MATERNAL AND CHILD HEALTH EPIDEMIOLOGY

2021 HEALTHY TEXAS MOTHERS AND BABIES DATA BOOK

TEXAS Health and Human Services
Texas Department of State Health Services

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Executive Summary

Under the authority granted in Texas Health and Safety Code, Sec. 161.0211, the Department of State Health Services (DSHS) conducts surveillance and investigations of the factors that increase risk for negative birth outcomes. Each year, DSHS summarizes this research in the Healthy Texas Mothers and Babies Data Book (Data Book) to give an overview of infant and maternal health in Texas. The Data Book highlights the trends and disparities in infant and maternal health outcomes to help programs and policymakers make data-driven decisions on how to improve these outcomes. The Data Book is released annually.

Key findings from the 2021 Data Book include:

- Substantial disparities exist for infant and maternal health indicators. For example, non-Hispanic Black mothers and infants have significantly higher rates of infant mortality, preterm birth, low birth weight, pregnancy-related depression, and severe maternal mortality and morbidity than other racial or ethnic groups. These populations are also less likely to receive first trimester prenatal care, use safe sleep practices, and experience recommended infant feeding practices.
- Geographic and regional differences were observed throughout Texas, especially for teen birth rates, infant mortality rates, the prevalence of smoking during pregnancy, and neonatal abstinence syndrome rates.
- After remaining relatively stable for several years, the Texas birth rate decreased in 2020 for the fifth year in a row. Texas has seen a reduction in the teen birth rate; however, the teen birth rate remains higher than the national teen birth rate.
- Over the past decade, Texas has seen a reduction in the percentage of women who smoke during pregnancy. Texas has one of the lowest rates of maternal smoking during pregnancy compared to other states.
- Over the past decade, the state has experienced an increase in pre-pregnancy obesity, maternal diabetes, and maternal hypertension.
- The infant mortality rate in Texas has declined throughout the past decade, reaching an all-time low in 2020.
- In 2020, the percent of preterm births in Texas decreased after four consecutive years of increases.
- Texas observed a decline in neonatal abstinence syndrome from 2018 to 2019 while national rates continued to rise (data for 2020 has yet to be released).
- The preterm birth rate continued to be higher in Texas than the national preterm birth rate.
- The percent of mothers receiving early prenatal care in Texas was the third lowest in the nation in 2019 and the lowest in the nation in 2020.

Purpose

The 2021 Department of State Health Services Healthy Texas Mothers and Babies Data Book (Data Book) provides an overview of infant and maternal health in Texas. The trends and disparities in infant and maternal health outcomes highlighted in this report can help programs and policymakers make data-driven decisions on how to improve these outcomes. The Data Book brings different data sources together for analysis and reporting to create a cohesive view of the status of both infant and maternal health in Texas.

The Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) fully funds completion of this Data Book under Grant Number B04MC40164, Maternal and Child Health Services. The information or content and conclusions in this report are those of the author and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS, or the U.S. Government.

Texas Pregnancy Risk Assessment Monitoring System is supported, in part, through funding from the Centers for Disease Control and Prevention (CDC) (Grant #6 U01DP006595-01-01), the State Systems Development Initiative Grant Program (Grant Number H18MC00048), and the Texas Maternal and Child Health Title V Block Grant Program. The contents of this publication do not necessarily represent the views of the CDC.

Data Sources and Terms

Data Sources

DSHS compiled and analyzed the following data sources to create the 2021 Healthy Texas Mothers and Babies Data Book (Data Book):

- Vital records data (information from Texas birth, death, fetal death, and linked birth-death files);
- Texas Health Care Information Collection (THCIC) Inpatient Public Use Data File (PUDF) data;
- Texas Pregnancy Risk Assessment Monitoring System (PRAMS) survey;
- DSHS/Texas Health and Human Services Texas Women, Infants, and Children (WIC) Infant Feeding Practices Survey; and the
- National Immunization Survey (NIS).

DSHS collects demographic data on all births and deaths in Texas, as well as information on fetal deaths weighing 350 grams or more or, if weight is unknown, occurring at 20 weeks of gestation or more. Vital records files are a rich and comprehensive source of data; however, birth certificate data quality depends on how accurately hospital staff or providers complete birth records. The birth file likely underreports the prevalence of several maternal health indicators, such as diabetes and preeclampsia.[1, 2] In addition, 2018, 2019, and 2020 Texas birth file data and 2020 death file data are provisional, meaning these datasets have not been thoroughly 'cleaned' and finalized. As such, certain provisional data elements were not presented due to potential data quality concerns. All data for other years used in the Data Book are final.

- DSHS did not analyze or report geographic information using provisional 2020 vital statistics data except for when several years of data were combined.
- DSHS did not use 2020 provisional vital statistics data when presenting maternal and infant death outcomes by race or ethnicity. Outcomes and maps are presented using provisional 2019 data since final 2019 data were not available at the time of this report.

Data were suppressed in maps when there were between one and four cases in the numerator to prevent identification of affected individuals, which could be possible with such small numbers. This data suppression protects the confidentiality and privacy of these individuals and their families.

[1] Haghighat, N., Hu, M., Laurent, O., Chung, J., Nguyen, P., & Wu, J. (2016). Comparison of birth certificates and hospital-based birth data on pregnancy complications in Los Angeles and Orange County, California. BMC pregnancy and childbirth, 16(1), 93.

[2] Vinikoor, L. C., Messer, L. C., Laraia, B. A., & Kaufman, J. S. (2010). Reliability of variables on the North Carolina birth certificate: a comparison with directly queried values from a cohort study. Pediatric and perinatal epidemiology, 24(1), 102-112.

THCIC Inpatient PUDF contains data on discharges from Texas hospitals. Inpatient PUDF data are available by quarter beginning with data for 1999 through fourth quarter 2020.[3] The Data Book uses International Classification of Diseases (ICD) diagnosis and procedure codes in the Inpatient PUDF to identify indicators for severe maternal morbidity (SMM) and neonatal abstinence syndrome (NAS).

The Texas PRAMS survey provides the most comprehensive population-based data on maternal health before, during, and after pregnancy. Conducted in partnership with the Centers for Disease Control and Prevention (CDC), DSHS has implemented the PRAMS survey annually since 2002. The PRAMS survey asks questions (via mail or telephone) of mothers who have recently given birth on topics such as prenatal care, pregnancy intention, alcohol use, smoking, intimate partner violence, postpartum depression, breastfeeding, infant sleep position, and infant secondhand smoke exposure. Unlike vital records data, which include information on almost all births and deaths in Texas, PRAMS data are obtained from a sample of women who are residents of Texas and have given birth to a live infant. The CDC provides Texas with a PRAMS survey data file that includes survey weights, and the CDC ensures that analyses are representative of women who have given birth to a live infant and are residents of Texas. For example, the 1,288 women who completed the survey in 2019 were representative of all Texas residents who had a live birth in that year. PRAMS data and results are generalizable to women who are Texas residents with at least one live birth within a specific year, whereas the birth file represents all live births in Texas.

For the above reasons, along with potential sampling and reporting differences, PRAMS findings may differ from results obtained from vital statistics data. PRAMS results are reported along with confidence intervals. The width of the confidence interval – the distance between its upper and lower limits – is an indicator of the variability, and thus the reliability, of the results. Texas PRAMS data are presented as estimated percentages or prevalence estimates to account for complex sampling and weighting. As with any self-reported survey, the possibility of recall bias exists; women may not answer the question correctly or leave it blank because they may not remember the event. However, to minimize recall bias, the PRAMS survey is mailed to potential respondents approximately 60 to 180 days after the birth of the infant.

To promote breastfeeding, DSHS Maternal and Child Health (MCH) and Texas Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) programs have regularly collaborated to conduct the Texas WIC Infant Feeding Practices Survey (IFPS) of breastfeeding beliefs, attitudes, and practices among Texas women receiving WIC services.

The most recent IFPS survey was conducted in 2018. The bilingual survey questionnaire allowed multiple choice (close-ended) responses. Each clinic that served eight or more infants from May through July 2017 was assigned a specified number of surveys

[3] Texas Inpatient Public Use Data File (PUDF) (released October 20, 2021). Retrieved from **dshs.texas.gov/thcic/hospitals/Inpatientpudf.shtm** [Accessed March 28, 2022].

proportionate to the number of participants served in that clinic. The eligible population of women were biological mothers 18 years of age or older that had a baby who was one month through 30 months old at the time of the IFPS survey. Eligible participants who agreed to participate during the survey period (October 15 through December 21, 2018) completed the survey booklet in the language of their choice (English or Spanish). Completed IFPS surveys were returned by all 65 local WIC agencies operating at the time of the survey. The final sample included 10,076 completed IFPS surveys after excluding surveys completed by ineligible respondents. Sampling methods did not include random sampling, and survey responses were not weighted or adjusted; therefore, IFPS survey findings may not be generalizable to the broader population of women participating in WIC services in Texas. A geographic one-stage cluster probability sampling design was used to increase the chance that the respondent sample was representative of the eligible study population. The age of respondents' reference children ranged from one month through 30 months old without an even distribution of age. For this reason, breastfeeding duration and exclusivity rates for children six months old and older should be interpreted with caution.

Despite the few limitations described above, these data sources combine to provide invaluable information on the status of infant and maternal health. Texas vital records are the most comprehensive available resource. PRAMS data provide much-needed information about maternal risk and health pre-pregnancy, during pregnancy, and post-pregnancy that is not available elsewhere. The Texas WIC IFPS provides essential data about infant feeding for the portion of the population that accesses Texas WIC services. DSHS, other state agencies, and stakeholders use each of these data sources to inform, develop, and drive policies and programs to improve the health of mothers and babies, as well as understand their emerging health needs. These sources provide an understanding of both infant and maternal health and serve as an important resource for risk factor analysis and for identification of possible avenues for prevention.

The National Immunization Survey, conducted by the CDC, collects data related to vaccination coverage among children and teens across the United States. This survey also includes data on breastfeeding practices, with current state and national data available through 2018.

Data Terms

Baby-Friendly Hospital: Birthing facilities that meet internationally recognized maternal and infant care standards for best practices in infant feeding care are eligible for designation as Baby-Friendly Hospitals. To achieve designation as a Baby-Friendly Hospital, which is accredited nationally through the organization **Baby-Friendly USA**, a facility must:

- Demonstrate that at least 80 percent of mothers are exclusively breastfeeding at the time of discharge or that there was a medical indication or parental request for formula;
- Adhere to the International Code of Marketing Breastmilk Substitutes; and

- Successfully implement the Ten Steps to Successful Breastfeeding.[4, 5]

Body Mass Index (BMI): A measure of weight-for-height that is often used to classify adults as being underweight, of normal weight, overweight, or obese.[6] In this report, maternal BMI is calculated using the mother's pre-pregnancy weight and height. Consistent with National Center for Health Statistics (NCHS) standards, BMI categories are defined using the standard cutoffs for adults, even if the mother is younger than 22 years of age.[7]

Causes of Infant Death: Causes of infant death categories from the NCHS Instruction Manual are used to calculate information regarding the leading causes of infant death in the Data Book.[8] Not all infant deaths in Texas are due to the leading causes shown in the report. Causes of infant death are reported as the number of deaths per 10,000 live births.

Gestational Age: Gestational age is used to calculate whether a birth is preterm, as well as to calculate when in pregnancy the mother first received prenatal care. However, exact gestational age is often unknown and must be estimated. Beginning with final 2014 data, NCHS changed the variable used to estimate gestation.[9] The current standard, starting in 2014, uses the obstetric estimate of gestation on the birth certificate and not a combination of last menstrual period and the obstetric estimate, as had been done in the past. This current standard for calculating gestational age is used throughout the Data Book.

Healthy People 2030 Target (HP 2030): A 10-year target released by U.S. Department of Health and Human services and designed to guide national health promotion and disease prevention efforts to improve the health of people in the U.S.

[4] Baby-Friendly USA, Inc. (2020). Baby-Friendly Hospital Initiative: Guidelines and Evaluation Criteria for Facilities Seeking and Sustaining Baby-Friendly Designation. Retrieved from **babyfriendlyusa.org/wp-content/uploads/2019/12/US-Interim-GEC_191107_CLEAN.pdf** [Accessed March 28, 2022].

[5] Baby-Friendly USA, Inc (2012). Baby-Friendly Hospital Initiative. Retrieved from **babyfriendlyusa.org** [Accessed March 28, 2022].

[6] Centers for Disease Control and Prevention. (2024, May 20). About body mass index (BMI). Centers for Disease Control and Prevention. **https://www.cdc.gov/bmi/about/index.html**.

[7] Branum, A. M., Kirmeyer, S. E., & Gregory, E. C. (2016). Prepregnancy body mass index by maternal characteristics and state: data from the birth certificate, 2014. *National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, *65*(6), 1-11. Retrieved from **cdc.gov/nchs/data/nvsr/nvsr65/nvsr65_06.pdf** [Accessed March 28, 2022].

[8] National Center for Health Statistics (2011). ICD–10 cause-of-death lists for tabulating mortality statistics (updated March 2011). Retrieved from **cdc.gov/nchs/data/dvs/Part9InstructionManual2011.pdf** [Accessed March 28, 2022].

[9] Martin, J. A., Osterman, M. J., Kirmeyer, S. E., & Gregory, E. C. (2015). Measuring gestational age in vital statistics data: transitioning to the obstetric estimate. National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, 64(5), 1-20.

Targets are released each decade and undergo a midcourse review in which targets may be adjusted due to new data.[10, 11, 12]

Infant Mortality Rate (IMR): The IMR is calculated as the number of infants who died in a given year divided by the number of live births in that same year, multiplied by 1,000. The births that comprise this rate are restricted to those women with Texas listed as their state of residence.

Perinatal Periods of Risk (PPOR): A comprehensive approach designed to help communities use data to improve infant and maternal health outcomes. In addition to infant deaths, fetal deaths are also included in the perinatal periods of risk (PPOR) analysis to provide more information. The PPOR analysis divides fetal and infant deaths into four Risk Periods (maternal health/prematurity, maternal care, newborn care, and infant health) based on birth weight and age of death. An excess feto-infant mortality rate (F-IMR) is then calculated for each of these periods, both statewide and for specific demographic study populations. The reference group for each of these calculations is a state-level population of mothers with near-optimal birth outcomes.[13] Due to the complexity of this analysis and estimate rounding, values in figures and graphs may not sum to the true amount described in the written analysis.

Race and Ethnicity: For information obtained from birth records, fetal death records, or PRAMS, race or ethnicity information shown throughout the Data Book refer to the mother, not the infant. However, infant death data were classified according to infant's race or ethnicity. Women who identified themselves as Hispanic were classified as Hispanic regardless of their race designation. Women who identified themselves as only White or only Black and who did not indicate that they were Hispanic were classified as non-Hispanic White or non-Hispanic Black, respectively. Women of all other races, including multiracial women, were classified as 'Other' if the woman did not self-identify as Hispanic. The 'Other' category encompasses a variety of racial and ethnic groups, including Native American, Asian, and multiracial, and there have been shifts in the demographics of women within this category. For example, since 2004, there has been an increase in the number of women identifying themselves as multiracial. While this allows for a large enough group for analysis, it limits the interpretability of the data. Starting in 2016, because of the nationwide implementation of the 2003 revision of the U.S. Standard

[10] United States Department of Health and Human Services, Office of Disease Prevention and Health Promotion (2010, November). Healthy People 2030 Framework. Retrieved from **healthypeople.gov/2020/About-Healthy-People/Development-Healthy-People-2030/Framework** [Accessed March 28, 2022].

[11] Centers for Disease Control and Prevention, National Center for Health Statistics (2018, June). Healthy People 2020 Midcourse Review. Retrieved from **cdc.gov/nchs/healthy_people/hp2020/hp2020_midcourse_review.htm** [Accessed March 28, 2022].

[12] Centers for Disease Control and Prevention, National Center for Health Statistics (2020, August). Healthy People 2030: NCSH Fact Sheet, August 2020. Retrieved from **cdc.gov/nchs/about/factsheets/factsheet-hp2030.htm#:~:text=HP2030%20is%20the%20fifth%20iteration,and%20research%20and%20developmental%20objectives** [Accessed March 28, 2022].

[13] Peck, M. G., Sappenfield, W. M., & Skala, J. (2010). Perinatal periods of risk: A community approach for using data to improve women and infants' health. *Maternal and Child Health Journal*, *14*(6), 864-874.

Certificate of Live Birth, national vital statistics data can also be classified using the above race or ethnicity group definitions. Notably, PRAMS data are reported with non-Hispanic White and 'Other' combined.

Maternal Mortality: The Data Book presents findings on maternal mortality from both the Texas Maternal Mortality and Morbidity Review Committee's (MMMRC) review of pregnancy-related deaths and DSHS analyses of statewide trends, rates, and disparities. The MMMRC uses standard methods to review cases of pregnancy-associated deaths, defined as the death of a woman occurring while pregnant or within 365 days of the end of pregnancy, regardless of cause (excluding cases related to motor vehicle crashes not involving vehicular homicide or suicide). In calculating the maternal mortality ratio, DSHS researchers used an enhanced four step approach and identified maternal deaths that occur during pregnancy or within 42 days postpartum.[14] Terminology used in this Data Book related to maternal mortality includes:

> *Pregnancy-Associated Death*: The death of a woman while pregnant or within one year of the end of pregnancy regardless of the cause. Pregnancy-associated deaths include maternal mortality cases that are pregnancy-related, not pregnancy-related, and when pregnancy-relatedness is undetermined.
>
> *Pregnancy-Related Death*: The death of a woman during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.
>
> *Pregnancy-Associated, but Not Related Death*: The death of a woman during pregnancy or within one year of the end of pregnancy from a cause that was not related to the pregnancy.
>
> *Pregnancy-Associated, but Unable to Determine Pregnancy-Relatedness Death*: The death of a woman while pregnant or within one year of pregnancy due to a cause that could not be determined to be pregnancy-related or not pregnancy-related.
>
> *Maternal Death*: A vital registration term used for the death of a woman while pregnant or within 42 days after pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes as indicated by ICD coding.[14]

Severe Maternal Morbidity (SMM): A term used to describe unintended outcomes of labor and delivery that result in significant consequences for a mother's health.[15] A

[14] Texas Department of State Health Services (2020). Texas Maternal Mortality and Morbidity Review Committee and Department of State Health Services Joint Biennial Report, 2020, revised February 2022.

