summary of Primary Outcomes Associated with The Center, by Race-Risk Category



Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10. McNemar's test conducted between intervention and matched comparison groups. Race/ethnicity categories for "other" and "no ethnicity" not shown (<5% of sample). Low birthweight does not significantly differ between The Center and matched comparison group for any race-risk category.
Note: Risk categories are based on weighted risk scores. See footnote [f] on page 22 for additional details.

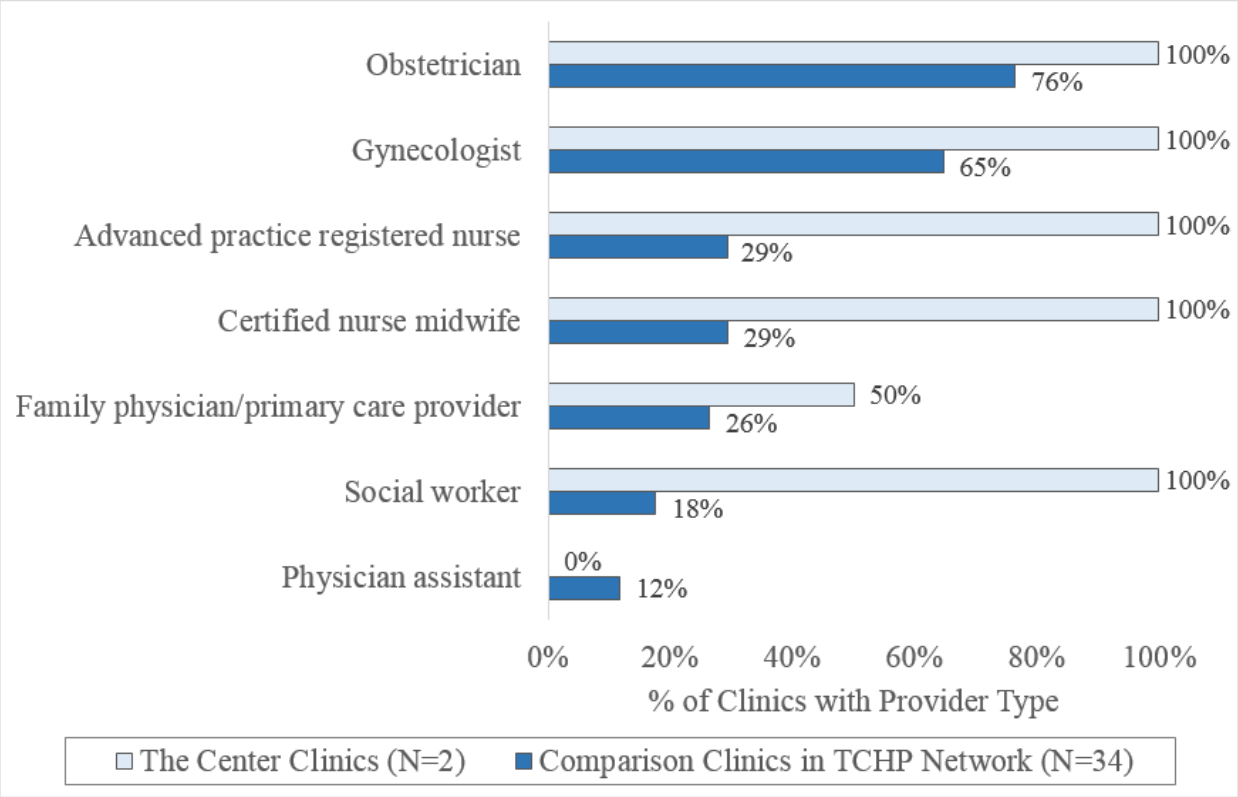
Provider Analysis

This section discusses findings from a short survey developed by HHSC to gauge differences in practice between The Center and other TCHP providers in Harris County. Survey items were developed to determine the extent to which each medical practice corresponds with the definition of a pregnancy medical home specified in H.B. 1605. In addition, providers were asked to rate their practice along ten dimensions of medical homeness,[g] as defined by the Center for Medical Home Improvement (CMHI). Data are presented at the clinic level, and include responses from both locations of The Center and 34 clinics run by other TCHP providers. Overall, though The Center clinics staff a greater variety of providers and are more likely to report meeting the criteria for a medical home, both groups adhere to a number of clinical policies that are integral to the model, and many in the comparison group actually consider themselves to be a pregnancy medical home.

Per H.B. 1605, pregnancy medical homes in the pilot study should have a maternity management team consisting of various provider types, including obstetricians, gynecologists, family physicians or primary care providers, physician assistants, certified nurse midwives, advanced practice registered nurses, and social workers. On average, The Center clinics staffed 5.5 of the 7 provider types listed, while other TCHP providers staffed 2.6 (not shown). **Error! Reference source not found.** shows the percentage of clinics associated with The Center and other TCHP providers reporting each provider type. Most clinics reported having obstetricians and gynecologists on staff, but few employed a physician's assistant. The Center clinics appear to deviate from most other providers in staffing advanced practice registered nurses (APRN), certified nurse midwives (CNM), and social workers. Both APRNs and CNMs are likely associated with cost savings as a result of billing rates that are 8 percentage points lower than the rate of a physician.[87]

[g] Medical homeness is defined as the degree to which a medical practice exhibits the ten characteristics of quality primary care as outlined in the Medical Home Index in Adult Primary Care Short Version; the provider survey used in this study was adapted for practices providing prenatal care.

Figure 5: Provider Types on Staff, by Intervention and Comparison Group Clinic



Note: List of provider types based on pregnancy medical home providers specified in H.B. 1605. Clinics may have other provider types not listed here.

Survey respondents were also asked to rank their clinics along ten dimensions of medical homeness, such as cooperative management between prenatal care providers and specialists, care continuity, and implementing needs assessments and plans of care. The medical homeness scale was derived from CMHI's Medical Home Index in Adult Primary Care Short Version, and adapted for the prenatal care setting by HHSC CADS.[88] For each of the 10 dimensions, providers scored between 1 and 5 points, with higher numbers representing higher levels of medical homeness. Altogether, The Center clinics scored an average of 4.4 points across the ten dimensions of medical homeness, while other TCHP providers logged an average of 3.4 points (p=0.21).

The provider survey also revealed several practice-level similarities between The Center and other TCHP providers. Both clinics belonging to The Center reported conducting formal risk assessments and creating individual care plans for every pregnant patient as part of practice-level policy; interestingly, however, roughly three-quarters of other TCHP providers also reported carrying out these tasks as part of formal clinic policy. A similar pattern emerged with regard to the use of 17P. Like The Center, more than 7 in 10 other TCHP providers reported that it is standard practice to prescribe 17P to patients with a previous preterm birth, barring any contraindications.

Findings from the survey also raise fundamental questions about what constitutes a pregnancy medical home. More than half of respondents from other TCHP providers in the comparison group (23 of 43) reported that they consider their clinic to be a pregnancy medical home. In open-ended responses, these providers emphasized qualities of the clinic such as accessibility/availability, care coordination, and the wide range of services provided (e.g., dental, behavioral health, nutrition, etc.). The discovery that many providers consider their clinics to be pregnancy medical homes raises questions about the definition of the model itself. The concept of a medical home consists of numerous elements, some of which are guiding ideals rather than concrete practices, leaving room for clinics to embrace the model in a selective and uneven manner. Most clinics meet the criteria for at least some level of medical homeness, but few meet all of the relevant criteria, suggesting that what sets The Center apart may simply be a more comprehensive implementation of medical home practices than other local clinics.

CONCLUSION

This report was produced in accordance with H.B. 1605, 83rd Legislature, Regular Session, 2013, which calls on HHSC to develop, implement, and evaluate a pregnancy medical home pilot program in Harris County for women receiving medical assistance through a Medicaid managed care model. Specifically, H.B. 1605 requires HHSC to assess the pilot program's impact on poor birth outcomes and issue recommendations as to whether it should be continued, expanded, or discontinued.