[15] Centers for Disease Control and Prevention (CDC, 2021, February). Severe Maternal Morbidity in the United States. Retrieved from **cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html** [Accessed March 28. 2022].

hospital delivery was considered an SMM case if the mother had one or more of the conditions (such as acute renal failure, cardiac arrest, eclampsia, and sepsis) or procedures (such as blood transfusion and hysterectomy) indicated on a list of SMM-related medical codes. The CDC SMM definition was used in this report.[16]

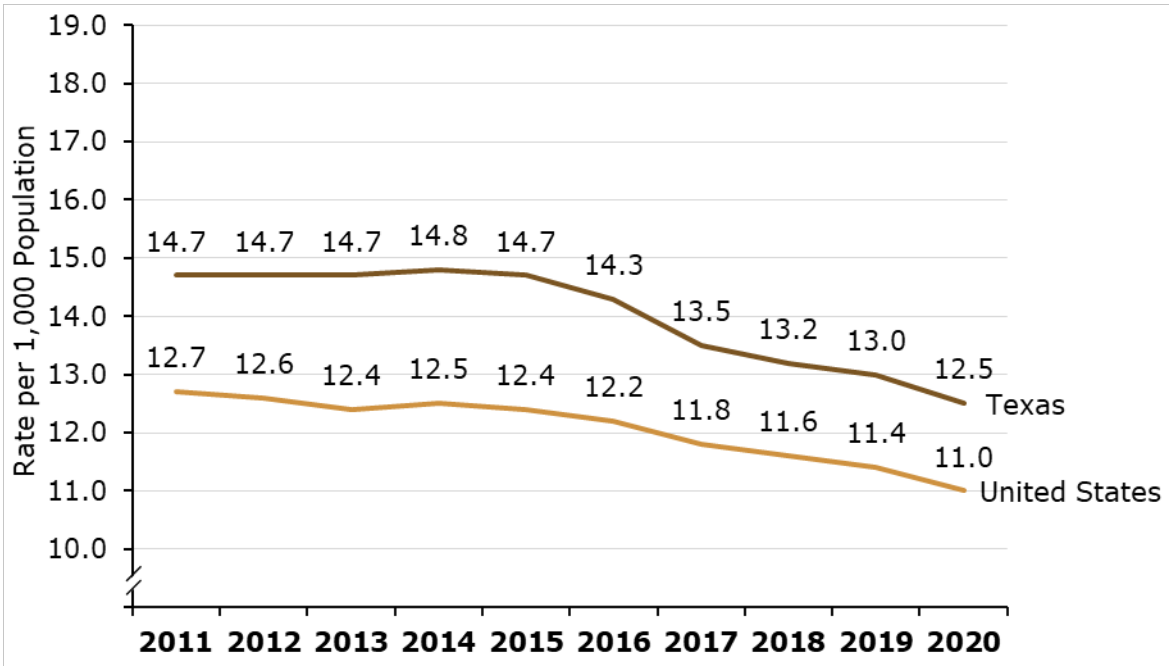
[16] Centers for Disease Control and Prevention (CDC, 2019 September). How Does CDC Identify Severe Maternal Morbidity? Retrieved from **cdc.gov/reproductivehealth/maternalinfanthealth/smm/severe-morbidity-ICD.htm** [Accessed March 28, 2022].

Birth Demographics

Birth Rate

In 2020, nearly 370,000 babies were born to mothers that were Texas residents. In Texas, the birth rate (defined as number of live births per 1,000 people in the population) has continued to decrease since 2015 after remaining stable from 2011 to 2015 (**Figure 1**). In 2020, Texas had the fifth highest birth rate in the United States.[17]

Figure 1: Birth Rate in Texas and The United States, 2011-2020



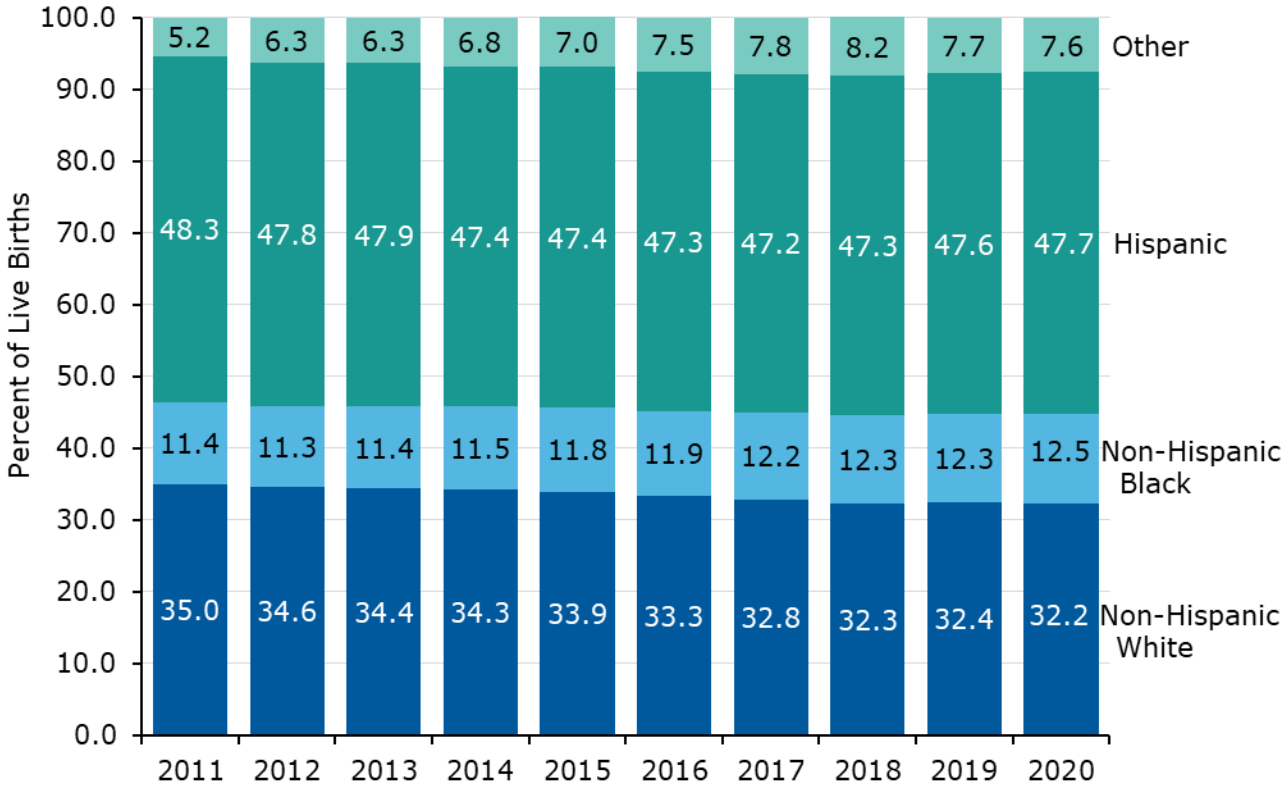
Source: National Center for Health Statistics
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Maternal Race and Ethnicity

Births to Hispanic women made up the largest percentage of all births in Texas (nearly half of all births), followed by births to non-Hispanic White women, non-Hispanic Black women, and women classified as 'Other' race or ethnicity (**Figure 2**). The percentage of births to non-Hispanic Black women has increased by about one percentage point over the last 10 years. From 2011 to 2020, the share of infants born to non-Hispanic White women decreased.

[17] United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Division of Vital Statistics, Natality public-use data 2007-2020, on CDC WONDER Online Database. Retrieved from **wonder.cdc.gov/natality-current.html** [Accessed March 28, 2022].

Figure 2: Distribution of Racial and Ethnic Groups Among All Live Births, 2011-2020



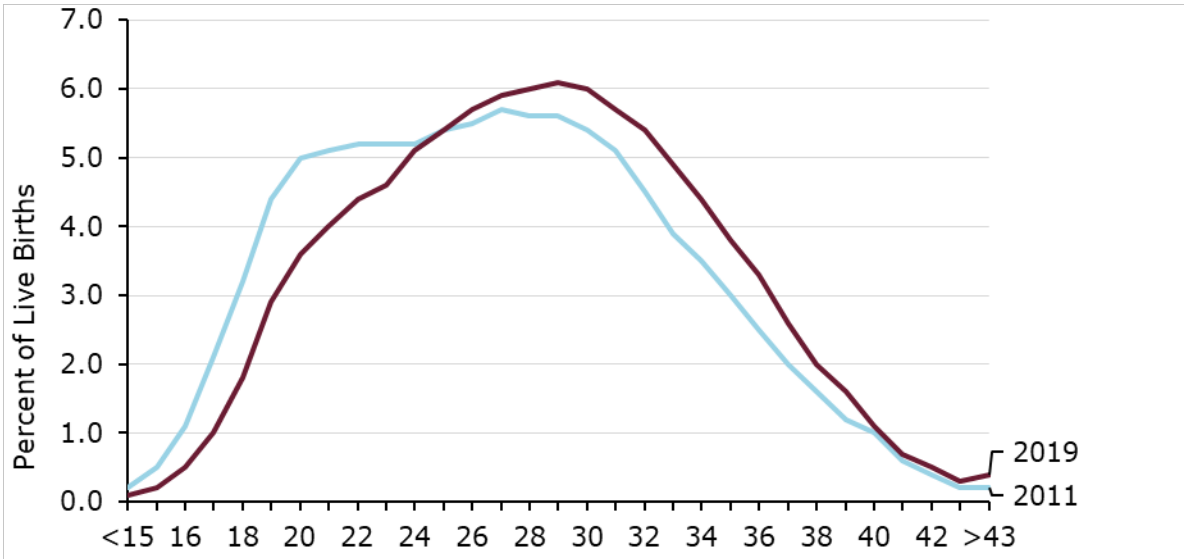
*2018, 2019 and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Sep 2021

The proportion of births to women in the 'Other' category grew from 5.2 to 8.2 percent of all births from 2011 to 2018 then decreased slightly to 7.6 percent in 2020. Although a smaller proportion of Texas births were to women who were categorized as being of 'Other' races or ethnicities, this group had the largest increase in the percent of total live births over the past decade in Texas. More than 30,000 births in 2018 were to mothers who classified themselves as Asian, multiracial, or other racial or ethnic designations. However, this group encompasses many different races and ethnicities, which often limits the interpretability of results for this racial and ethnic category.

Maternal Age

As in the U.S. as a whole, Texas has seen a shift over time in the maternal age of women giving birth.[18] The average maternal age at birth in 2019 was 28.4 years of age — a significant increase from an average age of 27.1 years in 2011 (**Figure 3**).

Figure 3: Maternal Age Distribution in 2011 and 2019

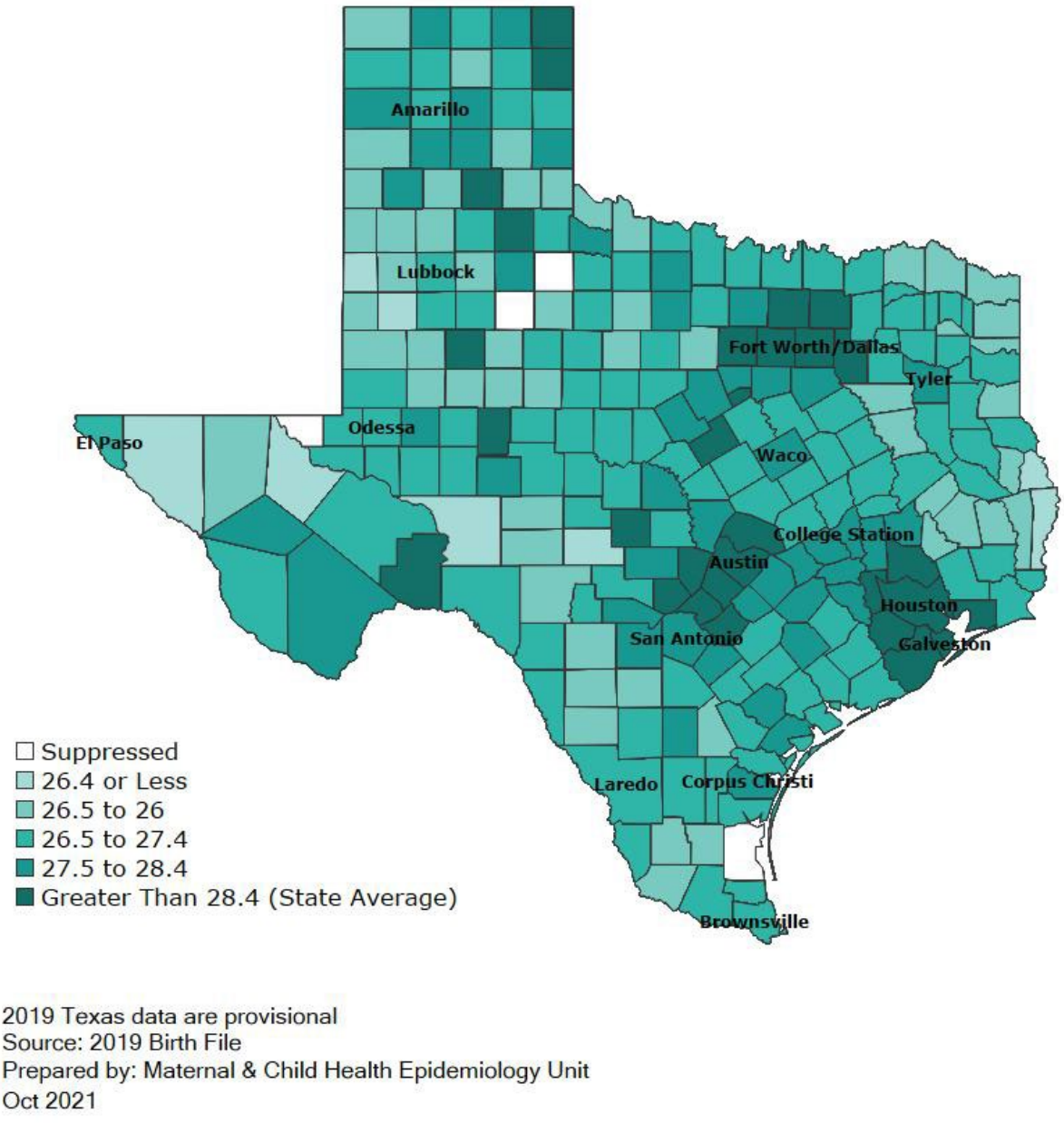


*2019 Texas data are provisional
Source: 2011 and 2019 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Sep 2021

[18] Mathews, T. J., & Hamilton, B. E. (2016). Mean age of mothers is on the rise: United States, 2000-2014. NCHS data brief, (232), 1-8.

The average age for women with a live birth in 2019 differed by region (**Figure 4**). Counties with densely populated areas, such as Harris and Dallas, tended to have older average maternal ages (greater than 28.4 years of age) compared to rural locations.

Figure 4: Average Age of a Woman with a Live Birth by County of Residence, 2019

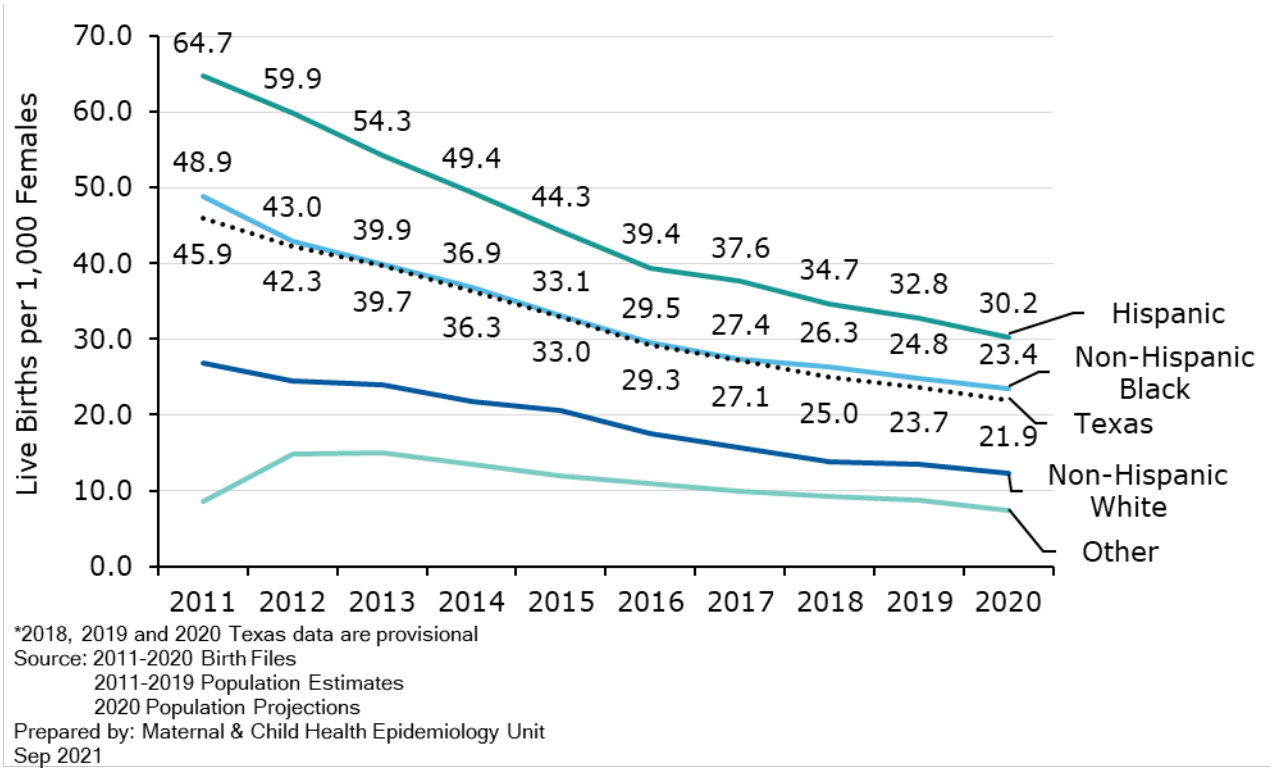


2019 Texas data are provisional
Source: 2019 Birth File
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

The increase in average maternal age observed over the past decade is likely due in part to a marked decrease in the teen birth rate in Texas and the nation. Texas, like the rest of the country, has reported dramatic decreases in the teen birth rate since 2009.[17] This drop has been particularly steep for Hispanic and non-Hispanic Black youth (**Figure 5**). Over the past 10 years, the teen birth rate has declined by 55.8 percent among Hispanic youth and by 56.0 percent among non-Hispanic Black youth.

The Centers for Disease Control and Prevention (CDC) defines the teen birth rate as the number of live births per 1,000 females aged 15-19 years.[19] Although Texas has experienced a steady decrease in the teen birth rate over the past decade (**Figure 5**), Texas's 2019 teen birth rate was the ninth highest teen birth rate in the United States.[20]

Figure 5: Teen (15-19 Years of Age) Birth Rate per 1,000 Females by Race and Ethnicity, 2011-2020



[19] Martin JA, Hamilton BE, Osterman MJK, and Driscoll AK, Division of Vital Statistics, Centers for Disease Control and Prevention (CDC, 2021). Births: Final Data for 2019. National Vital Statistics Report 70(2). Retrieved from **cdc.gov/nchs/data/nvsr/nvsr70/nvsr70-02-508.pdf** [Accessed March 28, 2022].

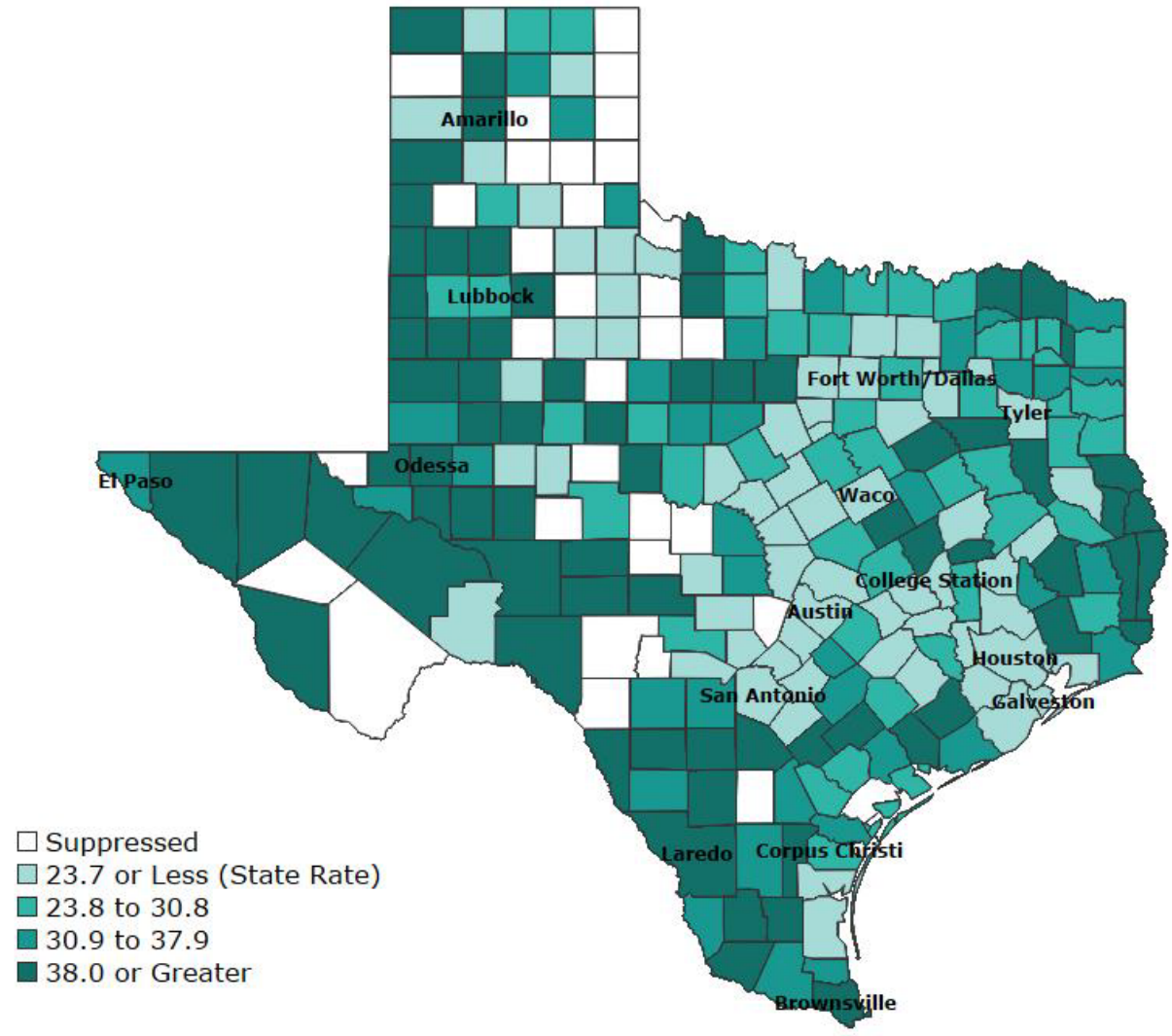
[20] Centers for Disease Control and Prevention (CDC, January 2020). National Center for Health Statistics: Teen Birth Rate by State. Retrieved from **cdc.gov/nchs/pressroom/sosmap/teen-births/teenbirths.htmhttp://www.cdc.gov/nchs/pressroom/sosmap/teen-births/teenbirths.htm** [Accessed March 28, 2022].

In 2019, Texas also had the second highest percent of repeat births among teen mothers ages 15-19 (18 percent) compared to other states. Nationally, the percent of teen mothers with repeat births in 2019 was 15.7 percent.[21]

Additionally, several areas in Texas had high teen birth rates when compared to the rest of the state (**Figure 6**). Many counties in the border regions, rural areas, and in the Texas Panhandle had teen birth rates over 38.0 births per 1,000 females aged 15-19 years in 2019.

[21] United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Division of Vital Statistics (2019, September). Natality public-use data 2016-2019, on CDC WONDER Online Database. Retrieved from **wonder.cdc.gov/natality-expanded-current.html** [Accessed March 28, 2022].

Figure 6: Teen Birth Rate per 1,000 Females Age 15-19 Years Old by County of Residence, 2019



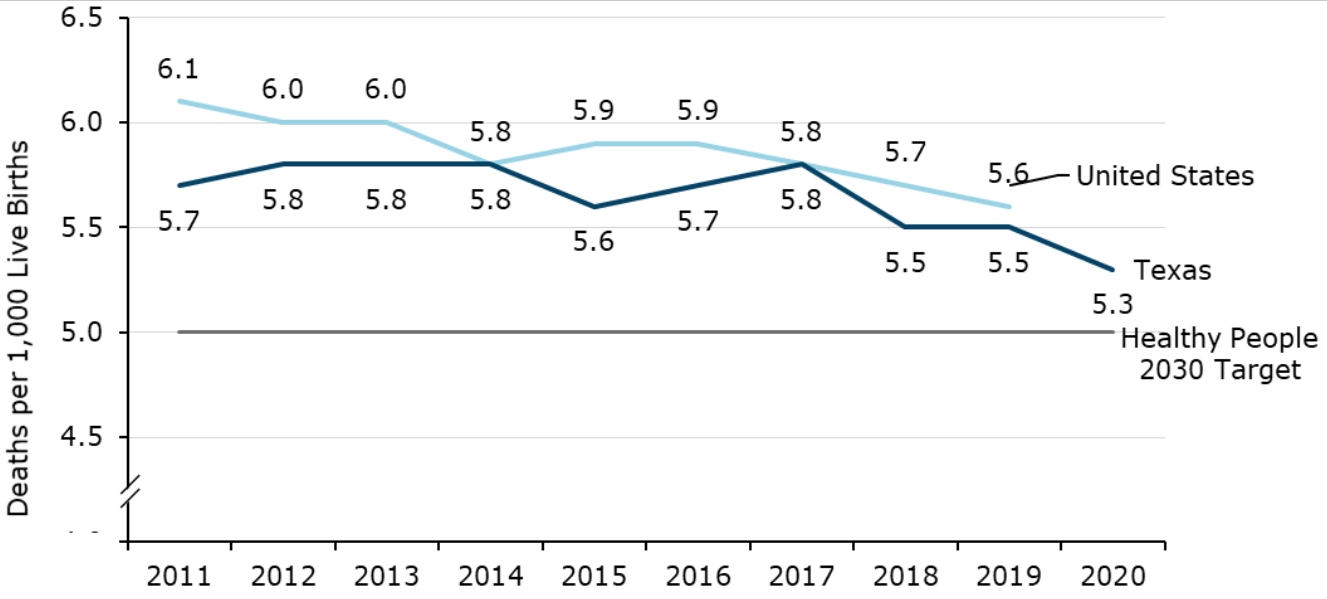
2019 Texas data are provisional
Source: 2019 Birth File
Texas Demographic Center 2019 Population Estimates
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Infant Mortality and Morbidity

Infant Mortality Rate

In 2020, the Texas infant mortality rate (IMR) reached a historic low of 5.3 deaths per 1,000 live births. The IMR in Texas has been at or below the national rate over the past 10 years (**Figure 7**) but is above the Healthy People 2030 (HP 2030) target of 5.0 deaths per 1,000 live births.[22]

Figure 7: Infant Mortality Rate in Texas and the U.S., 2011-2020

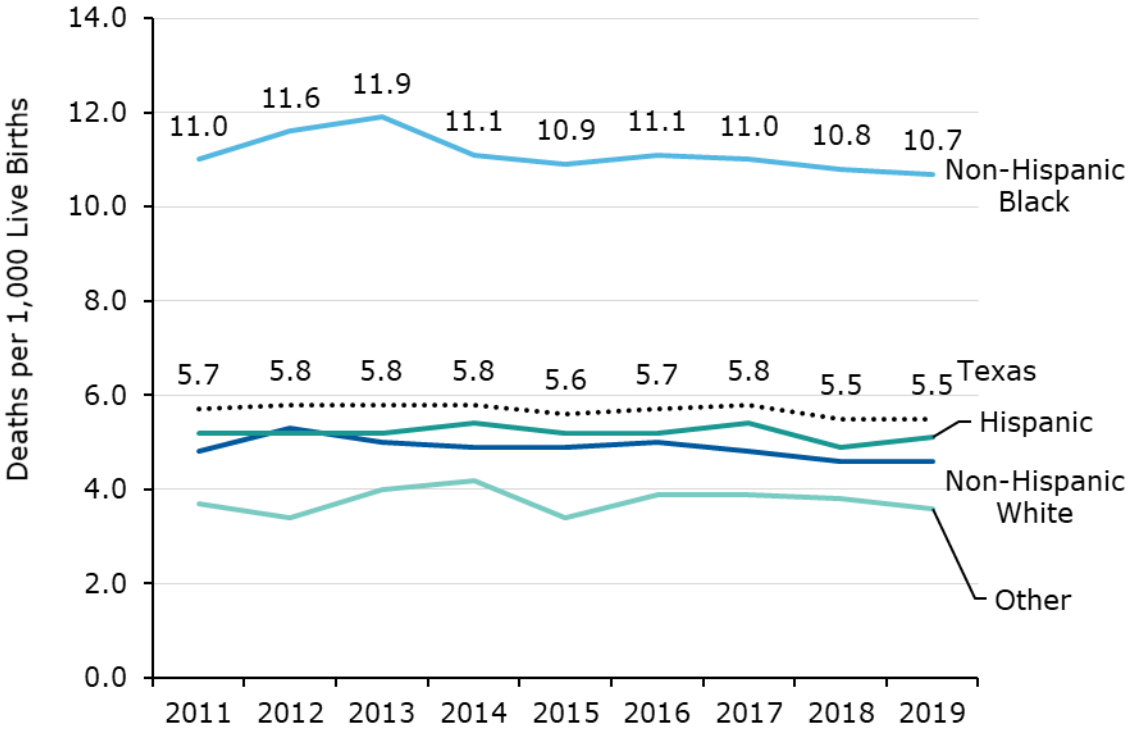


*2018, 2019, and 2020 Texas rates are provisional
Source: 2011-2020 Texas Birth and Death Files, National Center for Health Statistics
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

[22] Healthy People 2030, Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services Reduce the rate of infant deaths — MICH-02. Retrieved from **health.gov/healthypeople/objectives-and-data/browse-objectives/infants/reduce-rate-infant-deaths-mich-02** [Accessed March 28, 2022].

However, disparities in IMR have persisted in Texas, and the overall decrease in IMR observed over the past decade was not equally distributed across all racial or ethnic groups (**Figure 8**). IMRs for non-Hispanic Black mothers have been twice as high as IMRs for non-Hispanic White and Hispanic mothers throughout the decade.

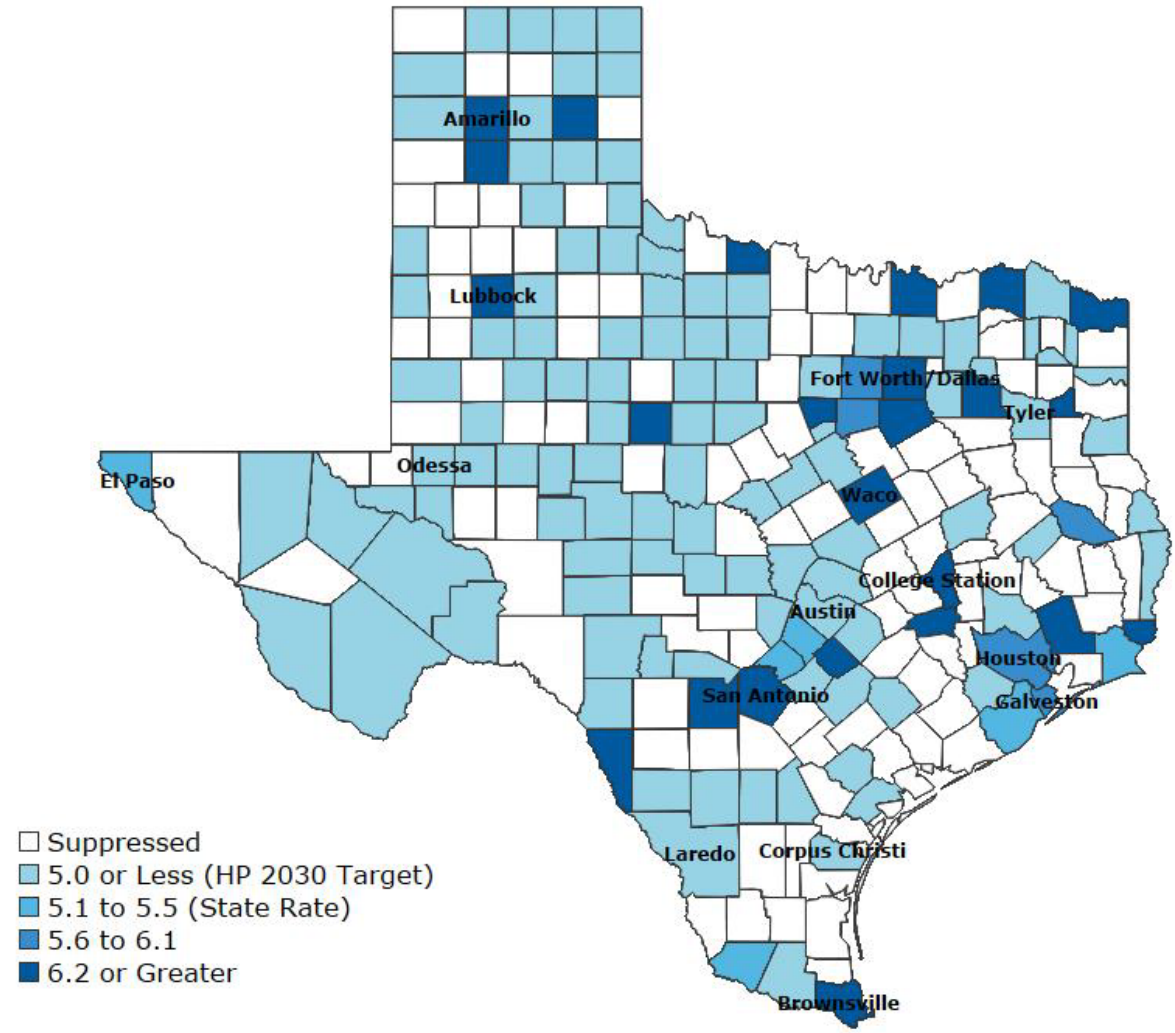
Figure 8: Infant Mortality Rate in Texas by Race and Ethnicity, 2011-2019



*2018 and 2019 Texas rates are provisional
Source: 2011-2019 Texas Birth and Death Files
Prepared by: Maternal & Child Health Epidemiology Unit
Nov 2021

In addition to these disparities, substantial regional differences in IMR persist within the state. In 2019, many Texas counties met the HP 2030 target of 5.0 or fewer infant deaths per 1,000 live births (**Figure 9**).[22] In contrast, Gray County, Washington County, Lamar County, Hood County, Bowie County, and Wichita County had the highest IMRs; at least nine deaths per 1,000 live births were reported in these counties in 2019.

Figure 9: Infant Mortality Rate per 1,000 Live Births by County of Residence, 2019



2019 Texas data are provisional
Source: 2019 Birth File
2019 Death File
Prepared by: Maternal & Child Health Epidemiology Unit
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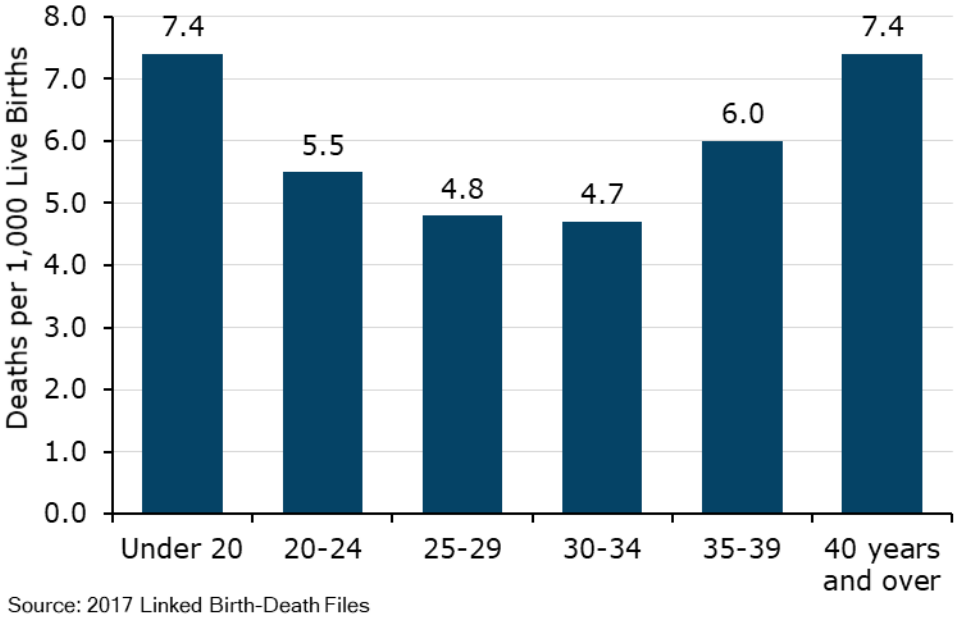
Differences in IMR also exist by maternal age. In 2017, a higher IMR was observed among young mothers aged less than 20 years and mothers aged 40 years or older than among mothers of other age groups. (**Figure 10**). Mothers in these two age groups comprised 9.9 percent of all Texas resident births in 2017.

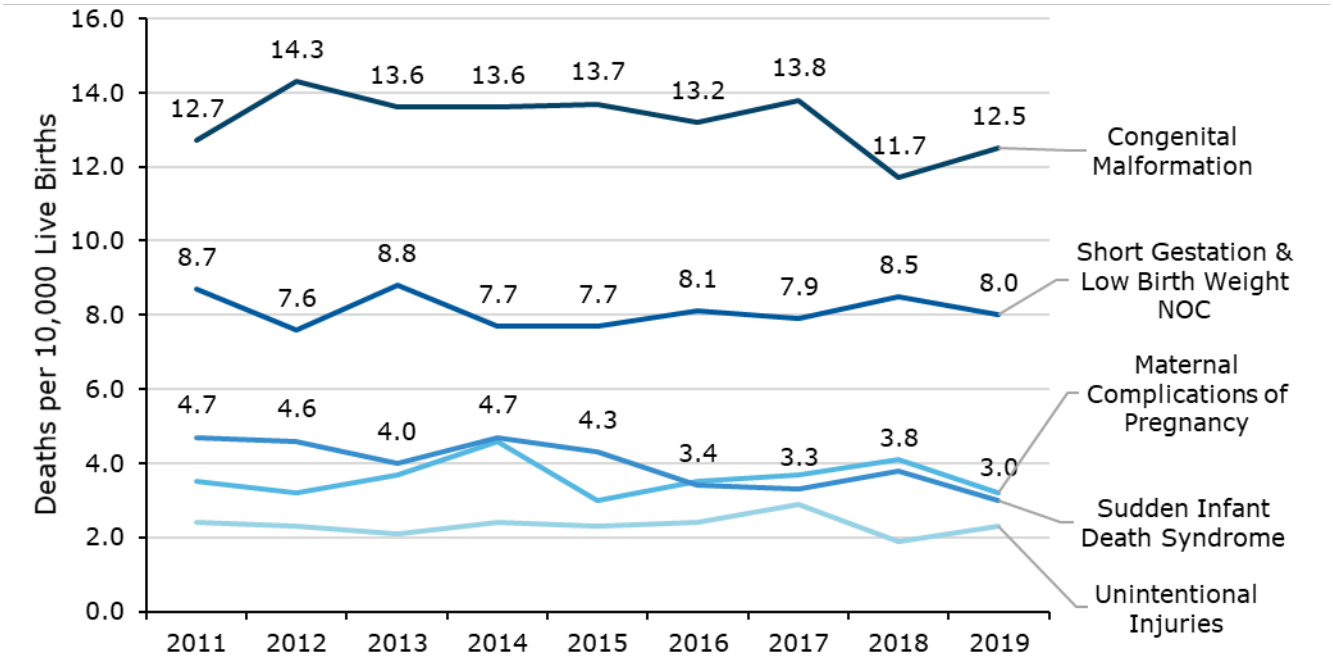
Figure 10: Infant Mortality Rate by Mother's Age Group, 2017



Causes of Infant Death

In 2019, the leading cause of death for infants younger than one year in Texas was congenital malformation, followed by short gestation and low birth weight, not otherwise classified (NOC), and maternal complications of pregnancy (**Figure 11**). For infants between 28 days and one year, congenital malformation (data not shown) was also the leading cause of death, followed by unknown causes, and Sudden Infant Death Syndrome (SIDS).