Findings from this evaluation indicate that mothers receiving care at the pregnancy medical home fared better than similar mothers at other local clinics on several important measures. Most notably, mothers associated with the pregnancy medical home were significantly less likely to go to the ED while pregnant, less likely to deliver by C-section, and less likely to have a newborn admitted to the NICU. Each of these trends is associated with anticipated cost savings. Mothers receiving care at the pregnancy medical home also spent more time in prenatal care and were more likely to attend a postpartum visit. Nevertheless, the pregnancy medical home did not yield significant improvement in two key birth outcomes; rates of preterm birth and low birthweight, though slightly lower among pregnancies affiliated with The Center, did not attain statistical significance at the conventional level of $p<0.05$.

This evaluation reiterates the difficulty of moving the mark on historically challenging public health problems, such as preterm birth and low birthweight. Even early prenatal care that is highly integrated with an array of specialty services may not have the time or means to correct for some of the long-term trends driving adverse birth outcomes. Still, this study suggests that pregnancy medical homes may be able to meaningfully curtail costly utilization trends, such as ED visits, C-section deliveries, and NICU admissions. For example, Texas Medicaid pays an average of $22,417 in newborn care for babies admitted to the NICU and $593 in newborn care for babies who are not.[89] Any reduction in NICU admissions is likely to result in meaningful cost savings.

It is not entirely clear why the pregnancy medical home attained these outcomes. One possibility is that staffing a greater number of provider types in house allowed the pregnancy medical home to treat a variety of health issues before they reached a stage requiring costly intervention (e.g., ED treatment or medically necessary C-section delivery). The Center is also able to treat conditions that might otherwise result in an ED visit through extended hours, walk-in appointments, and extensive outpatient services—features not required in the originating legislation, but available to patients at The Center.

The Center may have also achieved favorable utilization outcomes as a result of its unique operational and financial structure. One possibility is that The Center's distinctive arrangement as an MCO-operated facility prompts a heightened focus on achieving HEDIS quality measures financially incentivized by HHSC through MCO-level programs, such as the medical Pay-for-Quality (P4Q) program. The Center is also subject to a unique set of financial implications for the services it provides. Unlike other clinics, The Center operates under a full-risk financial model in which they receive a per member per month (PMPM) capitated payment from TCHP; this financial arrangement places the full responsibility of care on the clinic, incentivizing prevention and quality over the volume of services.

Strengths and Limitations

This study has several methodological and design features that strengthen the credibility of the results. Though women in this study were not randomized to receive prenatal care at The Center or other local clinics, the matched case-control study design allowed evaluators to correct for preexisting differences between the two groups by creating a comparison group that was statistically similar to the intervention group with respect to key demographic and prenatal risk characteristics. This study design was possible because data were available for the entire population of mothers receiving prenatal care through the TCHP network of Medicaid providers in Harris County during the study period. In implementing the matched case-control design, HHSC employed a 1:1 match—the recommended number of matches for estimating the effect of the intervention with minimal bias.[90] Though a higher number of matches (e.g., 1:2 or 1:3) would have provided a larger sample and greater power to detect small statistical differences, prior research has noted that increasing the number of matches can bias the results.[91] Finally, while the provider survey should be interpreted with respect to the limitations outlined below, this aspect of the evaluation provided additional context critical to understanding the study's primary results.

Findings from this evaluation should also be interpreted alongside several limitations. Most notably, conclusions from this study may not be generalizable to other medical homes or other areas of the state. This evaluation examined outcomes from one pregnancy medical home associated with a single MCO in Harris County. Other pregnancy medical homes contracting with different MCOs, or operating in other areas of the state may produce different results. Moreover, The Center is uniquely structured in that it is owned and operated by an MCO, and only provides services for members in its plan. Other clinics in the TCHP network may contract with multiple MCOs simultaneously.

Another key limitation is the thin distinction between services offered by the intervention and comparison group providers. Some providers in the comparison group offer elements of the pregnancy medical home model without having all of the characteristics to fully satisfy the requirements outlined in H.B. 1605. For example, most TCHP providers have obstetricians, gynecologists, and other staff; most conduct formal risk assessments and create care plans tailored to each individual patient; most prescribe 17P for the prevention of preterm birth as part of standard practice. These shared qualities mean that many women in the comparison group likely received elements of the pregnancy medical home "treatment," effectively diluting the effect of the intervention. Ultimately, this study was not able to determine or account for the level of medical homeness offered by each provider. The benefits of the pregnancy medical home model are likely to depend on which clinic serves as the comparison.

Evaluation findings are also limited by several data constraints. Though medical encounter data used in this report are largely complete and internally consistent, some observations contained missing fields or conflicting information. Where possible, HHSC CADS used imputation and other retention methods to prevent the loss of data, though these techniques are unable to correct original data entry errors or retrieve missing IDs and providers needed for analysis. Deficiencies in the encounter data affect a relatively small fraction of cases and are unlikely to introduce any meaningful bias to the study.

Finally, findings from the provider survey should not be considered representative of TCHP Medicaid providers in Harris County. Findings from this survey are generated from a small, self-selected sample and are included to provide additional context for interpretation of the primary findings.

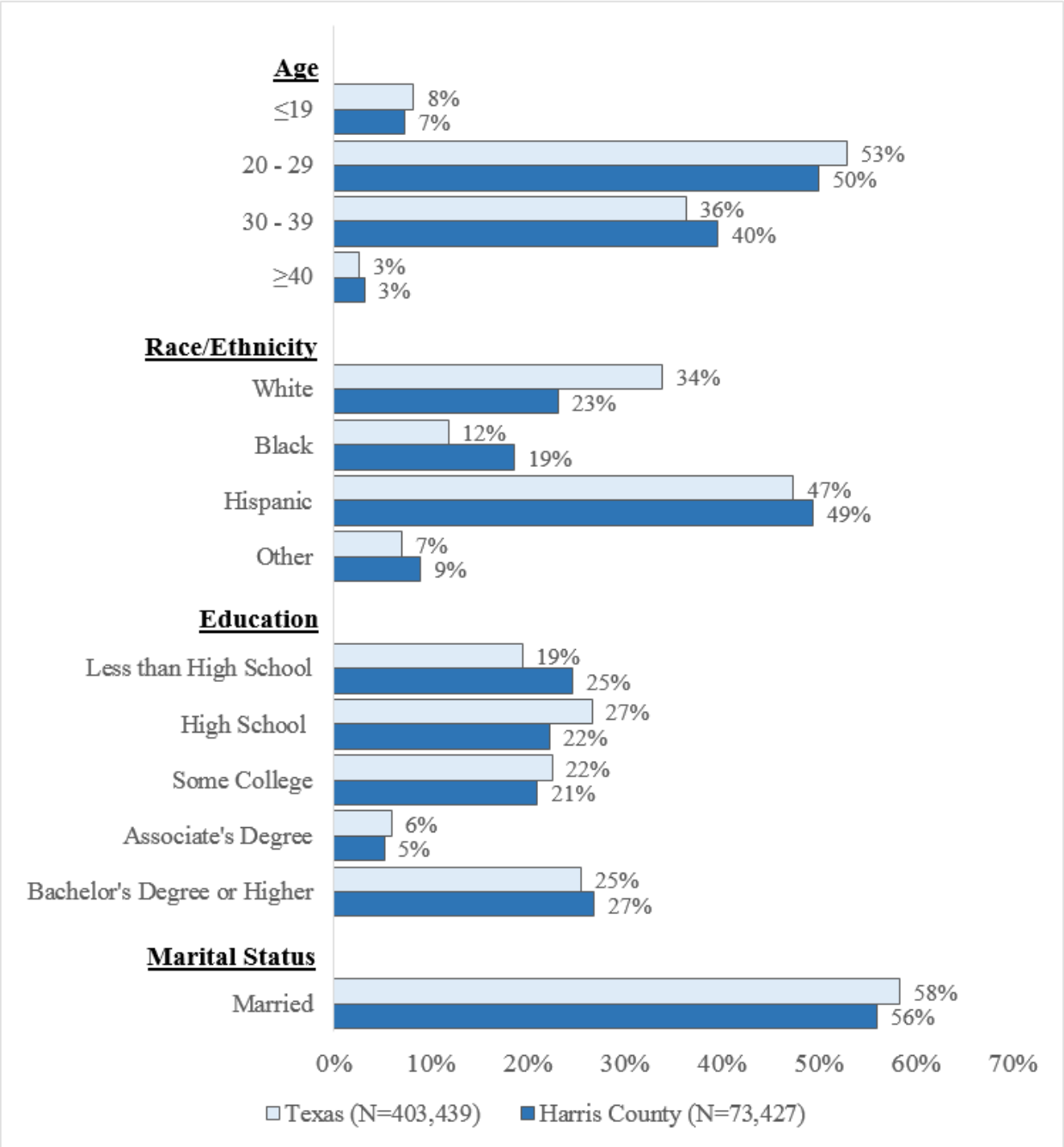
RECOMMENDATIONS

H.B. 1605 requires HHSC to submit recommendations as to whether the pregnancy medical home pilot program should be continued, expanded, or terminated. Based on findings from this evaluation, HHSC recommends continuation of the pregnancy medical home pilot program, as implemented by The Center for Children and Women. While The Center did not yield significantly lower rates of preterm birth or low birthweight, mothers at The Center did experience lower rates of ED utilization, C-section delivery, and NICU admission—each of which is associated with anticipated cost savings. Despite the favorable outcomes observed in this study, there is insufficient evidence at this time to recommend statewide expansion of the pregnancy medical home model, as defined in H.B. 1605. Ultimately, a better understanding is needed regarding why the pregnancy medical home produced lower levels of ED, C-section, and NICU utilization, and whether or not these elements are replicable in other settings. Future research should also assess the financial impact of these trends on the Medicaid program. In addition, HHSC may consider additional policy options, such as alternative payment models, incentive programs, and changes to provider reimbursement, to further the pregnancy medical home model in Texas Medicaid.

APPENDICES

Appendix A

Figure 6: Sociodemographic Characteristics of Mothers Giving Birth in 2015, Texas and Harris County



Source: Texas Department of State Health Services, Center for Health Statistics. Texas Health Data. Birth Data, 2015.

Appendix B

Community Care of North Carolina (CCNC)
Pregnancy Medical Home Program Incentives

Providers in North Carolina who join the pregnancy medical home program administered by CCNC receive the following benefits:

- A $50 incentive for completing a standardized risk screening at the initial OB visit
- A $150 incentive for performing the postpartum office visit
- Exemption from prior approval for OB ultrasounds (OB ultrasounds must be registered)
- An enhanced rate for vaginal deliveries equal to the cesarean section rate
- Coordination and support from the OB team (physician champion and nurse coordinator) from one of CCNC's 14 local networks
- A pregnancy care manager assigned to your practice to help you meet the needs of patients identified as being at-risk for poor birth outcomes
- Care management services provided based on the patient's level of need to facilitate access to resources
- Regular care management contact with the patient and prenatal care provider to improve coordination of care
- Access to practice-specific process and outcome data[92]

Appendix C

Data Sources and Construction of Analytic Sample

This Appendix provides a detailed description of the two primary data sources used in this study. Construction of the analytic sample, key measures, and imputation methods are also described.

Encounters Data

Texas Children's Health Plan provides data to HHSC on all clients in the study population. Data are transferred to HHSC every six months, and include a time lag of approximately five months to account for postpartum care and data preparation. The study period for this evaluation covers a period of approximately three years and ten months (May 1, 2013–March 1, 2017), including prenatal and postpartum care for all live births between February 1, 2014 and December 31, 2016.

Study data include client sociodemographic information and medical encounters for the prenatal, delivery, and postpartum periods. These data are provided at the client-level for each mother in the study period. Encounters data from the birth are also provided for the newborn. Finally, TCHP provides information on NICU admissions, birthweight, and a crosswalk linking mother and baby IDs. These data were merged into a single analytic file, as shown in Appendix D.

This study uses two distinct units of analysis. When analyzing maternal characteristics such as race or age, mothers giving birth to multiple babies during the study period are unduplicated to produce a sample in which each mother is included only once; this sample uses the mother as the unit of analysis. When analyzing outcomes specific to the baby or birth episode, the mother-baby pair serves at the unit of analysis; the majority of this study is focused on the mother-baby pair.

Approximately seven percent of mothers gave birth to multiple babies during the study period. In some cases, babies with the same mother belong to the same pregnancy (e.g., twins) and in other cases, they result from separate pregnancies (e.g., siblings both born within the study period). In some instances, a mother giving birth to multiple babies during the study period might receive prenatal care at The Center for one pregnancy and a separate TCHP provider for another pregnancy, causing her to be in both the intervention and comparison groups, depending on the pregnancy. It is also possible for babies born to a multi-fetal pregnancy to have different birth outcomes. These complexities require that the data be structured such that each mother-baby pair and its associated maternity care is treated as a unique observation.

Analytic Sample

A small proportion of clients with incomplete information on key variables were dropped from the study. Approximately seven percent of cases were missing provider information used to generate the intervention and comparison groups and were removed from the sample. Cases with a missing mother ID or baby ID were also excluded from the sample due to an inability to join relevant data across time periods, or link mothers to their newborns. The final analytic sample includes 23,712 unique mothers and 24,913 unique mother-baby pairs.

Measures

This study draws on a large number of variables to analyze the effectiveness of the pregnancy medical home pilot program. Key outcome variables include prenatal care utilization, use of 17P, emergency department (ED) visits, delivery method, preterm birth, low birthweight, NICU admission, postpartum care utilization, and an array of pre- and postnatal health indicators. Control variables and other covariates include maternal sociodemographic characteristics, pregnancy risk factors, and various indicators for preexisting health complications. A treatment variable denoting mothers who received maternity care at one of the two Center locations is also included. A full list of variables and their associated definitions is included in Appendix E.