Figure 11: Leading Causes of Infant Death, 2011-2019



*2018 and 2019 rates are provisional
NOC: Not otherwise classified
Source: 2011-2019 Death & Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
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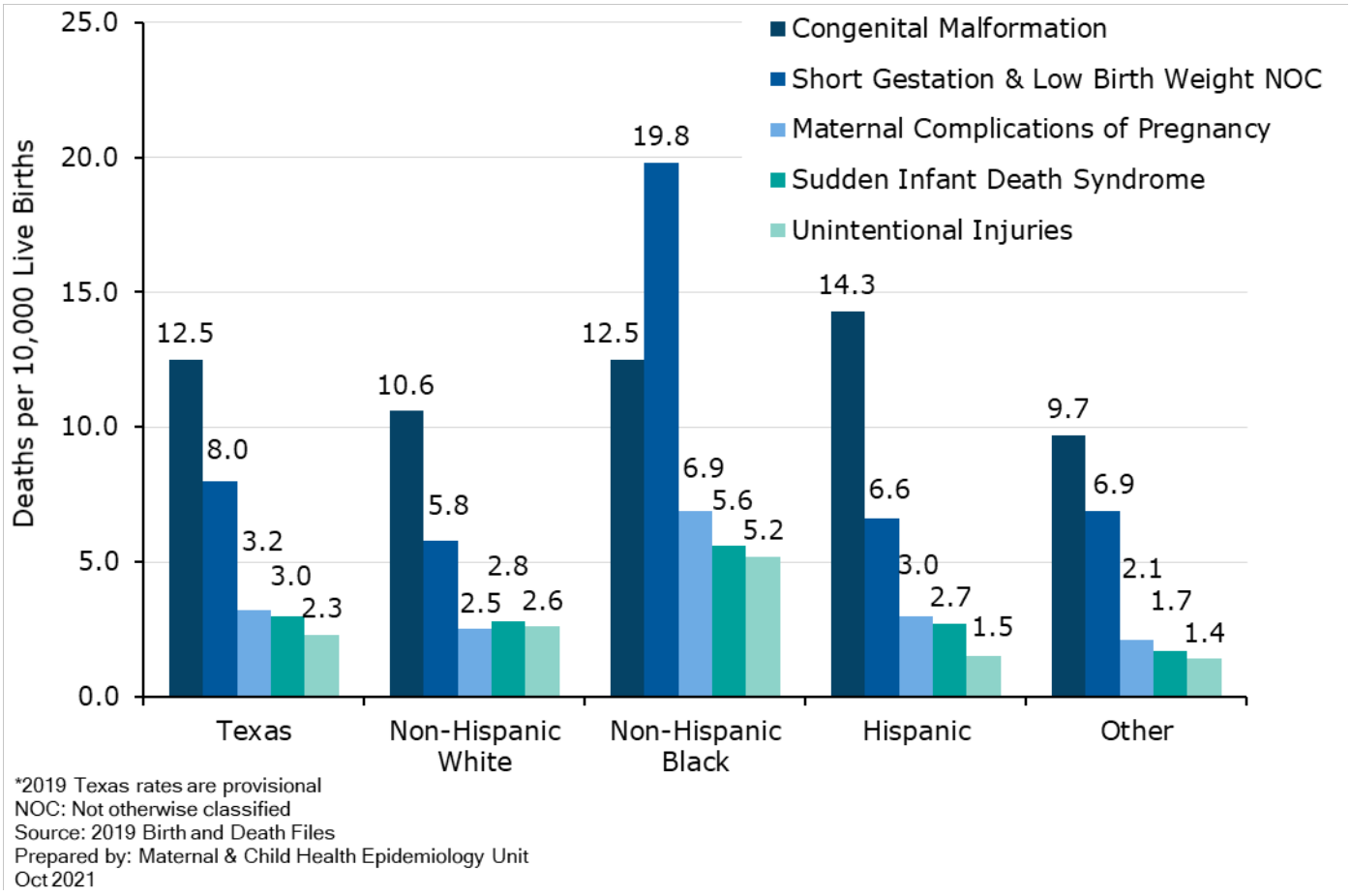
Leading causes of infant death differ by race and ethnicity. In 2019, the leading cause of death among non-Hispanic Black infants was short gestation and low birth weight (LBW). LBW, defined as weighing less than 2,500 grams at birth, accounted for 19.8 deaths per 10,000 live births for non-Hispanic Black infants. However, for the state as a whole and among non-Hispanic White, Hispanic, and 'Other' infants, congenital malformation was the leading cause of death. **Figure 12** highlights disparities between race/ethnic groups and shows that non-Hispanic Black infants were 3.4 times more likely to die of short gestation and low birth weight and 2.8 times more likely to die of maternal complications of pregnancy than non-Hispanic White infants.

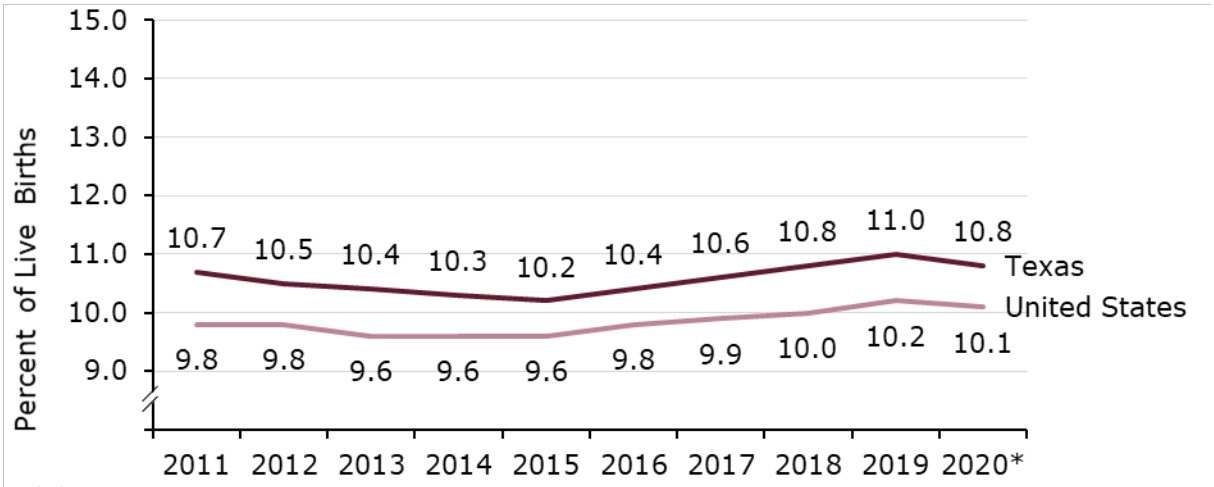
Figure 12: Leading Causes of Death by Race and Ethnicity, 2019



Preterm Birth

Preterm births are those that occur prior to 37 weeks of gestation. Texas and the United States peaked in 2019 at 11.0 percent and 10.2 percent, respectively, after four years of increasing preterm birth rates. This was followed by a slight decrease in preterm births in 2020. The preterm birth rate in Texas has consistently been higher than the national average over the past 10 years (**Figure 13**).

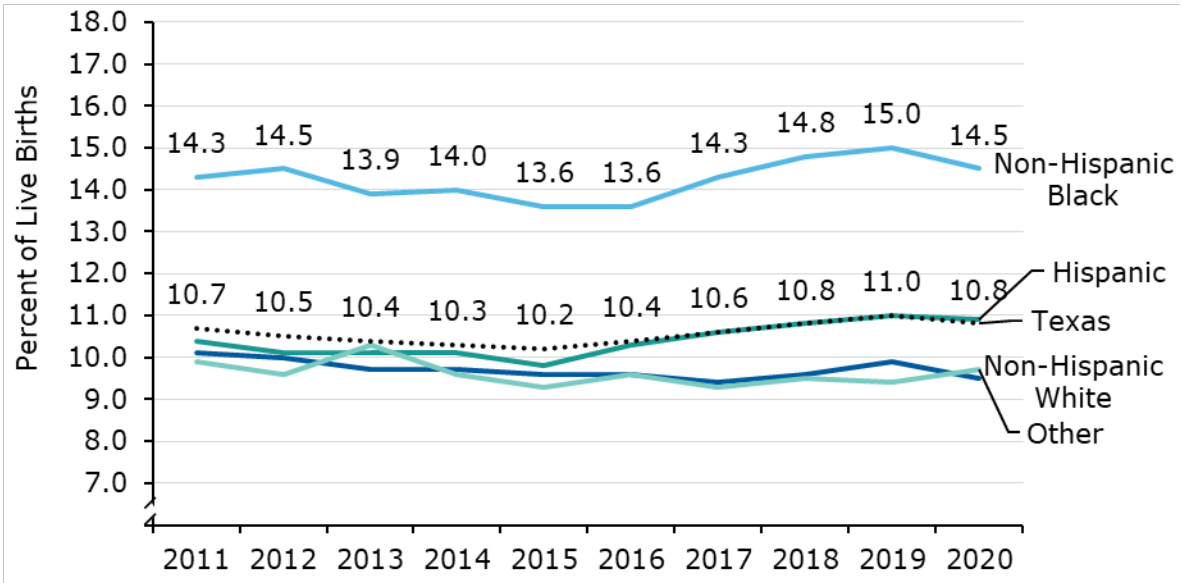
Figure 13: Percent of Live Births Born Preterm (less than 37 weeks) in Texas and United States Using Obstetric Estimate of Gestation, 2011-2020



*2020 data is provisional
Source: National Center for Health Statistics
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

As with IMR, substantial disparities in the preterm birth rate have been observed over the previous decade (**Figure 14**). Non-Hispanic Black infants had a higher preterm birth rate than infants of any other racial or ethnic group.

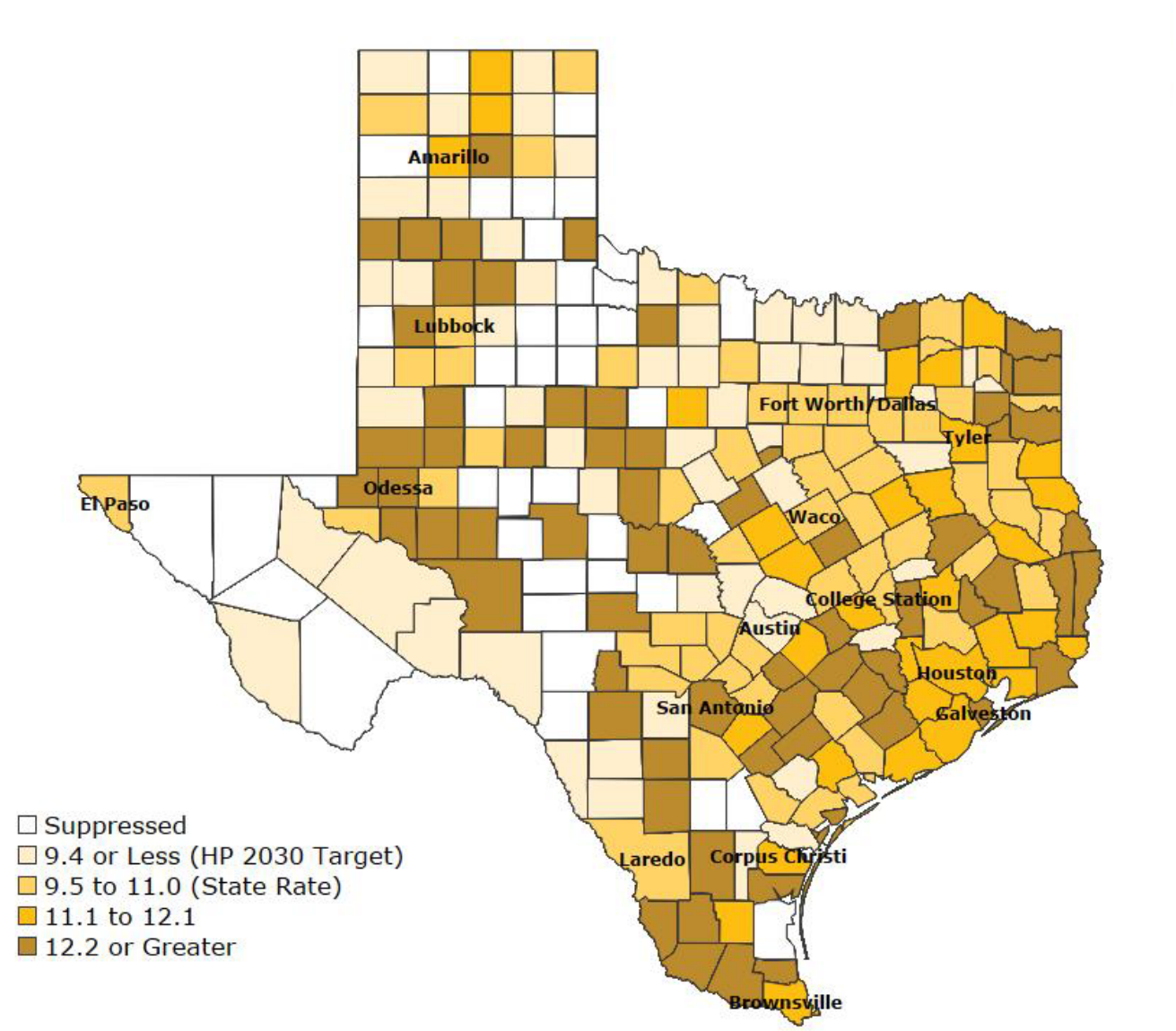
Figure 14: Percent of Live Births Born Preterm (less than 37 weeks) in Texas by Race and Ethnicity Using Obstetric Estimate of Gestation, 2011-2020



*2018, 2019 and 2020 Texas data are provisional
Source: 2011-2020 Texas Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Figure 15 shows the percentage of preterm births by county in Texas. There were no clear geographic patterns of disparities for preterm birth rates within the state.

Figure 15: Percent of Live Births Born Preterm (less than 37 weeks) in Texas Using Obstetric Estimate of Gestation by County of Residence, 2019



2019 Texas data are provisional
Source: 2019 Birth File
Prepared by: Maternal & Child Health Epidemiology Unit
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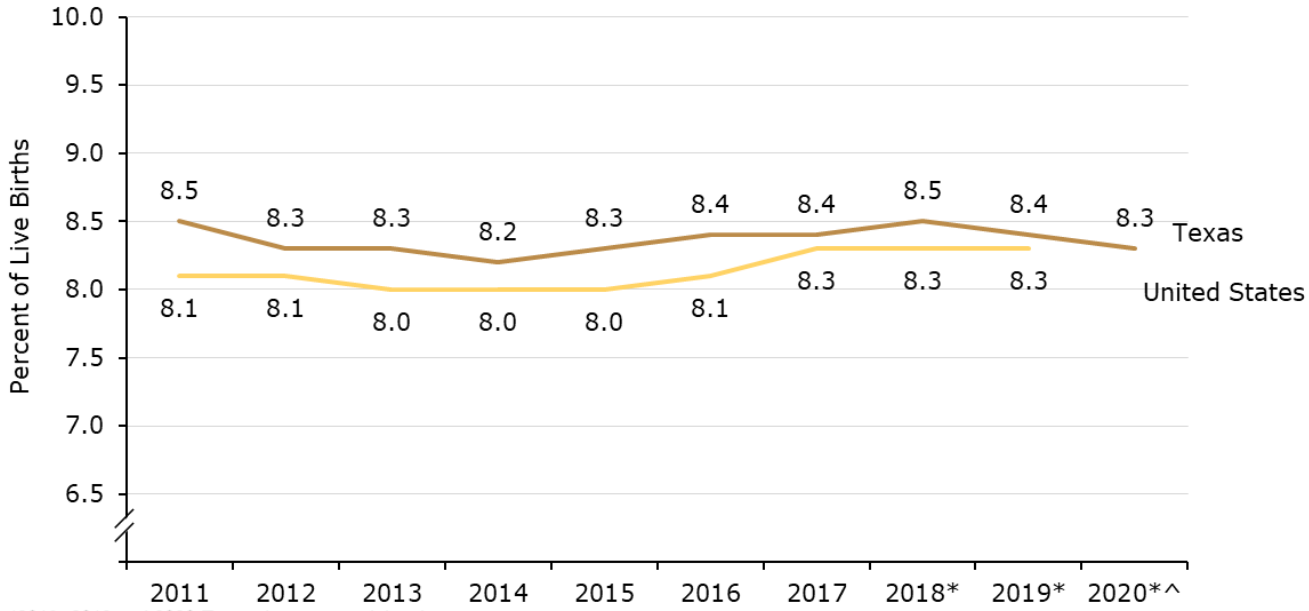
Low Birth Weight

The percentage of babies born with a low birth weight in Texas (weighing less than 2,500 grams) decreased slightly from 2018 to 2020, but overall, the rate has remained relatively stable throughout the decade, fluctuating between 8.2 to 8.5. The rate of low birth weight infants in Texas has been slightly higher than the national rate (**Figure 16**).

Figure 16: Percent of Births that are Low Birth Weight (less than 2,500 grams) in Texas and the United States, 2011-2020



*2018, 2019 and 2020 Texas data are provisional
^2020 national data not yet available
Source: 2011-2020 Birth Files
National Center for Health Statistics
Prepared by: Maternal & Child Health Epidemiology Unit
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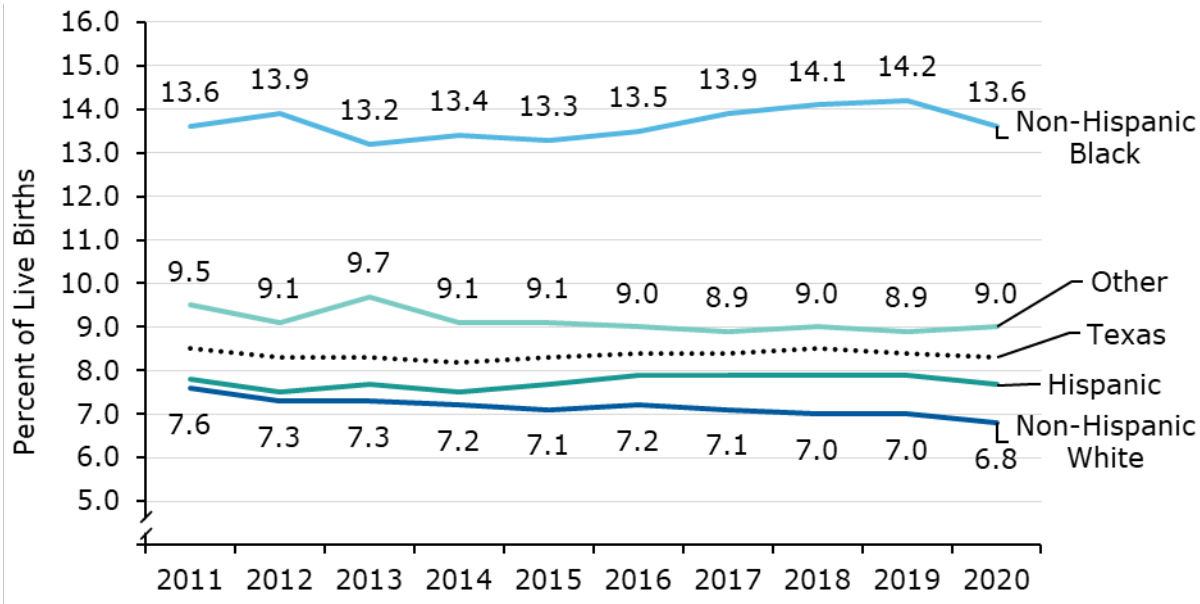
As with IMR and preterm births, non-Hispanic Black mothers had a disproportionately high percentage of low birth weight infants (**Figure 17**), and the gap between non-Hispanic Black mothers and non-Hispanic White mothers is slowly widening. The rate of low birth weight infants is also higher among mothers in the 'Other' racial or ethnic category than among non-Hispanic White or Hispanic mothers.

Figure 17: Percent of Births that are Low Birth Weight (less than 2,500 grams) in Texas by Race and Ethnicity, 2011-2020



*2018, 2019 and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
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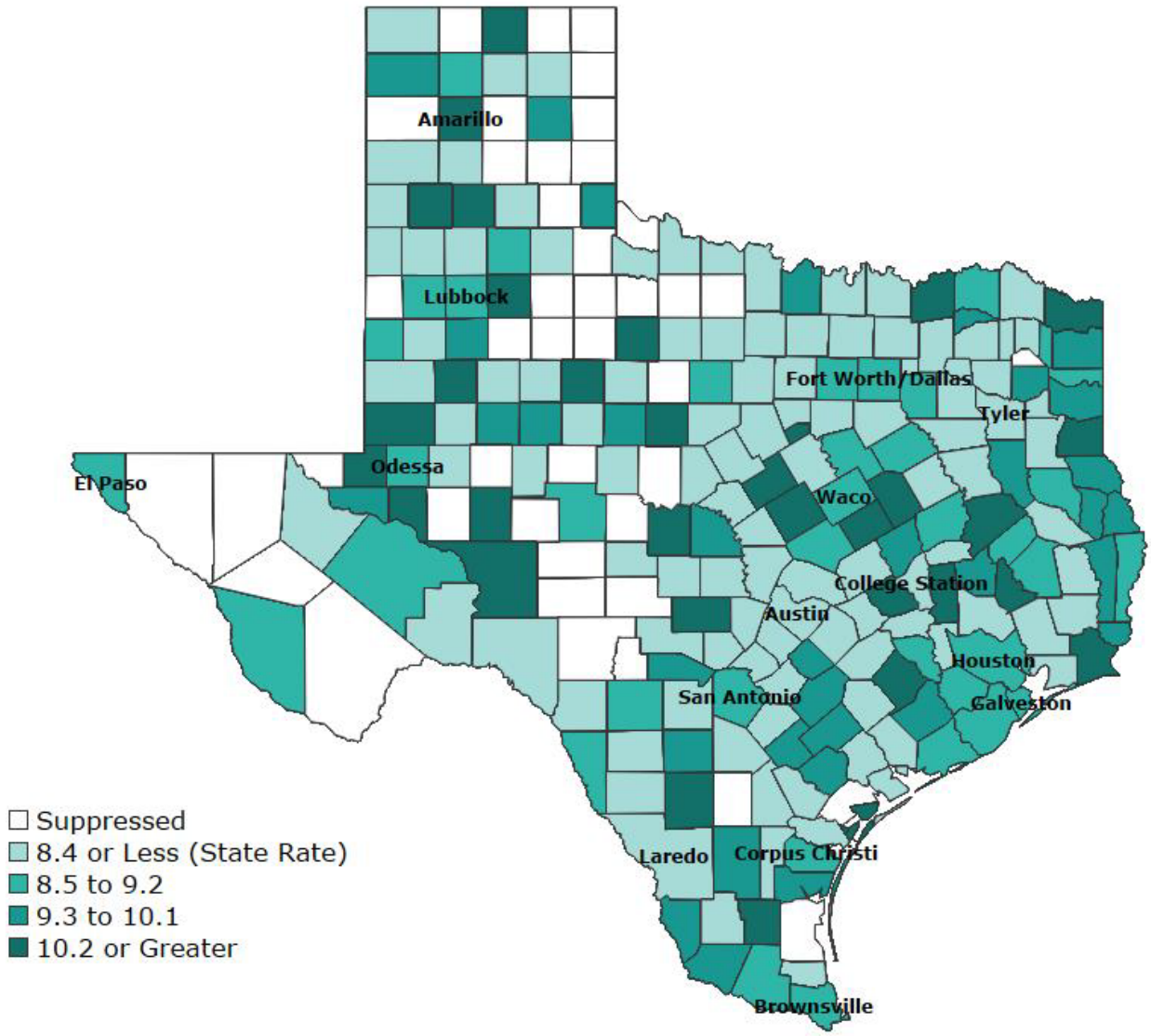
The percentage of infants born with low birth weight varied drastically across the state in 2019. (**Figure 18**). Fisher County reported the highest percentage of low birth weight infants at 20.6 percent. In contrast, 26 counties reported low birth weight infants in 6.0 percent or less of births.

Figure 18: Percent of Infants born Low Birth Weight (less than 2,500 grams) by County of Residence, 2019



2019 Texas data are provisional
Source: 2019 Birth File
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Infant Mortality: Analyzing Perinatal Periods of Risk

Although Texas has made progress in reducing infant mortality, data continues to show disparities in infant mortality and feto-infant mortality among different racial and ethnic groups, especially between non-Hispanic Black and non-Hispanic White women. To better understand these disparities, the Department of State Health Services (DSHS) conducted a Perinatal Periods of Risk (PPOR) analysis. PPOR analyses have been used in other states, urban areas, and counties to examine the risk of feto-infant mortality during four perinatal periods among different populations. The findings of PPOR analyses are intended to help policymakers create targeted, impactful interventions that reduce infant mortality.[23]

Fetal and infant deaths are categorized into four risk groups based on birth weight and when the death occurred (Figure 19):[13, 23, 24]

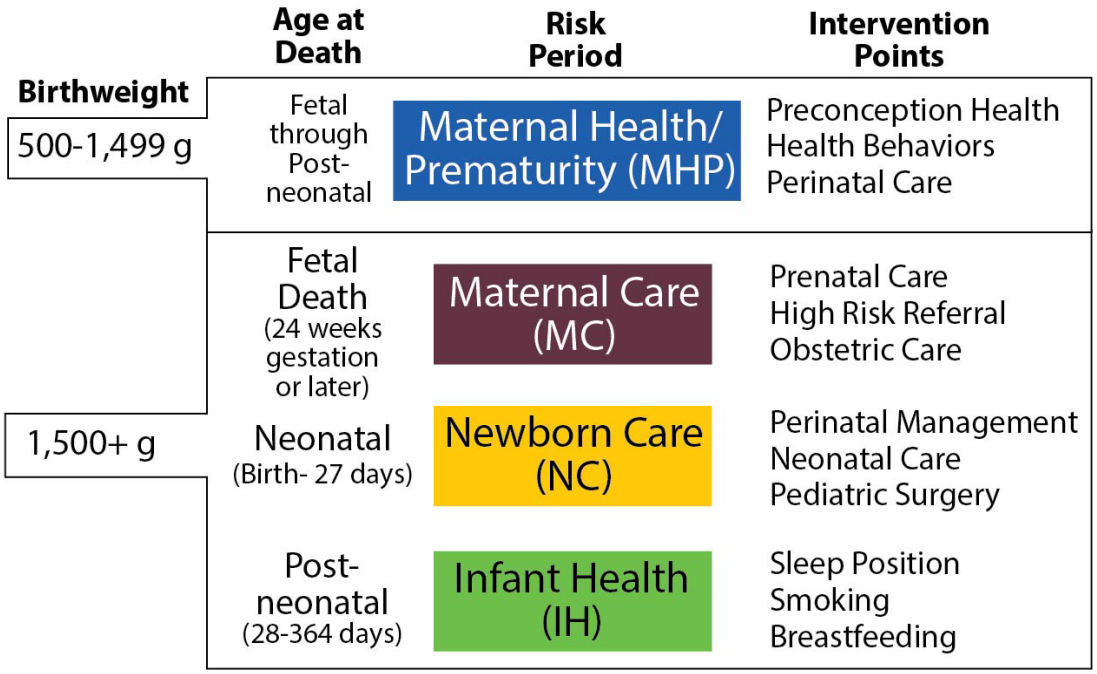
1. The Maternal Health/Prematurity (MHP) Risk Period: deaths occurring during pregnancy at 24 weeks gestational age or later with a fetus weighing 500-1,499 grams or death occurring after birth through 364 days with the infant birth weight between 500-1,499 grams.
2. The Maternal Care (MC) Risk Period: deaths occurring during pregnancy at 24 weeks gestational age or later with the fetus weighing over 1,500 grams.
3. The Neonatal Care (NC) Risk Period: deaths occurring between birth and 27 days postpartum with a birth weight over 1,500 grams.
4. The Infant Health (IH) Risk Period: deaths occurring 28-364 days postpartum with a birth weight over 1,500 grams.

[23] Sappenfield, W. M., Peck, M. G., Gilbert, C. S., Haynatzka, V. R., & Bryant, T. (2010). Perinatal periods of risk: Analytic preparation and phase 1 analytic methods for investigating feto-infant mortality. *Maternal and child health journal*, 14(6), 838-850.

[24] Sappenfield, W. M., Peck, M. G., Gilbert, C. S., Haynatzka, V. R., & Bryant, T. (2010). Perinatal periods of risk: phase 2 analytic methods for further investigating feto-infant mortality. *Maternal and child health journal*, *14*(6), 851-863.

Each of these periods has different risk factors and causes of death, and thus, different opportunities for prevention. Therefore, the four Risk Periods represent distinct points of intervention in the health care continuum.[13] **Figure 19** shows the criteria for each of these four categories and examples of interventions that might be appropriate for each period.

Figure 19: PPOR Risk Periods: Classification of Infant Deaths and Potential Interventions by Period of Risk



PPOR analysis was divided into two phases. Phase I Analysis was used to identify whether excessive feto-infant mortality occurs for each of the four Risk Periods. This analysis compared the feto-infant mortality rate (F-IMR) of Texas and chosen study populations (non-Hispanic Black, non-Hispanic White, Hispanic, and teens) to a state-level reference group generally known to have better feto-infant mortality outcomes. The reference group included non-Hispanic White women who were at least 20 years of age and had a minimum of 13 years of education. The reference group allowed for an estimation of preventable (excess) deaths for each period of risk and provided a realistic benchmark for reducing infant mortality in a community.

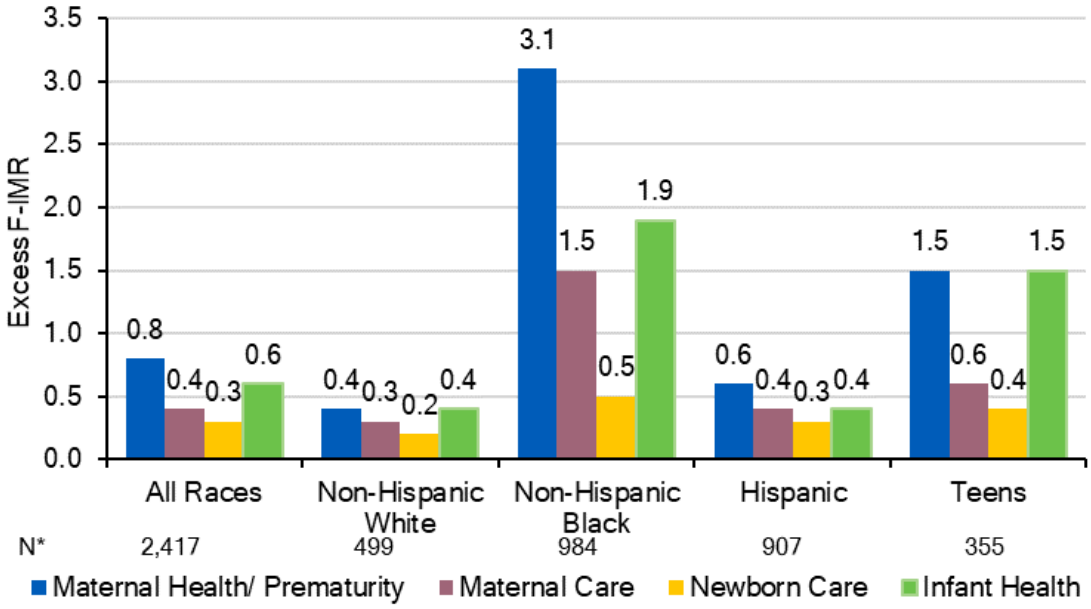
Phase II Analysis further investigated the Risk Periods with the highest excess feto-infant mortality to identify contributing risk factors and causes of death. Results of the Phase II Analysis are intended to help identify programmatic and policy initiatives that are expected to have the most impact at reducing infant mortality.

Phase I Analysis

In the following analysis, racial or ethnic categories are mutually exclusive. The category of teens includes all races and ethnicities, and teens are not excluded from the racial and ethnic categories. Additionally, the 'All Races' category shown in **Figure 20** includes all race, ethnicities, and ages not included in the reference population. The overall F-IMR was calculated as the number of fetal and infant deaths per 1,000 live births and fetal deaths and is the total of the rates across all Risk Periods for each study population. The 2015-2017 F-IMRs were 6.2 for non-Hispanic White mothers, 11.9 for non-Hispanic Black mothers, 6.6 for Hispanic mothers, and 8.9 for teen mothers (data not shown).

The excess F-IMR shown in Figure 20 indicates how much higher the F-IMR was for the study population compared to the reference group, which had an F-IMR of 4.9 per 1,000 live births and fetal deaths. Calculated as the sum of the excess rate for each period of risk shown in Figure 20, non-Hispanic Black mothers experienced a total of 7.0 excess fetal and infant deaths per 1,000 live births and fetal deaths in 2015-2017. Total excess F-IMRs for non-Hispanic White mothers, Hispanic mothers, and teen mothers were 1.3, 1.6, and 3.9 excess fetal and infant deaths per 1,000 live births and fetal deaths, respectively (Figure 20).

Figure 20: Excess Feto-Infant Mortality Rates (F-IMR) by Risk Period and Study Population, 2015-2017



*N is the number of excess fetal and infant deaths for each of the groups shown.
Source: 2015-2017 Linked Birth Infant Death Files
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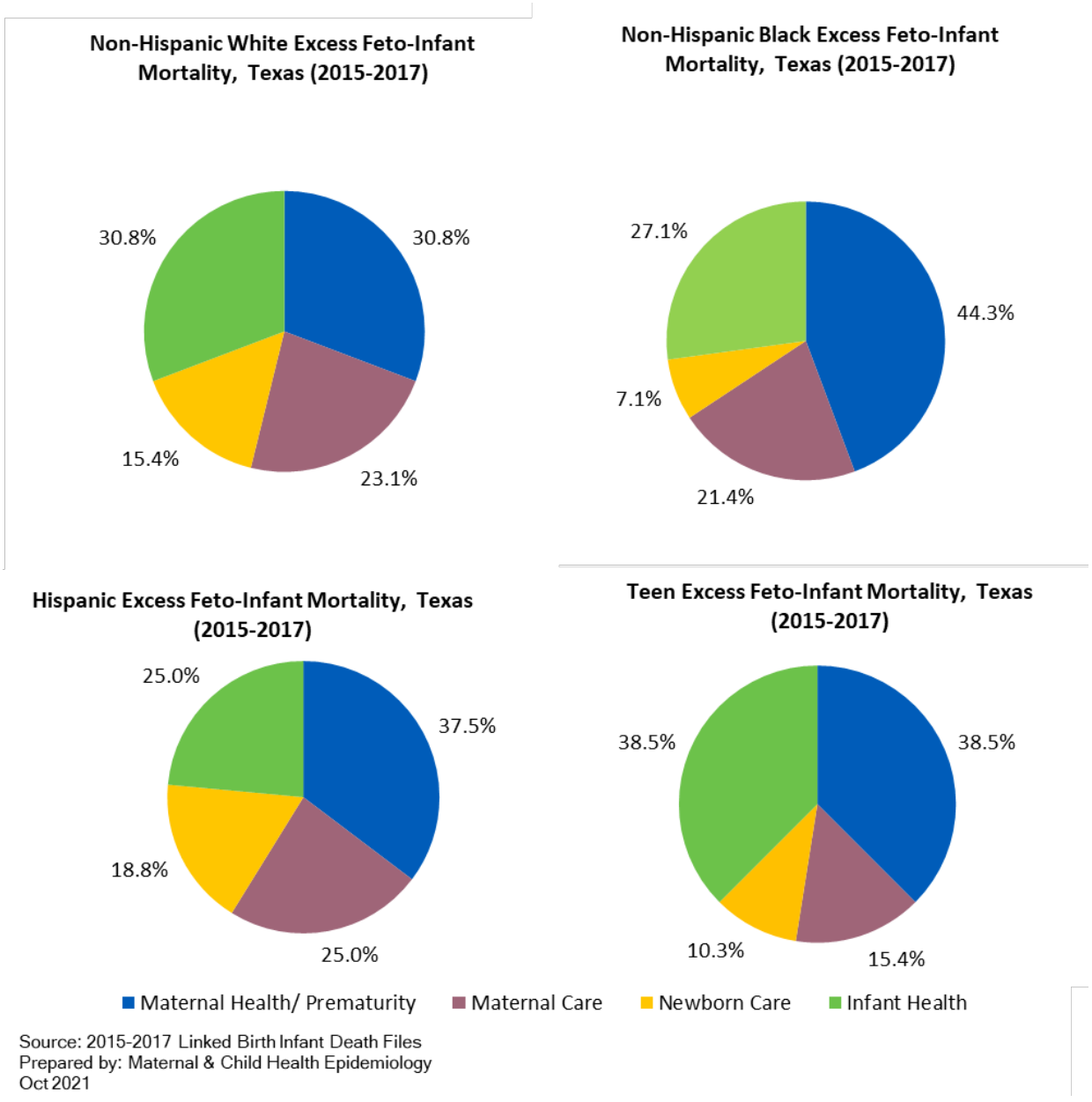
Non-Hispanic Black mothers had the highest excess F-IMR for all four Risk Periods when compared to other racial/ethnic groups (Figure 20), with 55.9 percent of all non-Hispanic Black fetal and infant deaths being potentially preventable (i.e., excess fetal and infant deaths). The percentage of potentially preventable deaths was 42.8 percent for teen mothers, 23.5 percent for Hispanic mothers, 19.6 percent for non-Hispanic White mothers, and 28.0 percent for the state (data not shown). Most of the excess deaths were in the Maternal Health/Prematurity Risk Period (any deaths occurring with a birth weight below 1,500 grams) for Hispanic and non-Hispanic Black mothers, while the Maternal Health/Prematurity Risk Period and Infant Health Risk Period were highest for teens and non-Hispanic White mothers. For non-Hispanic Black mothers, 44.3 percent of the overall excess fetal and infant deaths occurred in the Maternal Health/Prematurity Risk Period. For teen mothers, 77.0 percent of excess feto-infant deaths occurred in the Maternal Health (38.5 percent) and Infant Health (38.5 percent) Risk Periods combined (**Figure 21**).

Figure 21: Percent of Excess Feto-Infant Mortality Rates (F-IMR) per Risk Period within Study Populations, 2015-2017



Source: 2015-2017 Linked Birth Infant Death Files
Prepared by: Maternal & Child Health Epidemiology
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Phase II Analysis

In the Phase I Analysis, the Maternal Health/Prematurity Risk Period and the Infant Health Risk Period were identified as periods with the highest amount of excess mortality for the overall population, and rates were highest among non-Hispanic Black and teen mothers. These two Risk Periods were explored further during the Phase II Analysis to identify contributing factors to excess mortality to guide targeted strategies for intervention.