Imputation

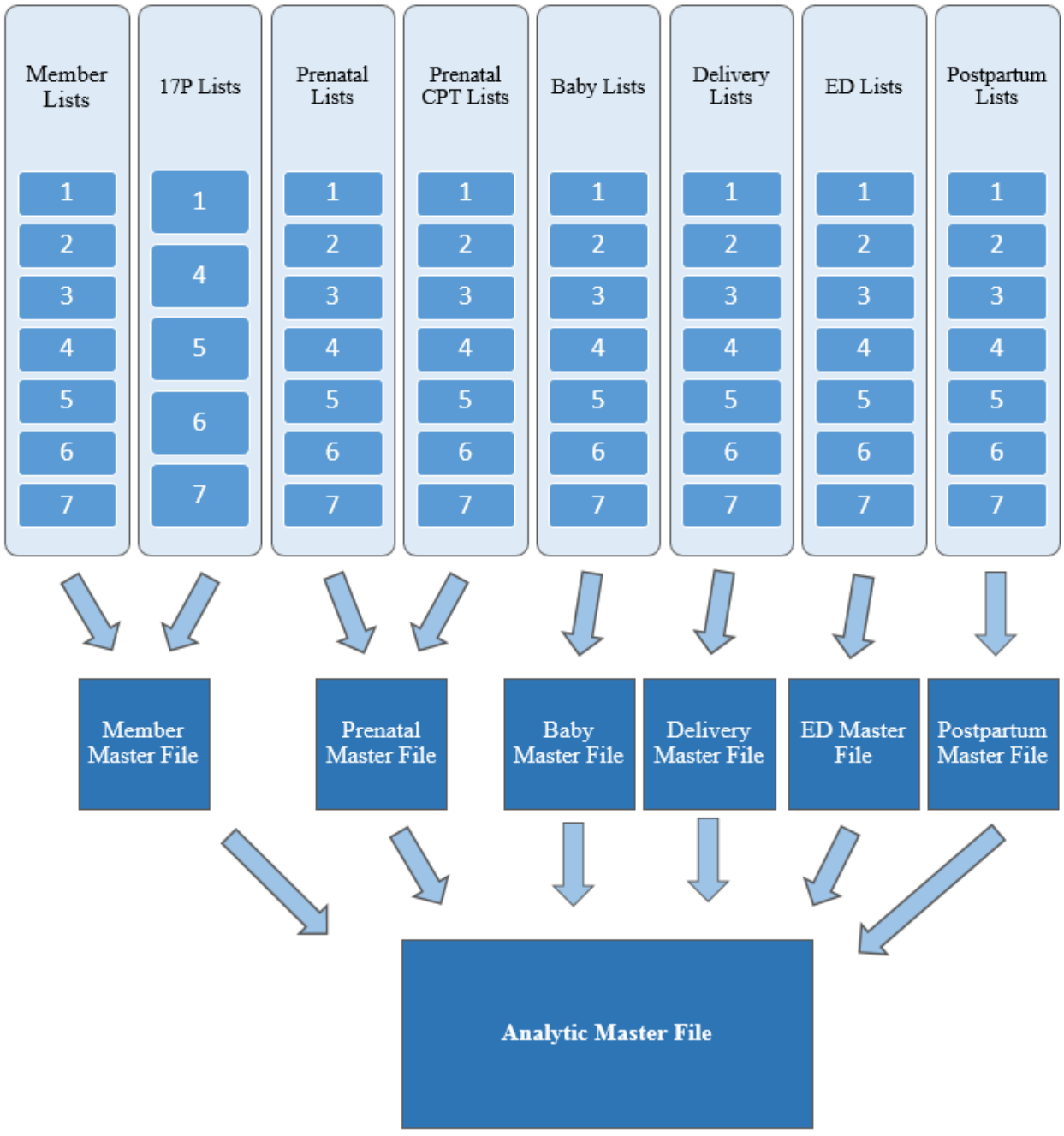
To reduce statistical bias and avoid reductions in sample size, missing values are imputed for a number of variables in this study. Imputation preserves observations that would otherwise be deleted by replacing missing data with an estimated value based on other information in the dataset. The largest source of missing data involves postpartum encounters, where approximately 36 percent of the sample is missing information. Clients with missing postpartum information are assumed to have zero postpartum visits, which is reported as its own category. This determination was affirmed by TCHP and brings the percentage of mothers who do not attend a postpartum visit in line with other estimates cited by the American College of Obstetricians and Gynecologists.[93] Postpartum indicator variables are imputed at the median, which assumes that the mother did not receive the relevant diagnosis or procedure. Variables with imputation affecting approximately 3.7 percent of the sample include preterm, low birthweight, and single/multiple pregnancy variables. These variables are imputed at the median, assigning missing observations to a singleton birth that does not meet the conditions for a preterm or low birthweight infant. A small number of cases are also imputed on prenatal care variables (0.35%), delivery file variables (0.74%), and NICU variables (0.79%) using median substitution.

Survey Data

To supplement findings from the client-level data described above, HHSC developed and conducted a short survey with TCHP Medicaid prenatal care providers in Harris County. A total of 54 respondents from 38 clinics completed the survey. Responses were aggregated by clinic, which serves as the unit of analysis. Data from the provider survey come from a non-representative sample, but provide important background information for interpreting evaluation outcomes.

Appendix D

Pregnancy Medical Home Data Merging Diagram



Note: 17P Lists for data transfers 2 and 3 are included in the member list files and did not require separate merging.

Appendix E

Codebook for the Pregnancy Medical Home Pilot Program Evaluation

Table 7: Mother Sociodemographic Characteristics

Variable	Variable Type(s)	Values and Explanation
Mother Age	• Continuous • Categorical	Mother age at time of delivery
Mother Race	• Categorical	Source values include "Hispanic", "African American", "Caucasian", "Asian/Pacific", "Alaskan/Amer Indian", and "No Ethnicity." "Asian/Pacific" and "Alaskan/Amer Indian" combined to create "Other" due to small sample sizes.
Mother Language	• Categorical	Source values include "English", "Spanish", "Vietnamese", and "No Language." "Vietnamese" and "No Language" combined to create "Other/No Language" due to small sample sizes.
Births in period	• Ordinal	Number of newborns born to each mother during the study period. Calculated through mother ID and baby ID match-merging in member file.
Days Between Births	• Continuous • Categorical	Absolute difference in the delivery dates of baby #1 and baby #2 from the same mother during study period.

Table 8: Matching Variables

Variable	Variable Type(s)	Values and Explanation
Nulliparous	• Binary	DX codes from prenatal file and delivery file indicating supervision of normal first pregnancy; elderly primigravida; young primigravida. ("V220" "V2381" "V2383" "Z3400" "O09511" "O09512" "O09513" "O09519" "O09611")
Prior Preterm Birth	• Binary	DX codes from prenatal file indicating supervision of pregnancy with history of preterm labor, any trimester; personal history of pre-term labor. ("V2341" "V1321" "O09211" "O09212" "O09213" "O09219" "Z8751")
Preeclampsia	• Binary	DX codes from prenatal file for preeclampsia (high blood pressure) ("64240" "64241" "64242" "64243" "64250" "64251" "64252" "64253" "64254" "O1400" "O1402" "O1403" "O1410" "O1412" "O1413" "O1420" "O1422" "O1423" "O1490" "O1492" "O1493")

Variable	Variable Type(s)	Values and Explanation
Obesity Complications	• Binary	DX codes from prenatal file and delivery file (obesity complicating pregnancy, childbirth, or the puerperium, antepartum condition or complication; obesity complicating pregnancy, childbirth, or the puerperium, delivered, with or without mention of antepartum condition) ("64911" "64913" "O99211" "O99212" "O99213" "O99214")
High Risk Pregnancy	• Binary	DX codes from prenatal file for supervision of any high risk pregnancy ("V237" "O0930" "V2381" "V2382" "V2383" "V2384" "V2385" "V2386" "O09511" "O09521" "O09611" "O09621" "O09819" "O09821" "O09822" "O09823" "O09829" "V2389" "V239" "O09891" "O09892" "O09893" "O09899" "O0990" "O0991" "O0992" "O0993")
Weighted Risk Score	• Continuous • Categorical	The weighted risk score is an additive index based on the number and severity of patients' prenatal diagnosis codes. Scores are generated by determining the number of prenatal diagnosis codes that correspond to a list of 155 high risk pregnancy ICD-9 codes (and corresponding ICD-10 codes) developed by Blue Cross Blue Shield and calibrated for severity by maternal-fetal medicine specialist, Dr. Lisa Hollier, MD, M.P.H. Each high risk diagnosis code is assigned a rank indicating the level of severity (1-4). Individuals scores are derived by assigning high risk patients the number of points corresponding with the severity ranking for each diagnosis code and summing the points to arrive at a total score. Diagnosis codes are unduplicated by mother ID prior to calculations.

Table 9: Prenatal Care Variables

Variable	Variable Type(s)	Values and Explanation
Number of Prenatal Visits	• Continuous • Categorical	Total count of prenatal visits
Time in Prenatal Care	• Continuous • Categorical	Difference between first prenatal visit and delivery date. Top end cut off at 290 days (9.66 months).