Analysis of Maternal Health / Prematurity Risk Period

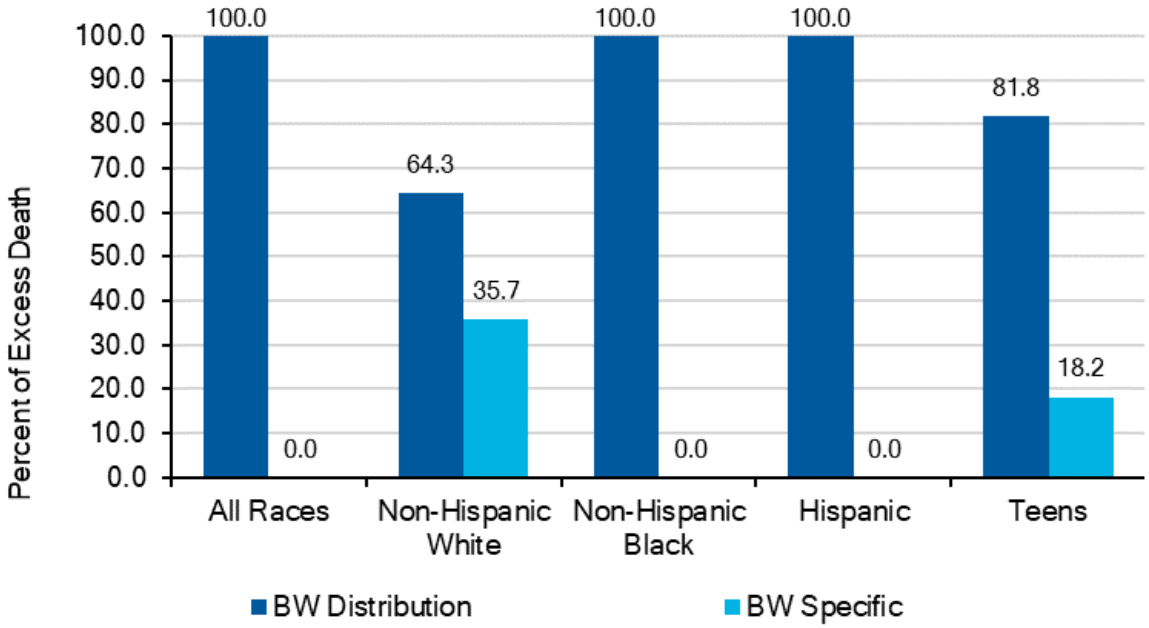
For fetal and infant deaths in the Maternal Health/Prematurity Risk Period, a Kitagawa analysis was conducted for each study population. The Kitagawa analysis indicates whether excess mortality in this Risk Period was primarily due to a greater number of very low birth weight (VLBW), defined as infants weighing less than 1,500 grams at birth, in the study population compared to the reference group (a difference in birth weight distribution) or to a higher mortality rate of VLBW infants in the study population compared to the VLBW infants in the reference group (a difference in birth weight specific mortality).[25] In other words, the analyses are used to ascertain whether excess feto-infant mortality emerged because of the greater number of VLBW infants in the study population compared to the reference group or because VLBW infants died at higher rates compared to the reference group.

This distinction is important because each requires different preventative measures. If there are excess deaths due to a higher number of VLBW infants being born, intervention methods should be aimed at preventing VLBW. If excess deaths occur for VLBW infants in a study population compared to the reference population, interventions should be aimed at improving care for VLBW infants in the study population. The percentage of excess deaths attributable to a difference in birth weight distribution (higher number of VLBW infants born) compared with the percentage attributable to a difference in birth weight specific mortality rates are shown in **Figure 22** for each study population.

For all populations examined, the majority of excess Maternal Health/Prematurity Risk Period deaths were attributable to a greater number of VLBW births (birth weight distribution) in these groups when compared to the reference population. Notably, for the total, non-Hispanic Black, and Hispanic populations, mortality rates among VLBW births were not higher compared to the reference population; for these subgroups, all excess deaths (100 percent) were potentially attributable to a greater number of VLBW births (Figure 22). For all study populations, but especially for infants born to non-Hispanic Black and teen mothers (who had the highest excess infant mortality rates in this Risk Period), interventions aimed at reducing the number of VLBW births are likely to be most effective at closing the gap in feto-infant mortality. For infants born to non-Hispanic White mothers and teens, a small proportion of excess feto-infant death was also attributable to a higher mortality rate among VLBW births than the reference population.

[25] C. Stampfel, C. Kroelinger, M. Dudgeon, D. Goodman, L. Ramos and W. Barfield, "Developing a standard approach to examine infant mortality: findings from the State Infant Mortality Collaborative (SIMC)," *Maternal Child Health J,* vol. 16, pp. 360-369, 2012.

Figure 22: Percent of Excess Death Attributable to Birth Weight (BW) Distribution vs. Birth Weight (BW) Specific Mortality, 2015-2017



Source: 2015-2017 Linked Birth Infant Death Files
Prepared by: Maternal & Child Health Epidemiology
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Birth Weight Distribution

To examine differences in birth weight distribution during the Maternal Health/Prematurity Risk Period, 1) a multivariable logistic regression analysis was conducted to identify factors associated with risk of delivering a VLBW baby, 2) the population attributable risk (PAR) percentages were calculated to determine attributable risk, and 3) adjusted risk ratios (ARR) were calculated with 95 percent confidence intervals (CI) to determine the risk of VLBW associated with each risk factor.

Factors examined in the regression models included maternal demographic factors (race, ethnicity, age, and education), smoking during pregnancy, high parity (a high number of births for a mother's age), previous preterm birth, infections, maternal weight gain during pregnancy, adequacy of prenatal care, trimester when prenatal care began, multiple gestations, and payment source for the delivery as indicated by the birth certificate. Although multiple gestation and payment source for delivery were included in the model and were often significantly correlated with VLBW, they were not discussed in the results. Multiple gestation was included as a control variable rather than a point of intervention, and payment source was not included due to limitations of the birth certificate data. Some of the variables included in this analysis are modifiable and/or known to have direct influences on birth outcomes, such as smoking during pregnancy. Other variables, such as race and ethnicity, are not modifiable or do not directly impact birth outcomes due to biological factors but serve as a proxy for other risk factors. Other variables, such as lack

of first trimester prenatal care access, may have both direct effects on birth outcomes and serve as a proxy for other risks.

For the whole population (and controlling for multiple gestation), inadequate gestational weight gain was associated with an adjusted risk ratio (ARR) of 2.73 (CI: 2.60-2.86), and non-Hispanic Black race/ethnicity doubled the risk of infant death (ARR: 2.11, CI: 1.97-2.24). Additionally, inadequate prenatal care increased the risk of a VLBW deliveries by about 60 percent (ARR: 1.63, CI: 1.52-1.74), and a previous preterm birth had an ARR of 2.63 (CI: 2.42-2.8). VLBW deliveries were mostly attributed to gestational weight gain less than 15 pounds (PAR: 19.3 percent), non-Hispanic Black race/ethnicity of the mother (PAR 11.6 percent), inadequate prenatal care (PAR: 7.7 percent), and previous preterm birth (PAR: 4.3 percent).

Excess deaths associated with birth weight distribution were seen for all study populations, but the non-Hispanic Black population and teens experienced the most excess mortality during this period of risk. For all study populations, factors associated with increased prevalence of VLBW births compared to the reference population included maternal weight gain less than 15 pounds, high parity, and inadequate prenatal care and lack of first trimester prenatal care. Increased VLBW prevalence was associated with having a previous preterm birth among non-Hispanic Black, Hispanic, and non-Hispanic White mothers. VLBW prevalence was associated with smoking and maternal weight gain over 40 pounds among non-Hispanic White mothers.

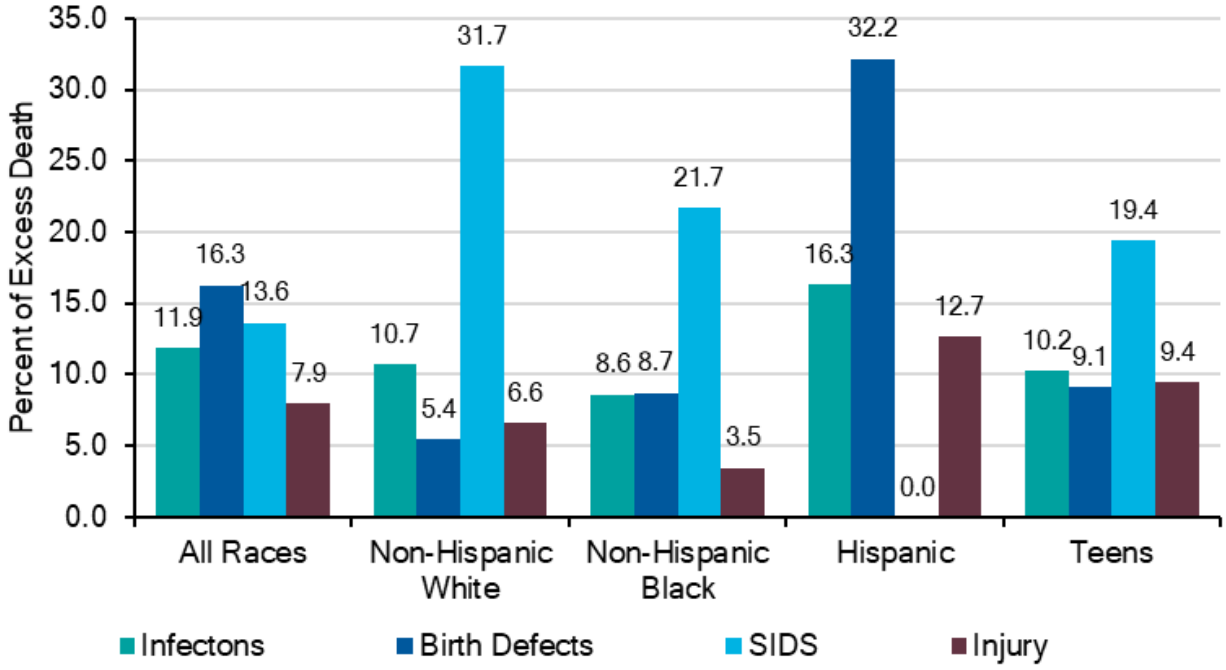
Analysis of Infant Health Risk Period

The Phase II analysis of the Infant Health Risk Period identified risk factors associated with infant death among infants 28-364 days, and the PAR percentages were calculated to determine attributable risk. Maternal demographic factors, smoking during pregnancy, adequacy of prenatal care, breastfeeding status at hospital discharge, and in which trimester prenatal care began were all examined. Some variables analyzed directly impact infant health outcomes, such as smoking, while other variables, such as race and ethnicity, are proxies for other risk factors.

Maternal risk factors for infant mortality in this period increased with late entry into prenatal care (ARR: 1.23, CI: 1.06-1.40), having less than 12 years of education (ARR: 1.35, CI: 1.17-1.52), non-Hispanic Black race and ethnicity (ARR: 1.84, CI: 1.54-2.15), inadequate prenatal care (ARR: 1.45, CI: 1.22-1.68), not breastfeeding by the time of hospital discharge (ARR: 1.67, CI: 1.44-1.91), and smoking (ARR: 2.07, CI: 1.63-2.51). Risk of infant death in this period was mostly attributed to having less than 12 years of education (PAR: 13.6 percent), non-Hispanic Black race or ethnicity of the mother (PAR 9.0 percent), not breastfeeding (PAR: 7.7 percent), and lack of first trimester prenatal care (PAR: 7.7 percent) (data not shown).

Primary causes of death were also analyzed for this Risk Period. **Figure 23** shows the percent of excess deaths, i.e., deaths occurring at higher rates compared to the reference population, by cause for the populations analyzed. Among all infant deaths in the Infant Health Risk Period, congenital anomalies and birth defects were the primary causes of death, accounting for 16.3 percent of excess deaths (Figure 23). Birth defects contributed to 32.2 percent of excess mortality among Hispanic infants, driving the leading cause for the state because nearly half of births in Texas are within the Hispanic population (Figure 2). However, SIDS was the leading cause of death for infants of non-Hispanic Black (21.7 percent), non-Hispanic White (31.7 percent), and teen mothers (19.4 percent).

Figure 23: Excess Infant Health-Related Death by Race and Ethnicity and Cause, 2015-2017



Source: 2015-2017 Linked Birth Infant Death Files
Prepared by: Maternal & Child Health Epidemiology
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Summary of Phase II Analysis

Phase II of this analysis investigated the two periods of risk that were identified in Phase I as having the most excess deaths: Maternal Health/Prematurity Risk Period and the Infant Health Risk Period. The highest percentage of excess infant mortality in both Risk Periods were seen among the non-Hispanic Black population, followed by teens.

In the Maternal Health/Prematurity Risk Period, birth weight distribution (i.e., a greater number of births to VLBW infants) was the primary risk across all populations studied; therefore, programming aimed at reducing the prevalence of VLBW births is expected to have the greatest impact in preventing infant mortality for this Risk Period. For all study populations (non-Hispanic White, non-Hispanic Black, Hispanic, and teen), factors associated with excess mortality due to higher numbers of VLBW infants included weight gain less than 15 pounds, inadequate prenatal care, and high parity. Previous preterm birth was a relevant risk factor for all study populations other than teens. Non-Hispanic White mothers had additional risk associated with smoking during pregnancy and gestational weight gain over 40 pounds.

In the Infant Health Risk Period, most excess infant deaths were seen among non-Hispanic Black mothers and teen mothers, and SIDS was identified as the leading contributor to excess mortality for these populations. Among the whole population, birth defects were a primary contributor to excess mortality in this Risk Period, which was related to the high prevalence of this cause of death among the Hispanic population.

Regional Summaries of PPOR Analysis

In addition to the statewide analysis, the PPOR analysis was conducted for border and non-border counties, urban and rural areas, and for the eight public health regions for 2015-2017. Below is a summary for each analysis. All confidence intervals are calculated at 95 percent. All F-IMR rates are given as the number of fetal and infant deaths per 1,000 live births and fetal deaths.

Border and Non-Border Counties: The border area contains 32 Texas counties that fall within 100 kilometers of the U.S.-Mexico border line, as defined by the La Paz Agreement. For the 32 border counties, 93 percent of the births and 97 percent of the excess deaths were within the Hispanic population. Phase I analysis showed that the F-IMR was 6.2 and the excess feto-infant mortality rates were similar across all periods, though the Infant Health Risk Period had an excess rate of 0.4, and all other periods had an excess rate of 0.3. In the Infant Health Risk Period, birth defects were the leading cause of excess death (31.4 percent), followed by injury (14.4 percent). Risk of infant death in this period increased with not breastfeeding (ARR: 1.68, CI: .95-2.41, $p<0.02$), and 8.8 percent of deaths were attributable to this risk factor.

The PPOR analysis for the non-border area, which includes the remaining 222 counties that do not fall within 100 kilometers of the U.S.-Mexico border line, was similar to the whole state. The F-IMR was 7.1. The Maternal Health/Prematurity Risk Period had the highest rates of excess mortality rates for the total population and the non-Hispanic Black

population, and birth weight distribution was the primary contributor. Controlling for multiple gestations, risk factors associated with VLBW births included gestational weight gain under 15 pounds (ARR: 2.75, CI: 2.61-2.89) and non-Hispanic Black race/ethnicity, which doubled the risk of infant death (ARR: 2.11, CI: 1.98-2.24). Gestational weight gain under 15 pounds and non-Hispanic Black race/ethnicity were the factors mostly attributed to VLBW (PAR: 18.7 percent and 12.9 percent, respectively) when compared to the reference group.

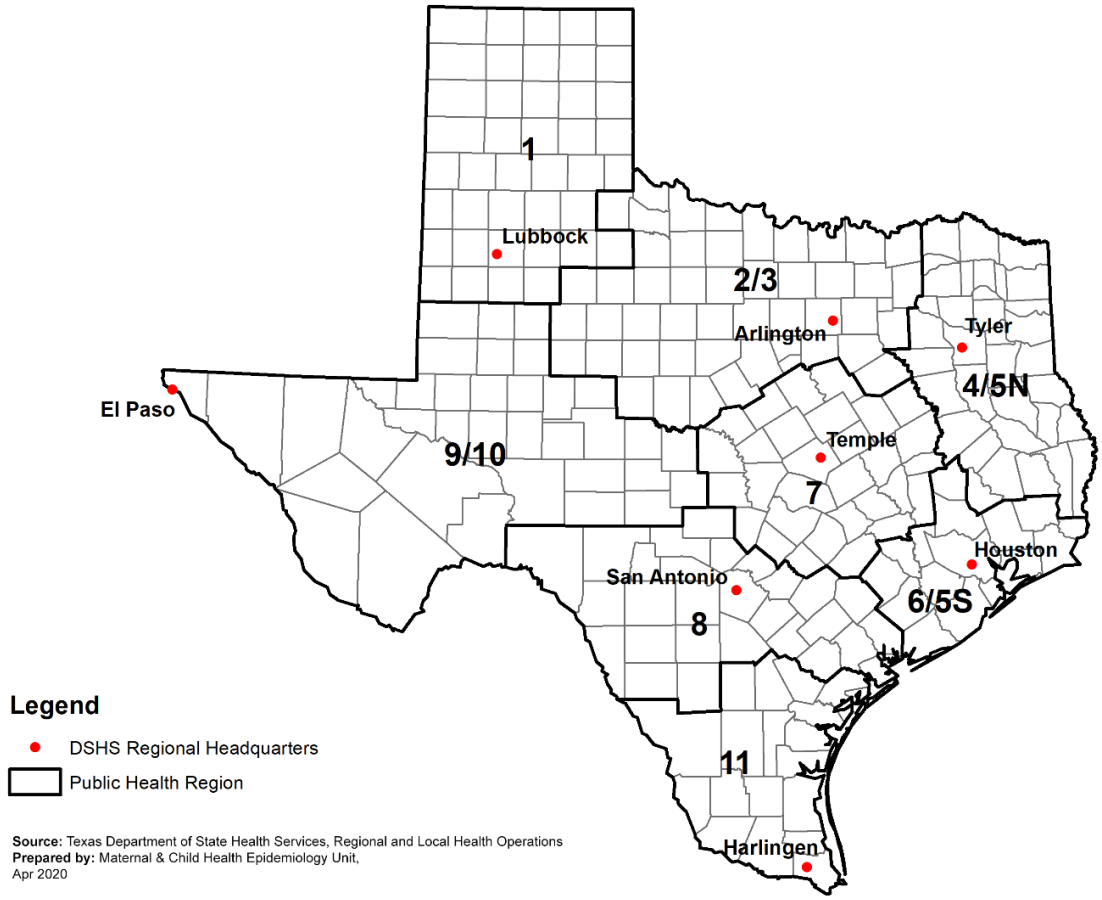
Urban and Rural Counties: In urban Texas counties, the F-IMR was 7.0 and the non-Hispanic Black population had the highest excess mortality rate at 7.1. The highest rates of excess deaths occurred in the Maternal Health/Prematurity Risk Period. During this period, the rate of excess death was 0.8 for the total population and 3.2 for the non-Hispanic Black population. For both the total population and the non-Hispanic Black population, all excess deaths during the Maternal Health/Prematurity Risk Period were attributable to birth weight distribution (i.e., a high prevalence of VLBW deliveries rather than high mortality rates among VLBW deliveries).

For urban counties, and controlling for multiple gestations, the following factors were associated with an increased risk of delivering a VLBW baby: gestational weight gain under 15 pounds (ARR: 2.74, CI: 2.60-2.87), non-Hispanic Black race/ethnicity (ARR: 2.10, CI: 1.96-2.24), having a previous preterm birth (ARR:2.70, CI: 2.47-2.93), and inadequate gestational weight gain (ARR: 1.61, CI: 1.50-1.72). Weight gain under 15 pounds (PAR: 19.1 percent) and non-Hispanic Black race/ethnicity (PAR: 12.2 percent) were the risk factors most attributed to VLBW.

In rural Texas counties, the F-IMR was 7.0 and the Infant Health Risk Period had the highest excess mortality at 0.8. In these counties, SIDS was the leading cause of infant death (14 percent). Of the factors studied, maternal education of less than 12 years attributed most to the risk of infant death in this period (PAR 33.5 percent), almost doubling the risk (ARR:1.92, CI: 1.18-2.66). Among the study populations, excess mortality rates were highest among non-Hispanic Black infants (5.4), and the Maternal Care Risk Period had the highest excess mortality for this population (2.2).

Public Health Regions: A PPOR analysis was conducted for the eight public health regions, shown in **Figure 24**. Main findings are summarized for each region.