Variable	Variable Type(s)	Values and Explanation
≥ 27 weeks in Prenatal Care	• Binary	Indicator approximating first trimester care, defined as the distance between the first day of the patient's last menstrual period and 14 weeks, 0 days. The 14 week cutoff is 189 days prior to delivery in a pregnancy with average gestational length. Indicator denotes mothers with a prenatal visit at least 189 days, or 27 weeks, before the delivery.
First Trimester Care (ICD-10 only)	• Binary	DX codes (ICD-10 only) from the delivery file. ICD-9 codes do not specify trimester.
Number of Prenatal DX	• Continuous • Categorical	Total number of unique diagnoses during prenatal period (unduplicated by DX code)
Antepartum Anemia	• Binary	DX codes from prenatal file for antepartum anemia; anemia complicating pregnancy ("64823" "O99011" "O99012" "O99013")
Estimated Eligibility for 17P	• Binary	Indicator estimating eligibility for 17P treatment. A mother is determined to be eligible for 17P if she is currently pregnant with a singleton birth AND has a history of preterm birth (unknown whether prior preterm is spontaneous or medical, singleton or multiple) AND has a prenatal care visit before the third trimester (estimated retroactively from the delivery date) OR received 17P.
Receive 17P	• Binary	Indicator denoting 17P treatment for the prevention of preterm birth. Indicator derived from member file, 17P file (where available), and CPT codes in the prenatal file ("J1725" "J2675")
Estimated Rate of 17P Among Eligible Mothers	• Rate	Proportion of mothers who are estimated to be eligible for 17P and receive the shot.
ED Utilization	• Binary	Indicator variable for emergency department utilization during the prenatal period, as denoted by encounter data in the ER file

Table 10: Birth Outcome Variables

Variable	Variable Type(s)	Values and Explanation
Delivery Method	• Categorical	Member file variable indicating vaginal or C-section delivery. Supplemented by delivery file CPT codes when "unknown" ("59409" "59514")

Variable	Variable Type(s)	Values and Explanation
Single/ Multiple Pregnancy	• Interval	DX codes from baby file indicating single or multiple births. ("V30.00" "V30.01" "V30.1" "V30.2" "Z38.00" "Z38.01" "Z38.1" "V31.00" "V31.01" "V32.00" "V32.01" "V33.00" "V33.01" "Z38.30" "Z38.31" "V34.00" "V34.01" "V37.00" "V37.01" "Z38.61" "V39.00")
Low birthweight	• Binary	DX codes from baby file indicating weight under 2500g ("765.00" "765.01" "765.02" "765.03" "765.04" "765.05" "765.06" "765.07" "765.08" "765.10" "765.11" "765.12" "765.13" "765.14" "765.15" "765.16" "765.17" "765.18" "P07.00" "P07.01" "P07.02" "P07.03" "P07.10" "P07.14" "P07.15" "P07.16" "P07.17" "P07.18") OR information from mother file where baby weight in grams is below 2500g
Preterm	• Binary	DX codes from baby file, prenatal file, and delivery file indicating less than 37 weeks of gestation OR DX codes from delivery file indicating preterm labor with preterm delivery ("765.21" "765.22" "765.23" "765.24" "765.25" "765.26" "765.27" "765.28" "P07.20" "P07.21" "P07.22" "P07.23" "P07.24" "P07.25" "P07.26" "P07.30" "P07.31" "P07.32" "P07.33" "P07.34" "P07.35" "P07.36" "P07.37" "P07.38" "P07.39" "O6010X0" "O6010X1" "O6012X0" "O6012X1" "O6013X0" "O6013X1" "O6014X0" "O6014X1")
Growth Retardation	• Binary	DX codes from baby file and prenatal file indicating growth retardation (i.e., not growing to normal weight) ("764.90" "764.91" "764.92" "764.93" "764.94" "764.95" "764.96" "764.97" "764.98" "764.99" "P05.9")
Small/Light for Gest Age	• Binary	DX codes from baby file indicating light for gestational age and ICD-10 codes indicating small for gestational age ("764.00" "764.01" "764.02" "764.03" "764.04" "764.05" "764.06" "764.07" "764.08" "764.09" "764.10" "764.11" "764.12" "764.13" "764.14" "764.15" "764.16" "764.17" "764.18" "764.19" "P05.00" "P05.01" "P05.02" "P05.03" "P05.04" "P05.05" "P05.06" "P05.07" "P05.08" "P05.10" "P05.11" "P05.12" "P05.13" "P05.14" "P05.15" "P05.16" "P05.17" "P05.18")
Large/Heavy for Gest Age	• Binary	DX codes from baby file indicating large or heavy for gestational age ("766.0" "766.1" "P08.0" "P08.1")

Variable	Variable Type(s)	Values and Explanation
Late or Postterm	• Binary	DX codes from baby file indicating late or postterm ("766.21" "766.22" "P08.2" "P08.21" "P08.22")
Delivery Anemia	• Binary	DX codes in delivery file indicating anemia of mother with delivery; anemia complicating childbirth; anemia unspecified ("64821" "O99011" "O99012" "O99013" "O9902" "2859" "D649")
Abnormal Fetal Heart Rate	• Binary	DX codes in delivery file indicating abnormality in fetal heart rate or rhythm delivered with or without antepartum condition ("65971" "O76")
NICU Level of Care	• Categorical	Indicator for admission into NICU Levels II, III, and IV, as denoted in the member file
Days in NICU	• Continuous • Categorical	Number of days spent in NICU Levels II-IV, as denoted in the member file

Table 11: Postpartum Care Variables

Variable	Variable Type(s)	Values and Explanation
Number of Postpartum Visits	• Continuous • Categorical	Total count of postpartum visits
Days to First Postpartum Visit	• Continuous • Categorical	Difference between delivery date and date of first postpartum visit. Top end cutoff at 60 days, the time at which TP40 Medicaid coverage ends.
Postpartum Anemia	• Binary	DX code for postpartum anemia (chronic iron deficiency after delivery). ("64824" "O9081" "O9903")
Severe Maternal Morbidity	• Binary	Indicator variable denoting the existence of one or more DX codes from the delivery or postpartum files that corresponds to a list of ICD-9 and ICD-10 DX codes specifying severe complications of labor or delivery impacting maternal health. Examples include blood transfusions, disseminated intravascular coagulation, heart failure during a procedure/surgery, hysterectomy, or operations on the heart/pericardium. Severe Maternal Morbidity DX codes drawn from the Centers for Disease Control and Prevention.[94]
LARC	• Binary	DX code for insertion of Intrauterine Device (IUD) or subdermal contraceptive ("V2511" "V2513" "V255" "Z30430" "Z30433") OR HCPCS/CPT code for Intrauterine Copper Contraceptive, Skyla, Mirena, Liletta, Levonorgestrel-Releasing Intrauterine Contraceptive System, Nexplanon, or Insertion of IUD ("J7300" "J7301" "J7302" "J7306" "J7307" "J7297" "J7298" "58300")

Variable	Variable Type(s)	Values and Explanation
Breast Pump CPT	• Binary	CPT code for breast pump, any type ("E0603")

Appendix F

Analytic Strategy

This evaluation is conducted in three stages. The first two stages examine and prepare the data for analysis. Stage three conducts the final analysis. An overview of each stage is presented below.

- Stage 1: Examine Baseline Characteristics of the Study Population
  The section below entitled **Characteristics of the Study Population** provides a descriptive portrait of the original study population, including mothers receiving maternity care at The Center (intervention group; N=1,639) and mothers receiving maternity care at other TCHP providers in Harris County (comparison group; N=22,073). The data reveal important preexisting differences between the two groups of mothers.
- Stage 2: Create a Matched Sample to Account for Preexisting Differences
  The following section entitled **Matched Case-Control Design** uses propensity score modeling to develop a matched (1:1) case-control sample (n=3,382) using mother-baby pairs as the unit of analysis. This approach, described in more detail below, attempts to correct for preexisting differences by balancing intervention and comparison group cases on observed baseline characteristics, such as race/ethnicity and prenatal risk factors.
- Stage 3: Conduct Final Analysis on the Matched Sample
  The **Results** section, included in the main body of the report, presents the study's main findings. HHSC relies on a combination of descriptive statistics and multivariate models to assess the effect of the pregnancy medical home using encounter data from the matched sample. To provide additional context, survey data from a sample of TCHP Medicaid providers in Harris County (n=54) is also included.

Characteristics of the Study Population

Table 12 below presents the sociodemographic characteristics of mothers at The Center (intervention group) and mothers at other TCHP providers in Harris County (comparison group). Asterisks denote where the two groups are statistically different. Though mothers in each group are broadly similar with regard to age, language, and the numbers of births during the study period, there are substantial differences in race/ethnicity. Mothers at The Center are significantly more likely to be Black, and less than half as likely to be White as their counterparts receiving care in other local clinics.