Figure 24: Texas Public Health Regions



Public Health Region 1 (Texas Panhandle): For Public Health Region (PHR) 1, the total, non-Hispanic White, and Hispanic populations met the criteria to be included in the PPOR analysis. The F-IMR was 7.6 and the excess F-IMR was 2.6. The Infant Health Risk Period had the highest excess death rates for the total population (1.0) and non-Hispanic White population (0.9). In the Hispanic population, the Infant Health and Maternal Care Risk Periods both had an excess mortality rate of 0.8. For the Infant Health Risk Period, birth defects were the leading cause of excess death (19.7 percent). The risk of infant death in the Infant Health Risk Period was most attributable to a lack of first trimester prenatal care (PAR: 23.6 percent).

Public Health Region 2/3 (North Texas): For PHR 2/3, the F-IMR was 7.3 and the non-Hispanic Black population had the highest excess mortality rate at 6.7, followed by teens at 4.7. For both subgroups and for the total population, the Maternal Health/Prematurity Risk Period had the highest excess death rate. Birth weight distribution (i.e., a high prevalence of VLBW deliveries rather than high mortality rates among VLBW deliveries) was the primary driver of deaths for this Risk Period for the total population and all

subgroups other than non-Hispanic White. For the Maternal Health/Prematurity Risk Period, 59.3 percent of deaths were attributed to birth weight specific mortality.

In this region, non-Hispanic Black mothers had over twice the risk of VLBW deliveries compared to non-Hispanic White mothers (ARR: 2.20, CI: 1.97-2.43), and 15.5 percent of the VLBW births were attributable to this risk factor. Other factors associated with an increased risk of VLBW deliveries included inadequate prenatal care (PAR: 10.3 percent) (ARR: 1.84, CI: 1.62-2.05), gaining less than 15 pounds during pregnancy (PAR: 17.3 percent) (ARR: 2.85, CI: 2.60-3.10), and having a previous pre-term birth (PAR: 4.2 percent) (ARR: 2.81, CI: 2.38-3.24).

Public Health Region 4/5N (Northeast Texas): For PHR 4/5N, the F-IMR was 8.2 and the non-Hispanic Black population had the highest excess mortality rate (6.4), closely followed by teens (5.8). For both subgroups and for the total population, the Infant Health Risk Period had the highest excess death rate. In the Infant Health Risk Period, SIDS was the leading cause of excess deaths (17.9 percent). Inadequate prenatal care doubled the risk of infant death for this period (ARR: 2.13, CI: 0.83-3.42) and was the highest attributable factor (PAR: 11.0 percent).

Public Health Region 6/5S (Southeast Texas): For PHR 6/5S, the F-IMR was 7.1 and the non-Hispanic Black population had the highest excess mortality rate at 7.2. For this subgroup and for the total population, the Maternal Health/ Prematurity Risk Period had the highest excess death rate at 1.0 and 3.2, respectively, and birth weight distribution (i.e., a high prevalence of VLBW deliveries rather than high mortality rates among VLBW deliveries) was the primary driver of deaths for the whole population and all study populations. Controlling for multiple births, risk factors that were associated with having a VLBW delivery were gestational weight gain under 15 pounds (ARR: 2.73, CI:2.47-2.99), non-Hispanic Black race/ethnicity (ARR: 2.08, CI 1.83-2.33), having a previous preterm birth (ARR: 3.01, CI: 2.52-3.51), and inadequate prenatal care (ARR: 1.61, CI: 1.41-1.81). Gestational weight gain under 15 pounds (PAR: 20.1 percent) and non-Hispanic Black race/ethnicity (PAR: 15.9 percent) were the risk factors most attributed to VLBW.

Public Health Region 7 (Central Texas): For PHR 7, the total population F-IMR was 6.4 and the excess F-IMR was 1.4. The non-Hispanic Black population had the highest excess mortality rate at 7.0. For the total population and the non-Hispanic Black population, the Maternal Health/Prematurity Risk Period had the highest excess death rate at 0.6 and 2.8, respectively. Birth weight distribution (i.e., a high prevalence of VLBW deliveries rather than high mortality rates among VLBW deliveries) was the primary driver of deaths for all populations. Controlling for multiple births, gestational weight gain under 15 pounds tripled the risk of having a VLBW delivery (ARR: 3.05, CI: 2.59-3.50), and non-Hispanic Black race/ethnicity doubled the risk (ARR: 2.12, CI: 1.72-2.52). VLBW deliveries were mostly attributable to gestational weight gain under 15 pounds (PAR: 19.1 percent), followed by non-Hispanic Black race/ethnicity (PAR: 10.3 percent).

Public Health Region 8 (South Central Texas): For PHR 8, the overall F-IMR was 7.1 and the excess F-IMR was 2.1. The non-Hispanic Black population had the highest excess mortality rate at 9.2. Although the excess mortality rate was lower for the Hispanic

population (2.1), 62 percent of the excess deaths were within this population. For the overall population, the Maternal Health/Prematurity Risk Period had the highest excess death rate at 0.7, and birth weight distribution (i.e., a high prevalence of VLBW deliveries rather than high mortality rates among VLBW deliveries) was the primary driver of deaths for the whole population and all study populations except non-Hispanic White. Controlling for multiple gestations, gestational weight gain of less than 15 pounds more than doubled the risk of having a VLBW delivery (ARR: 2.33, CI: 1.97-2.68) and had the highest PAR (16.9 percent). Other risk factors associated with VLBW deliveries in this period included non-Hispanic Black race/ethnicity (ARR: 2.48, CI: 1.83-3.13), Hispanic race/ethnicity (ARR: 1.25, CI: 1.02-1.47), smoking (ARR: 1.96, CI:1.19-2.52), and having a previous preterm birth (ARR: 1.81. CL:1.26-2.36).

Public Health Region 9/10 (West Texas): For PHR 9/10, the non-Hispanic Black and teen populations were not analyzed individually because of the small sample size (fewer than 60 deaths) but were included in the total. The F-IMR was 6.1 and the Infant Health Risk Period had the highest excess death rates for the total population (0.5) and the non-Hispanic White population (0.8). In the Hispanic population, the Infant Health and Maternal Health/Prematurity Risk Periods both had an excess mortality rate of 0.4. In the Infant Health Risk Period, birth defects were the leading cause of excess death (23 percent). Deaths in the Maternal Health/Prematurity Risk Period were primarily driven by high prevalence of VLBW deliveries.

Public Health Region 11 (South Texas): For PHR 11, the F-IMR was 6.1 and the excess F-IMR was 1.3. The Infant Health Risk Period had the highest rate of excess deaths at 0.6. Birth defects (33.1 percent) were the leading cause of excess deaths for the Infant Health Risk Period, followed by infections (19.6 percent). Not breastfeeding (ARR: 2.08, CI: 1.20-2.97) doubled the risk of infant death in this period and had a PAR of 13.5 percent.

Infant Health Practices

Breastfeeding

Breastmilk contains essential nutrients, antibodies, and other properties that support infant growth, development, and protection from disease. For the child, suboptimal breastfeeding is associated with a higher risk of sudden infant death syndrome (SIDS), necrotizing enterocolitis, lower respiratory infections, chronic diseases (such as asthma, obesity, and type 2 diabetes), and other poor outcomes.[26, 27] For the mother, reduced exclusive breastfeeding and shorter breastfeeding duration are associated with increased population risk for maternal breast and ovarian cancers, diabetes, hypertension, cardiovascular disease, and other poor maternal health outcomes.[28, 29, 30, 31]

[26] Bartick, M., & Reinhold, A. (2010). The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. *Pediatrics*, *125*(5), e1048-e1056.

[27] Section on Breastfeeding. Breastfeeding and the use of human milk. (2012) *Pediatrics.;129(3*), e827-41.

[28] Centers for Disease Control and Prevention. (2024b, December 9). About breastfeeding. Centers for Disease Control and Prevention. **https://www.cdc.gov/breastfeeding/php/about/index.html**.

[29] Crowe, S. D., & Hanley, L. E. (2018). Optimizing Support for Breastfeeding as Part of Obstetric Practice. *Obstetrics and Gynecology*, *132*(4), E187-E196.

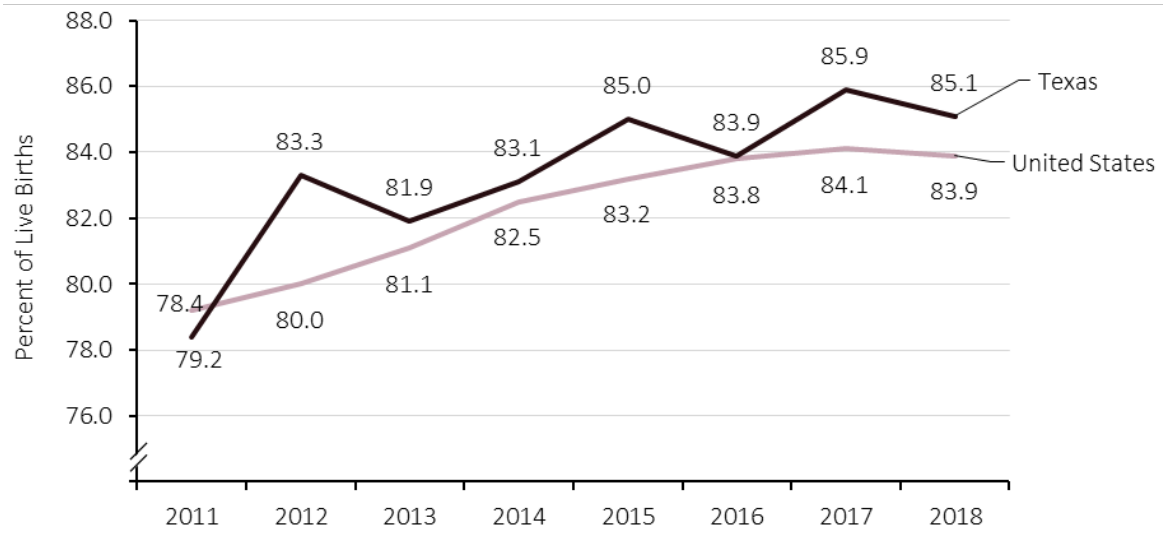
[30] Johnston M, Landers S, Noble L, Szucs K, Viehmann L (2012). Breastfeeding and the Use of Human Milk. Section on Breastfeeding. *Pediatrics Mar* 2012, 129(3) DOI: 10.15422/peds.2011-3552.

[31] Breastfeeding Challenges: ACOG Committee Opinion Summary, Number 820. (2021) *Obstet Gynecol.137(2)*, 394-395.

Initiation of Breastfeeding

According to the National Immunization Survey, 85.1 percent (95 percent Confidence Interval (CI): 81.6-88.6) of infants born in Texas in 2018 were ever breastfed (**Figure 25**).[32] The 2018 national rate was 83.9 percent (95 percent CI: 83.0-84.8) (Figure 25).

Figure 25: Percent of Infants Ever Breastfed in Texas and the United States, National Immunization Survey 2011-2018

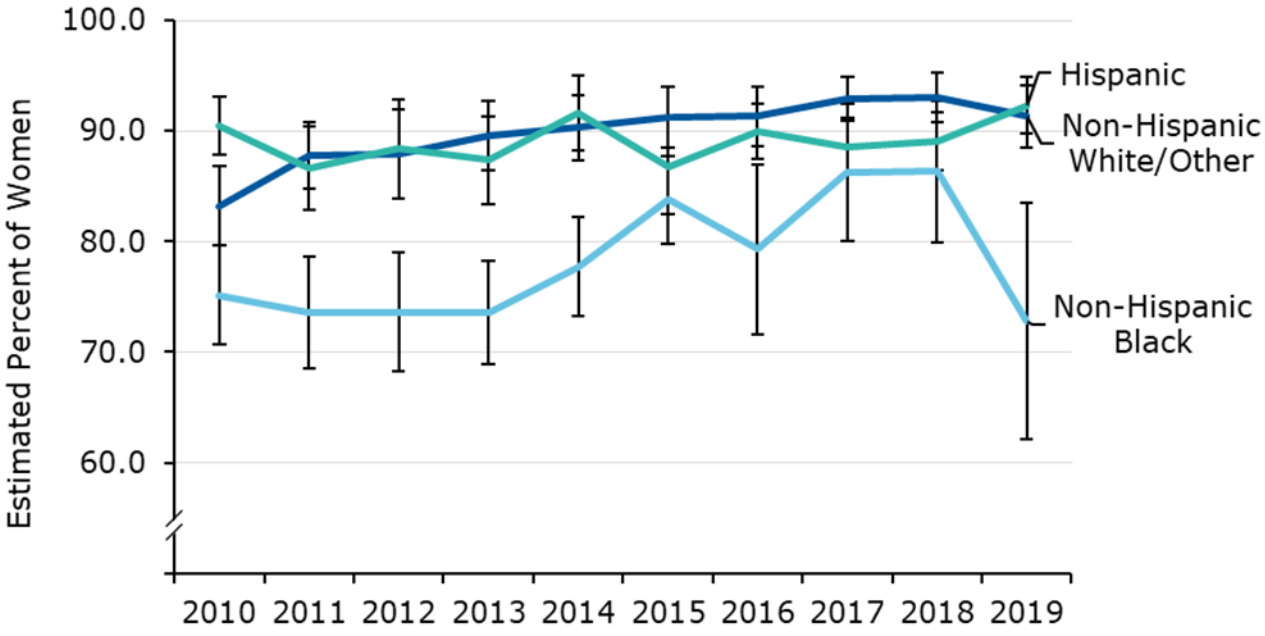


Source: National Immunization Survey
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Significant racial or ethnic disparities exist in the rate of women who have breastfed their infant. As shown in data from the 2019 PRAMS survey, non-Hispanic Black mothers reported lower rates of ever breastfeeding than non-Hispanic White and Hispanic mothers (**Figure 26**). The PRAMS 2018 and 2019 surveys included questions about reasons for not initiating breastfeeding. The most common reason women gave for not ever breastfeeding was not wanting to breastfeed (34.1 percent), followed by breastfeeding being too difficult (27.3 percent), having other children to care for (26.5 percent), and not liking breastfeeding (23.4 percent).

[32] Centers for Disease Control and Prevention (CDC, 2020). Rates of Any and Exclusive Breastfeeding by State among Children Born in 2018. Retrieved from **cdc.gov/breastfeeding/data/nis_data/rates-any-exclusive-bf-by-state-2018.htm** [Accessed March 28, 2022].

Figure 26: Women Who Ever Breastfed Their Baby by Race and Ethnicity, Texas PRAMS 2010-2019



Error Bars: 95% Confidence Interval
Source: 2010-2019 Texas PRAMS
Prepared by: Maternal & Child Health Epidemiology Unit
May 2021

The Texas Women, Infants, and Children (WIC) Infant Feeding Practices Survey (IFPS) also showed similar results for breastfeeding initiation by race and ethnicity. According to the most recent data (2018), non-Hispanic Black infants were least likely to receive only breastmilk and most likely to receive only formula while at the hospital or birthing center. Of women who reported that they had ever breastfed their infant, non-Hispanic Black women were the least likely to report breastfeeding or trying to breastfeed in the first hour after delivery (36.6 percent), and non-Hispanic White women were most likely to breastfeed or attempt to breastfeed within this timeframe (47.2 percent). For infants of non-Hispanic Black mothers, their first feeding was less likely to be breastmilk (58.2 percent) compared to infants of non-Hispanic White women (68.8 percent), Hispanic women (69.3 percent) or 'Other' women 67.3 percent). Of mothers who never initiated breastfeeding, a third believed formula was as good or better than breastfeeding.[33]

Initiating breastfeeding in the hospital is an important first step towards exclusive breastfeeding. A Baby-Friendly Hospital, which is a designation given to birthing facilities that meet internationally and nationally recognized maternal and infant care standards for best practices in infant feeding care, provides increased support for initiating

[33] Texas Department of State Health Services, Community Health Improvement Division, Maternal and Child Health Section (2019). 2018 Texas WIC Infant Feeding Practices Survey State Report.

breastfeeding in the hospital.[5] According to 2020 Baby-Friendly USA and Centers for Disease Control data, only 20.0 percent of births in 2020 occurred in a Baby-Friendly Hospital in Texas.[34]

Exclusive and Continued Breastfeeding

While most (85.1 percent) Texas mothers reported having ever breastfed, rates of exclusive breastfeeding were significantly lower. Research has shown that maternal and infant health outcomes are optimized when the baby is exclusively breastfed for the first six months of life and is continued to be breastfed, in combination with the introduction of complementary foods, for at least one to two years after birth.[27, 35]

According to the 2018 National Immunization Survey, 46.3 percent (95 percent CI: 41.7-50.9) of Texas mothers reported exclusively breastfeeding at three months (**Figure 27**), 26.9 percent (95 percent CI: 22.9-30.9) reported breastfeeding exclusively at six months (**Figure 28**), and 34.9 percent (95 percent CI: 30.6-39.2) reported any breastfeeding at 12 months (**Figure 29**).[32] The Healthy People 2030 (HP 2030) targets aim to increase exclusive breastfeeding at six months to 42.4 percent and any breastfeeding at one year to 54.1 percent.[36, 37] The discrepancies between breastfeeding initiation and the percent of women who continue any and exclusive breastfeeding underscore the barriers to maintaining breastfeeding for the recommended duration.

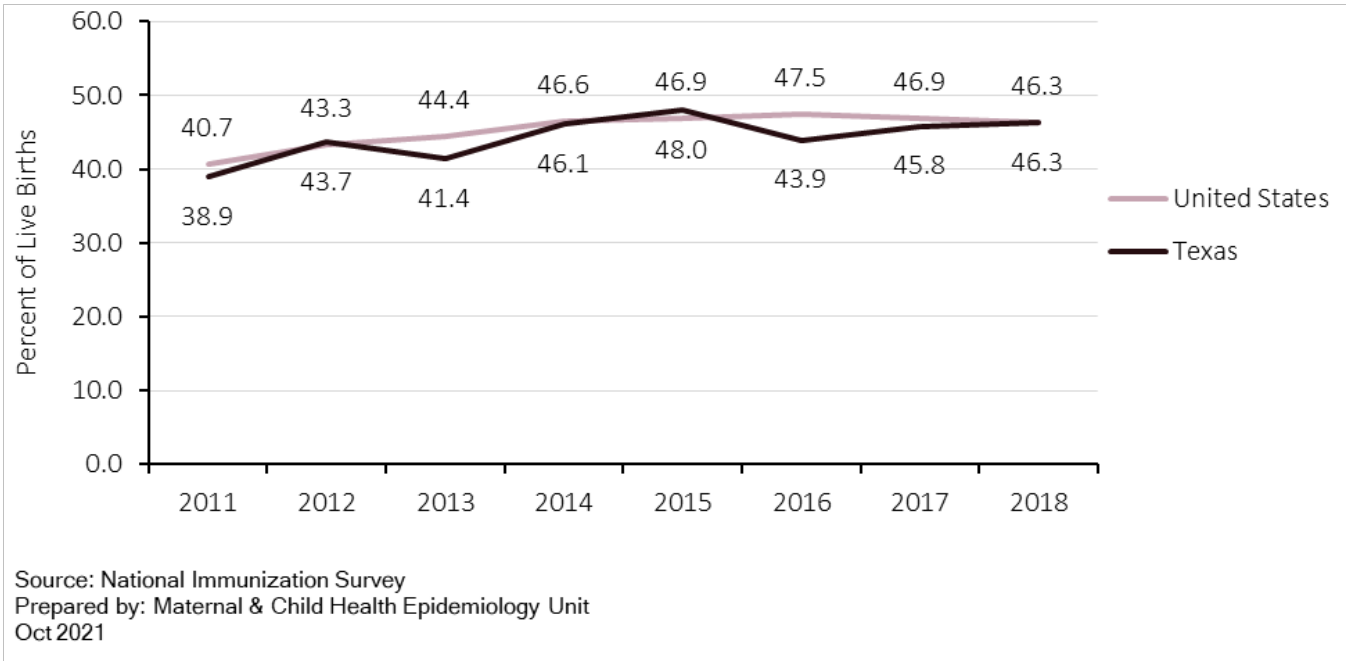
[34] Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps. Retrieved from **www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html** [Accessed March 28, 2022].