Table 12. Sociodemographic Characteristics, Study Population

	The Center (Intervention)	Other TCHP Providers (Comparison)	Overall
N	*1,639*	*22,073*	*23,712*
Mother Age			
≤ 19	16.5%	16.2%	16.2%
20-24	39.1%*	36.1%	36.3%
25-29	24.5%	26.2%	26.1%
30-34	13.1%	14.2%	14.2%
≥ 35	6.8%	7.2%	7.2%
Mother Race			
Hispanic	49.1%	50.1%	50.0%
Black	38.4%***	26.1%	27.0%
White	8.1%***	18.6%	17.9%
Other	2.0%	2.7%	2.7%
Not Reported	2.5%	2.5%	2.5%
Mother Language			
English	87.1%	87.7%	87.7%
Spanish	9.5%***	7.0%	7.2%
Other/Not Reported	3.4%***	5.3%	5.1%
Births in Period [a] (Range 0-5)			
1	91.6%	90.7%	90.7%
2	8.0%	9.0%	8.9%
3 or more	0.4%	0.4%	0.4%
Days Between Births [b]			
220-300	0.8%	1.2%	1.2%
301-400	20.0%	22.1%	21.9%
401-500	32.0%*	22.4%	23.1%
501-600	16.8%	19.0%	18.9%
601-700	16.0%	15.7%	15.8%
701+	14.4%	19.6%	19.2%
Mean	*529.6*	*546.7*	*545.6*

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016.
Note: ***p<0.001, **p<0.01, *p<0.05. The unit of analysis is the mother. Mothers giving birth to multiple babies during the study period are unduplicated in this table.
Note: [a] Includes multifetal pregnancies [b] Where number of pregnancies in period=2

Matched Case-Control Design

The pregnancy medical home pilot evaluation is a quasi-experimental study without random assignment. Studies of this type are prone to problems with selection bias. Selection bias occurs when systematic differences in the characteristics of participants could also cause the observed effect.[95] In this study, selection concerns arise from the fact that each mother chooses her own prenatal care clinic. Mothers who choose to receive care at The Center may be systematically different from mothers who seek prenatal care at other local clinics, making it difficult to know whether pregnancy outcomes are due to preexisting differences or The Center itself. To help correct for preexisting differences between the two groups of mothers, HHSC uses propensity score modeling to construct a 1:1 matched sample in which each mother at The Center is paired with a similar mother in the comparison group.[h] The matched sample allows HHSC CADS to compare two groups of mothers that are characteristically similar, except for the location of prenatal care.

Table 13 below shows the baseline characteristics of intervention and comparison group mothers before and after matching. Prior to matching, the two groups of mothers differ significantly with regard to race/ethnicity and various measures of prenatal risk. In contrast to the original comparison group, mothers at The Center are significantly more likely to have a prior preterm birth, pregnancy complications resulting from obesity, and diagnoses codes indicating the supervision of a high-risk pregnancy. Intervention group mothers also score higher on a weighted risk score comprised of hundreds of high-risk pregnancy diagnosis codes. In addition, mothers at The Center are less likely to be first-time mothers or have preeclampsia. Each of these factors is linked to adverse birth outcomes, introducing possible bias from preexisting differences between the groups. The matched comparison group generated to address these concerns is shown in the right-hand column. After matching, the two groups are statistically equivalent across all baseline characteristics. Future analyses are conducted on the matched sample.

[h] The 1:1 matched sample mimics a randomized experiment by balancing the intervention and comparison groups across a range of characteristics significantly associated with intervention group status prior to any effect from receiving care. Matching is performed using a propensity score, which gives the predicted probability of being in the intervention group based of a set of covariates associated with The Center, including race/ethnicity and prenatal risk factors. Selecting a single comparison group match for each intervention group mother is considered optimal for estimating the treatment effect with minimal bias. A 1:1 match also allows for the clearest interpretation of McNemar's test, the most commonly used test in the analysis. [Source: Imbens, G. W. (2004). Nonparametric estimation of average treatment effects under exogeneity: A review. The review of Economics and Statistics, 86(1), 4-29.; Austin, P. C. (2010). Statistical criteria for selecting the optimal number of untreated subjects matched to each treated subject when using many-to-one matching on the propensity score. American journal of epidemiology, 172(9), 1092-1097.]

Table 13. Balance Checks on Matched Sample

	The Center (Intervention)	Original Population of Other TCHP Providers (Comparison)	Matched Sample of Other TCHP Providers (Comparison)
N	*1,691*	*23,222*	*1,691*
Mother Race [a]			
Hispanic	48.9%	50.1%	49.0%
Black	38.6%	26.2%***	38.7%
White	8.0%	18.5%***	8.1%
Other	2.0%	2.7%	1.8%
Not Reported	2.5%	2.5%	2.4%

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016.
Note: The unit of analysis is the mother-baby pair. Mothers giving birth to multiple babies during the study period are duplicated for each unique birth. Data from the original population of births is independent; differences are evaluated using unpaired t-tests and z-tests (***p<0.001, **p<0.01, *p<0.05). The propensity score matched sample is considered paired data; differences are evaluated using the standardized mean difference (SMD).
Note: [a] The SMD for the difference between The Center and Matched Sample for all levels of the categorical variable Mother Race is 0.0192. Imbalance in the SMD is defined as absolute value greater than $[1.96*\sqrt{(2/1,691)}]$= 0.0674 (per Austin (2009)).[96] The distributions of maternal race levels in The Center and Matched Sample are considered statistically similar.

Table 14: Balance Checks on Matched Sample (cont.)

	The Center (Intervention)	Original Population of Other TCHP Providers (Comparison)	Matched Sample of Other TCHP Providers (Comparison)
N	*1,691*	*23,222*	*1,691*
Prenatal Risk Factors			
Nulliparous	15.9%	20.9%***	15.8% (SMD=0.0016)
Prior Preterm Birth	7.5%	3.7%***	7.1% (SMD=0.0159)
Preeclampsia	0.7%	1.2%*	0.5% (SMD=0.0309)
Obesity Complications	27.0%	16.3%***	27.1% (SMD=-0.0027)
High Risk Pregnancy	54.6%	39.4%***	54.2% (SMD=0.0071)
Weighted Risk Score[a] (*Mean*)	*2.5*	*1.8****	*2.5* (SMD=-0.0006)

Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016.
Note: Data from the original population of births is independent; differences are evaluated using unpaired t-tests and z-tests (***p<0.001, **p<0.01, *p<0.05). The propensity score matched sample is considered paired data; differences are evaluated using the standardized mean difference (SMD). Imbalance in the SMD is defined as absolute value greater than $[1.96*\sqrt{(2/1,691)}]= 0.0674$ (per Austin (2009))[97]
Note: [a] Weighted risk score calculated based on the number and severity of high risk diagnosis codes received during the prenatal period. For more information, see variable definitions in Appendix E.

Appendix G

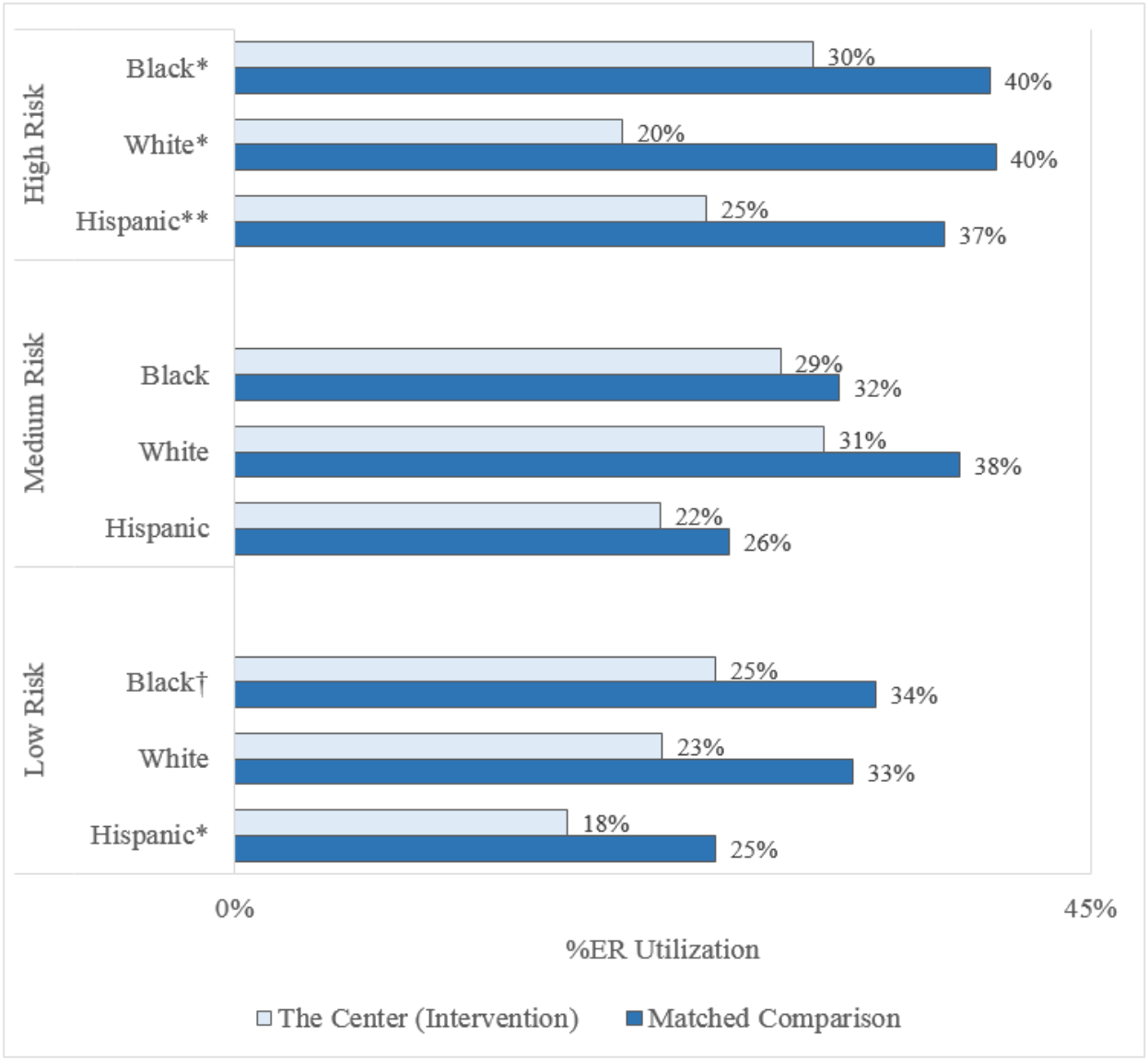
Table 15. Conditional Logit Estimation of Primary Outcomes, Matched Sample

	M1	M2	M3	M4	M5	M6	M7	M8
N	*3,382*	*3,382*	*3,382*	*3,382*	*3,382*	*3,382*	*3,382*	*3,382*
Outcome	*ED Utilization*		*Preterm Birth*		*Low Birthweight*		*NICU Admission*	
The Center	0.70***	0.67***	0.83	0.81†	0.91	0.89	0.72***	0.70***
Mother Age		0.97**		0.98		1.0		0.97*
Male Baby		0.96		0.88		0.56*		1.24

Source: TCHP Medicaid Births, 2/2014 to 12/2016.
Note: ***p<0.001, **p<0.01, *p<0.05, †p<0.10. Conditional logistic regression stratified on matching identifier. Columns display odds ratios.
Note: Additional multivariate models (not shown) were conducted to examine whether the effect of The Center is dependent on maternal race or risk level, however these analyses failed to show significant variation in the main effect by race or weighted risk score. Interaction effects were tested in logistic regression models using the Wald Chi-Squared test for individual effects.

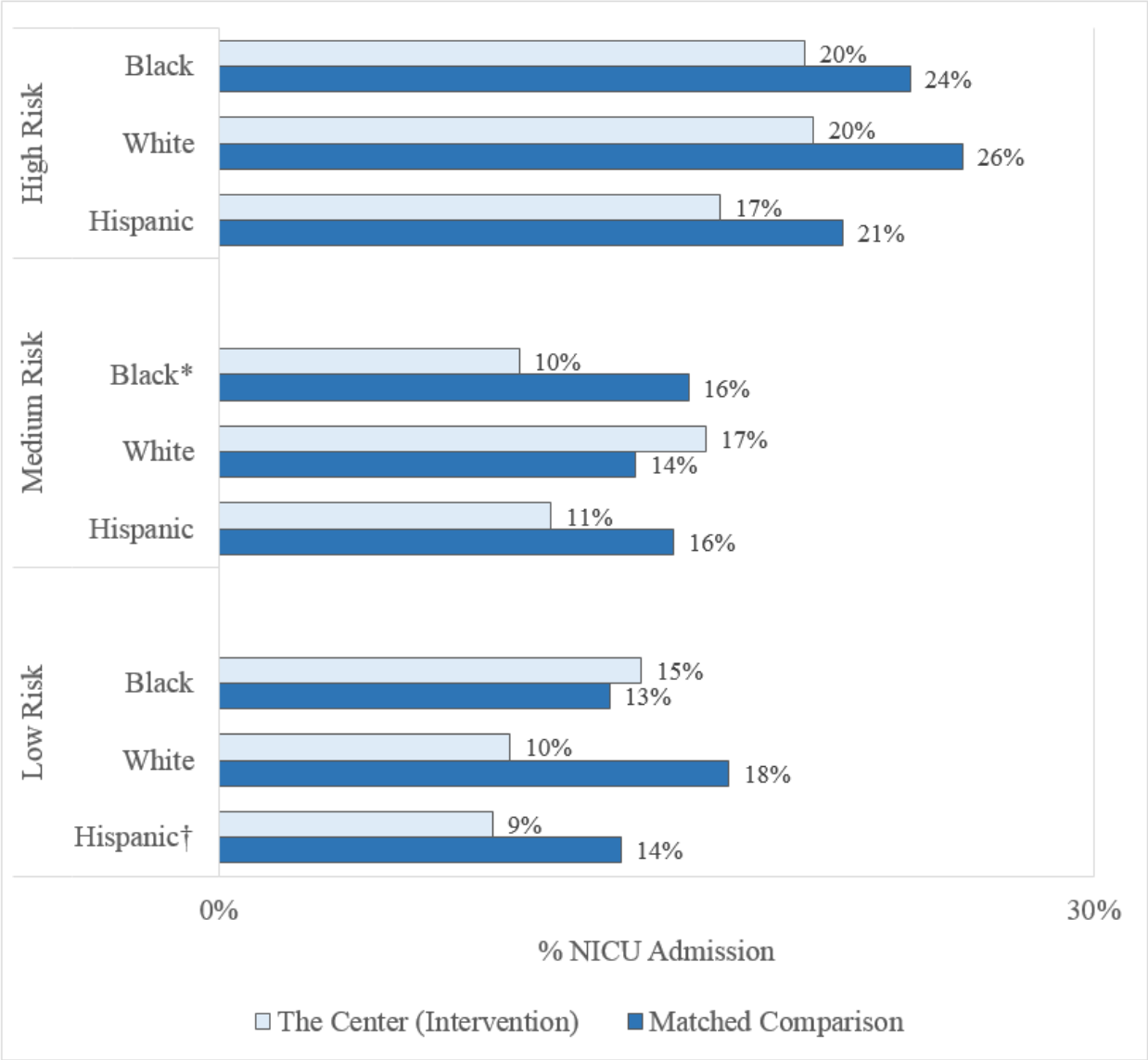
Appendix H

Figure 7. ED Utilization, by Race-Risk Category and Intervention Status



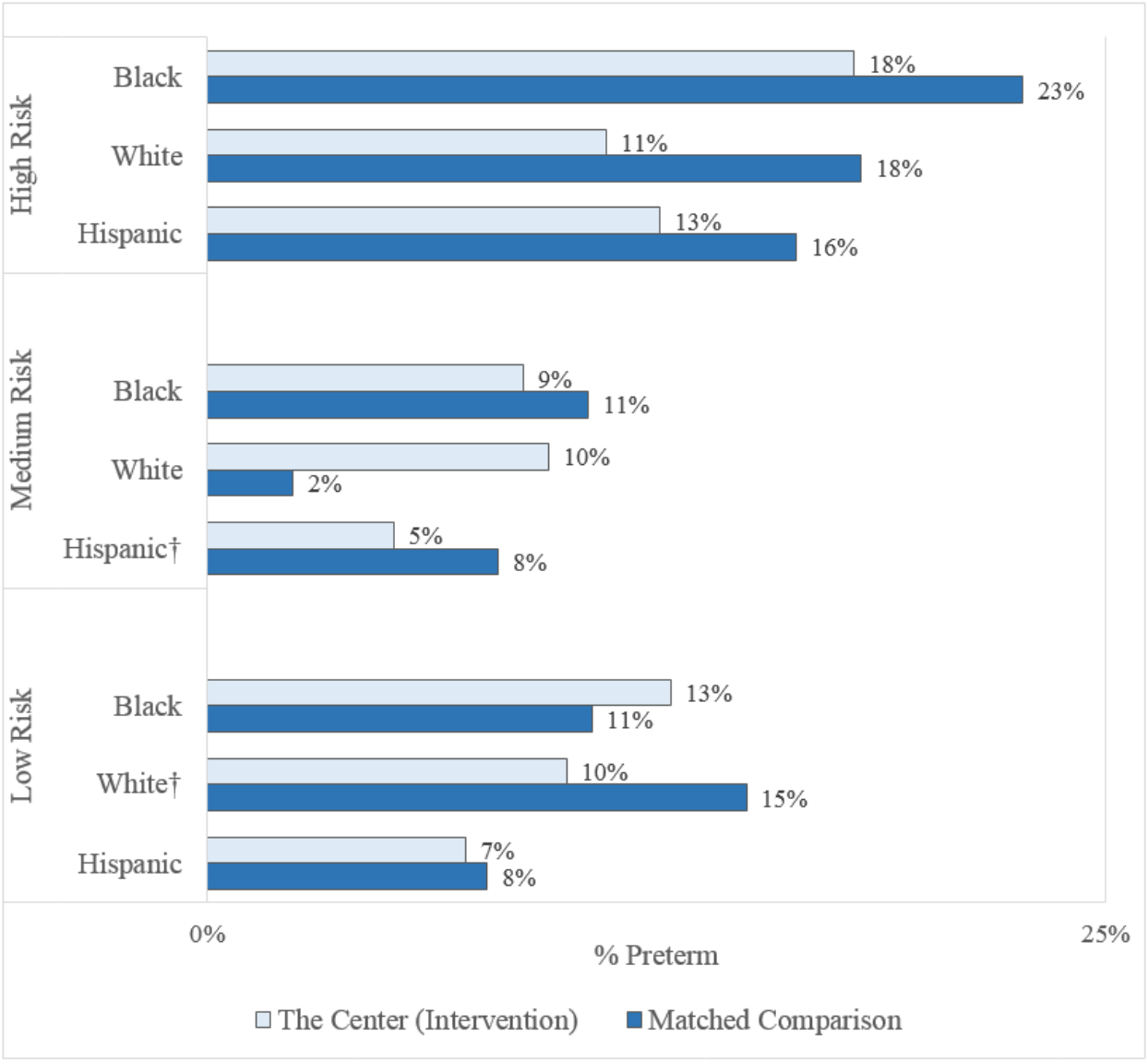
Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: McNemar's test. ***p<0.001, **p<0.01, *p<0.05, †p<0.10. Race/ethnicity categories for "other" and "no ethnicity" not shown (<5% of sample).

Figure 8. NICU Admission, by Race-Risk Category and Intervention Status



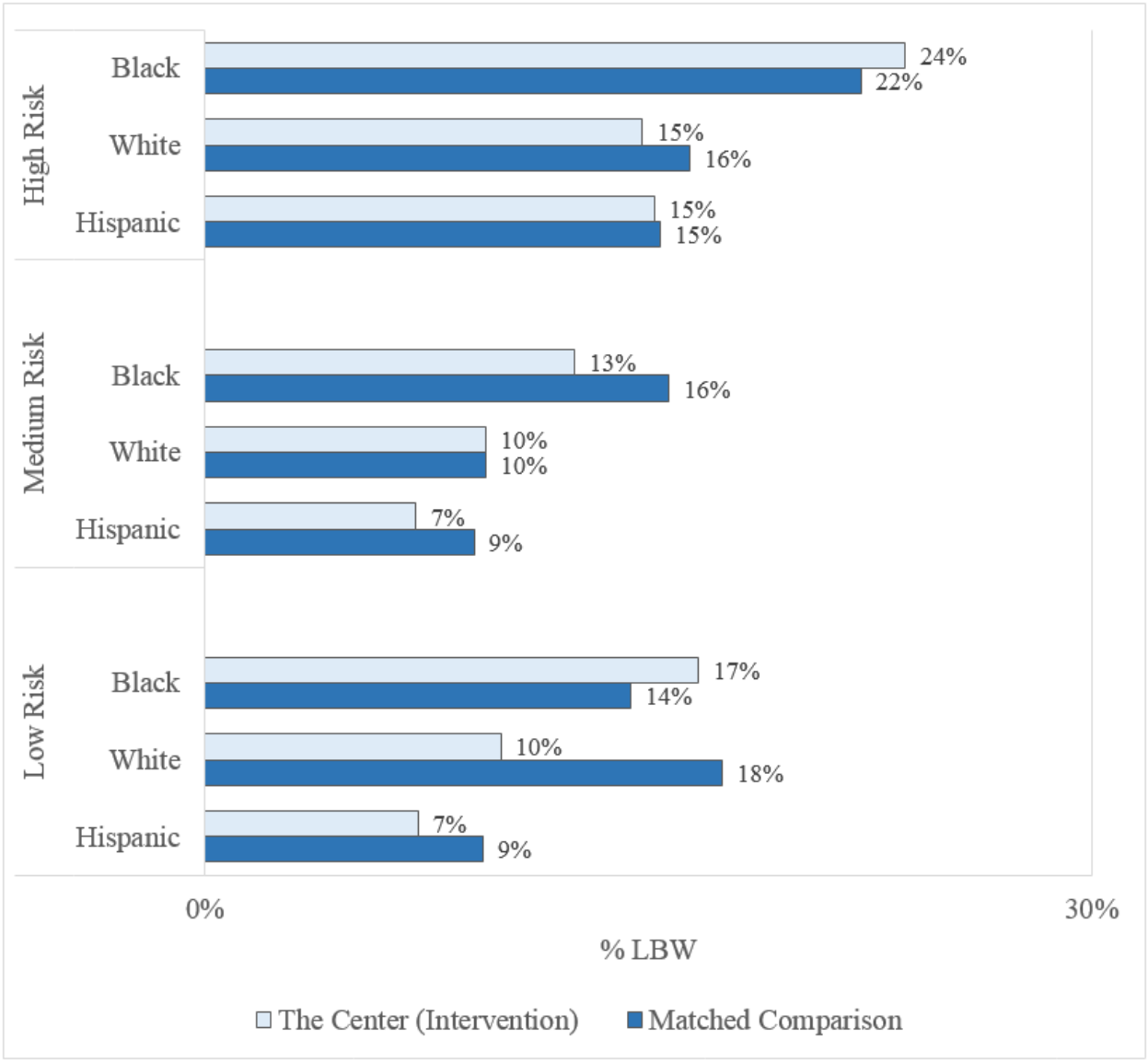
Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: McNemar's test. ***p<0.001, **p<0.01, *p<0.05, †p<0.10. Race/ethnicity categories for "other" and "no ethnicity" not shown (<5% of sample).

Figure 9. Preterm Births, by Race-Risk Category and Intervention Status



Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: McNemar's test. ***p<0.001, **p<0.01, *p<0.05, †p<0.10. Race/ethnicity categories for "other" and "no ethnicity" not shown (<5% of sample).

Figure 10. Low Birthweight, by Race-Risk Category and Intervention Status



Source: TCHP Medicaid Births in Harris County, TX. 2/2014 to 12/2016. Matched Sample, (n=3,382).
Note: McNemar's test. ***p<0.001, **p<0.01, *p<0.05, †p<0.10. Race/ethnicity categories for "other" and "no ethnicity" not shown (<5% of sample).

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