[35] American College of Obstetricians and Gynecologists. (2016). Optimizing support for breastfeeding as part of obstetric practice. Committee Opinion No. 658. *Obstet Gynecol*, 127(2), e86-e92.

[36] Healthy People 2030, Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services. Increase the proportion of infants who are breastfed at 1 year — MICH-16. Retrieved from **health.gov/healthypeople/objectives-and-data/browse-objectives/infants/increase-proportion-infants-who-are-breastfed-exclusively-through-age-6-months-mich-15** [Accessed March 29, 2022].

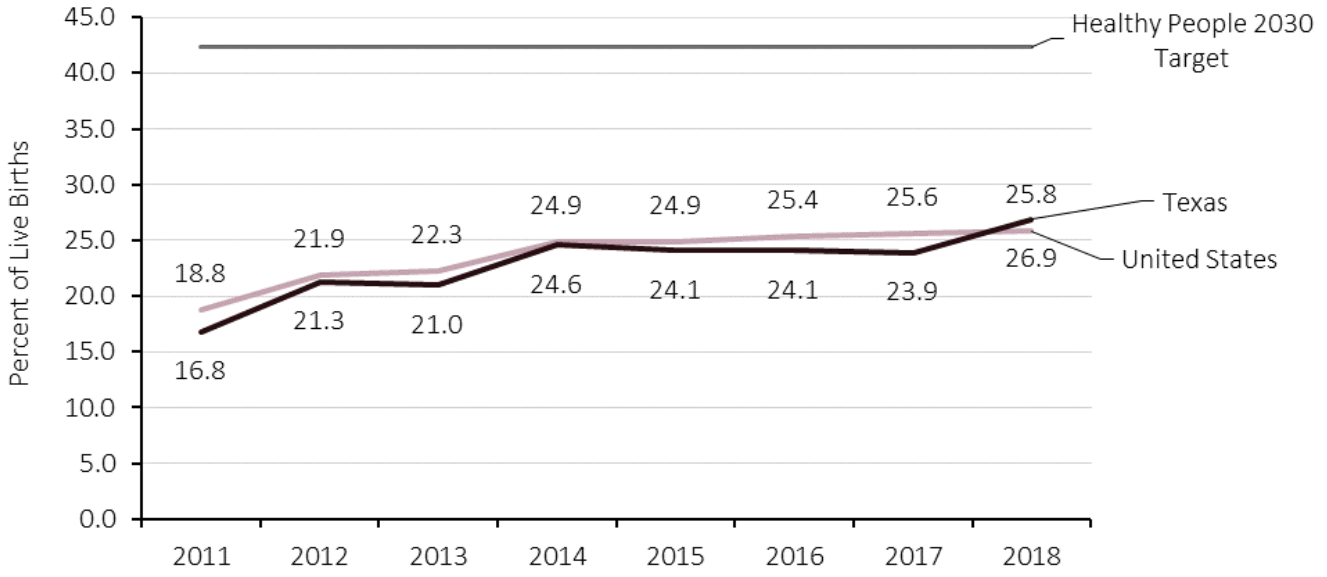
[37] Healthy People 2030, Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services. Increase the proportion of infants who are breastfed at 1 year — MICH-16. Retrieved from **health.gov/healthypeople/objectives-and-data/browse-objectives/infants/increase-proportion-infants-who-are-breastfed-1-year-mich-16** [Accessed March 28, 2022].

Figure 27: Percent of Infants Who Were Exclusively Breastfed Through Three Months in Texas and the United States, National Immunization Survey 2011-2018



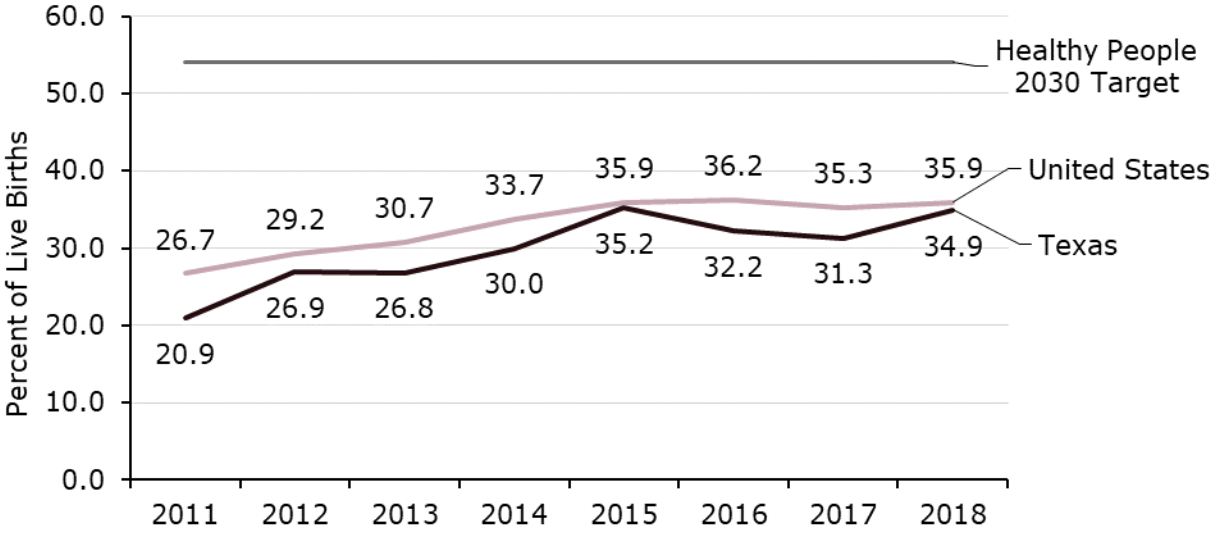
Source: National Immunization Survey
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Figure 28: Percent of Infants Who Were Exclusively Breastfed Through Six Months in Texas and the United States, National Immunization Survey 2011-2018



Source: National Immunization Survey
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Figure 29: Percent of Infants Who Were Breastfed for One Year in Texas and the United States, National Immunization Survey 2011-2018



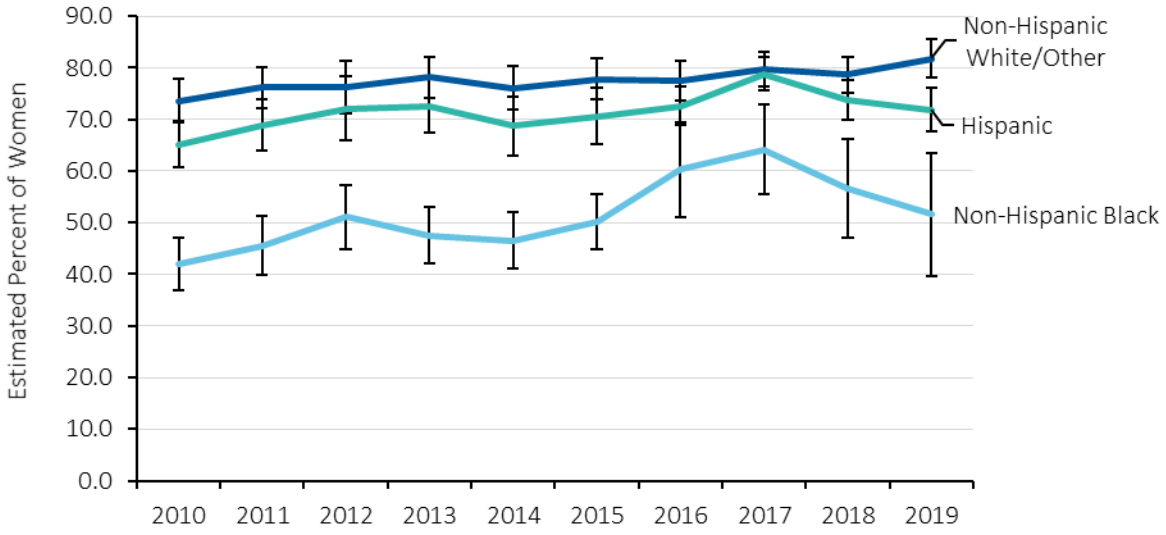
Source: National Immunization Survey
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Safe Sleep

Placing Infants on their Back to Sleep

Placing an infant on their back to sleep, rather than on their stomach or side, is an important strategy to reduce sleep-related deaths.[38] According to Texas PRAMS data, 74.2 percent of mothers reported placing their infant on their back to sleep in 2019. This percentage has increased by 13 percent since 2010. Despite this significant increase, substantial racial and ethnic differences still existed. The proportion of non-Hispanic Black mothers placing their infant on their back to sleep increased by 70 percent between 2010 and 2017, but the percent remained significantly lower among non-Hispanic Black mothers than among non-Hispanic White mothers and Hispanic mothers in 2019 (**Figure 30**).

Figure 30: Women Who Reported Placing Infant on Back to Sleep by Race and Ethnicity, Texas PRAMS 2010-2019



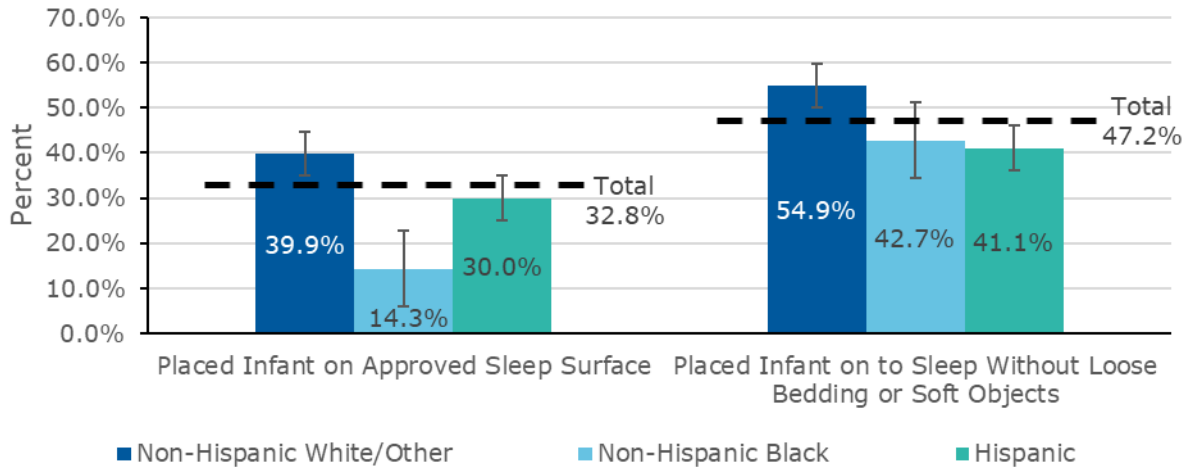
Error Bars: 95% Confidence Interval
Source: 2010-2019 Texas PRAMS
Prepared by: Maternal & Child Health Epidemiology Unit
May 2021

[38] Moon, R. Y., & TASK FORCE ON SUDDEN INFANT DEATH SYNDROME (2016). SIDS and Other Sleep-Related Infant Deaths: Evidence Base for 2016 Updated Recommendations for a Safe Infant Sleeping Environment. *Pediatrics*, *138*(5), e20162940.

Additional Safe Sleep Practices

Beyond placing infants on their backs to sleep, PRAMS collects data about other sleep safety measures that can reduce the risk of unexpected infant death during sleep, such as placing infants to sleep on an approved sleep surface and placing infants to sleep without loose bedding or soft objects.[38] Based on 2019 PRAMS data, less than half of Texas mothers reported using each of these safe sleep measures (**Figure 31**). Of PRAMS respondents, 32.8 percent placed infants to sleep on an approved sleep surface, and the percentage was lower among non-Hispanic Black mothers (14.3 percent) compared to Hispanic (30.0 percent) or non-Hispanic White/Other mothers (39.9 percent). Placing infants to sleep without loose bedding or other soft objects was reported by 47.2 percent of mothers; the highest percentage was among non-Hispanic White/Other mothers (54.9 percent) and the lowest percentage was among Hispanic mothers (41.1 percent).

Figure 31: Mothers Who Reported Placing Infant on Approved Sleep Surface to Sleep and Placing Infant to Sleep Without Loose Bedding or Soft Objects by Race and Ethnicity, Texas PRAMS 2019



Error Bars: 95% Confidence Interval
Source: 2019 Texas PRAMS
Prepared by: Maternal & Child Health Epidemiology Unit
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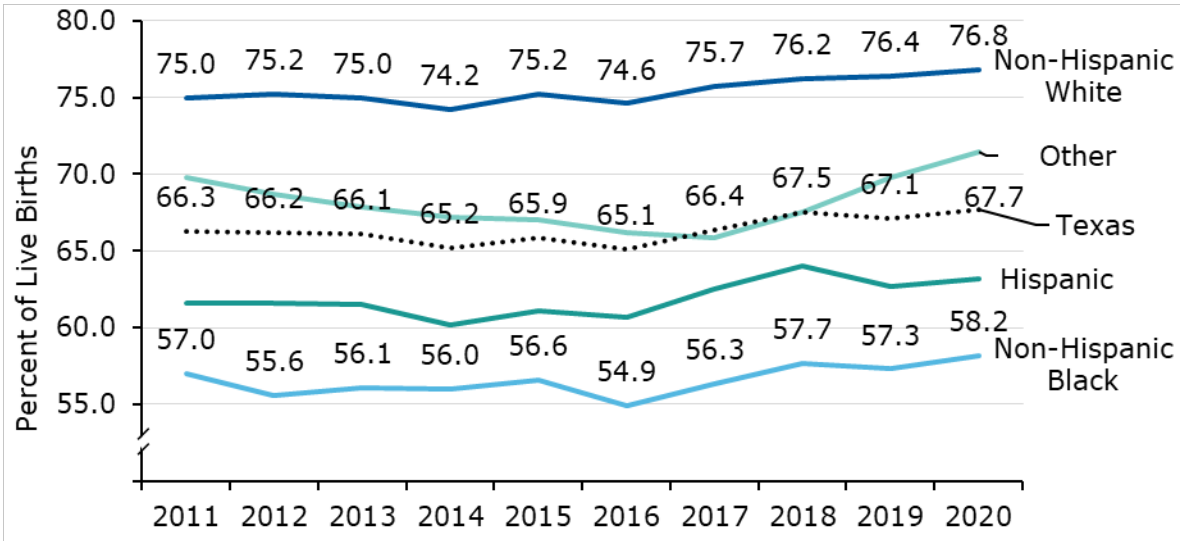
Prenatal, Delivery, and Postpartum Care

Prenatal Care

In 2020 in Texas, 67.7 percent of mothers entered prenatal care within the first trimester (**Figure 32**), which was the lowest proportion of women receiving first trimester care compared to other states.[21] Nationally, 76.1 percent of mothers entered prenatal care during the first trimester in 2020.[21]

Disparities in first trimester prenatal care access were apparent between different racial and ethnic groups. A consistently larger percentage of non-Hispanic White women received prenatal care in the first trimester of pregnancy compared to all other racial and ethnic groups from 2011-2020. While the percentages of Hispanic and non-Hispanic Black mothers receiving first trimester prenatal care have consistently been below the state average, a smaller percentage of non-Hispanic Black mothers received prenatal care in the first trimester than any other racial or ethnic group from 2011 to 2020. The proportion of mothers of 'Other' racial and ethnic backgrounds who received prenatal care in the first trimester has remained similar to the state average across the decade (Figure 32).

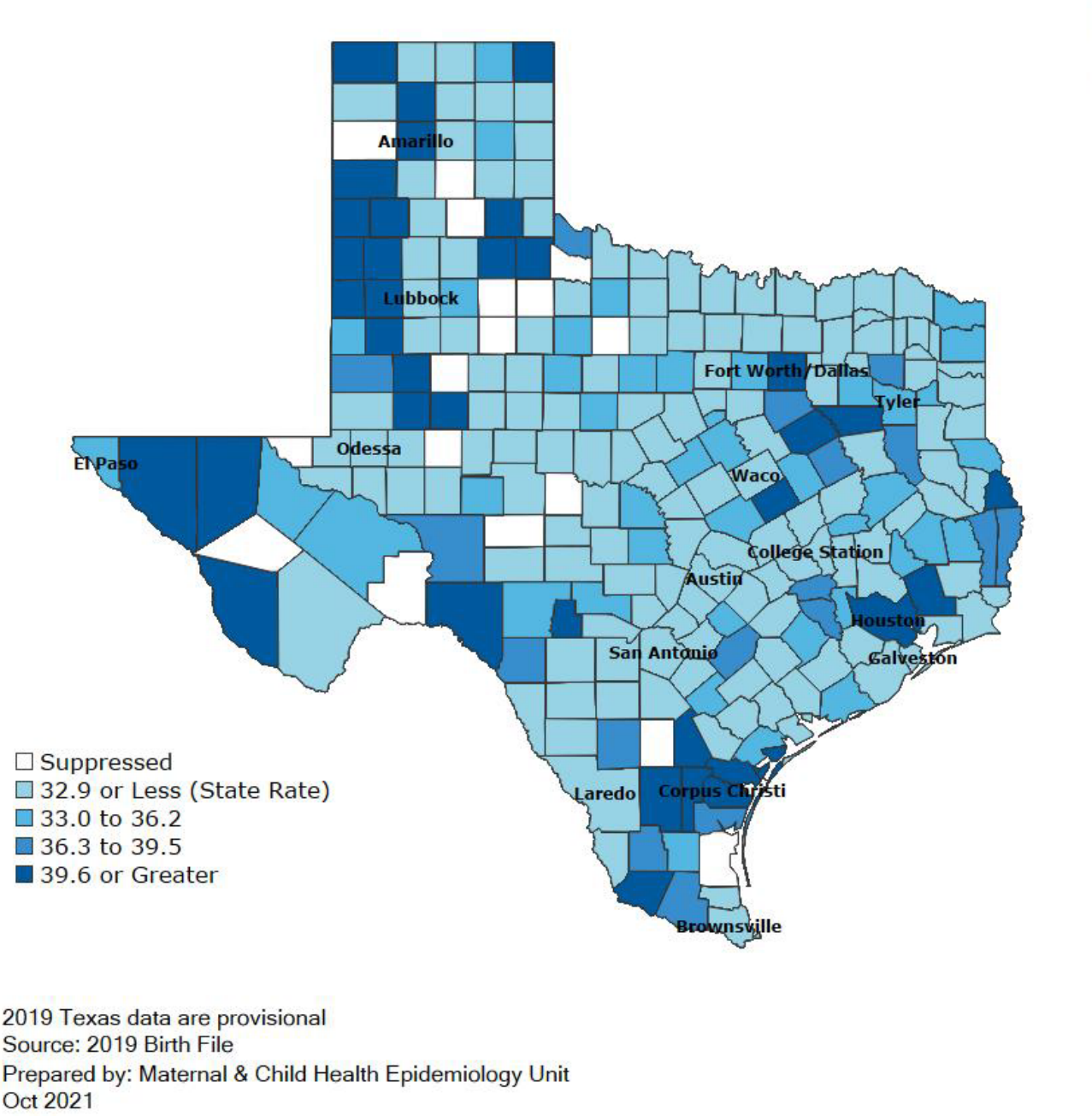
Figure 32: Percent of Live Births Where Mother Received Prenatal Care in the First Trimester by Race and Ethnicity, 2011-2020



*2018, 2019 and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Late entry (after first trimester) into prenatal care is a statewide problem. In 2019, Cochran County, Duval County, Val Verde County, and Culberson County reported that at least 55 percent of mothers did not enter prenatal care in the first trimester (**Figure 33**).

Figure 33: Percent of Live Births Where Mother Did Not Receive Prenatal Care in the First Trimester (Obstetric Estimate) by County of Residence, 2019



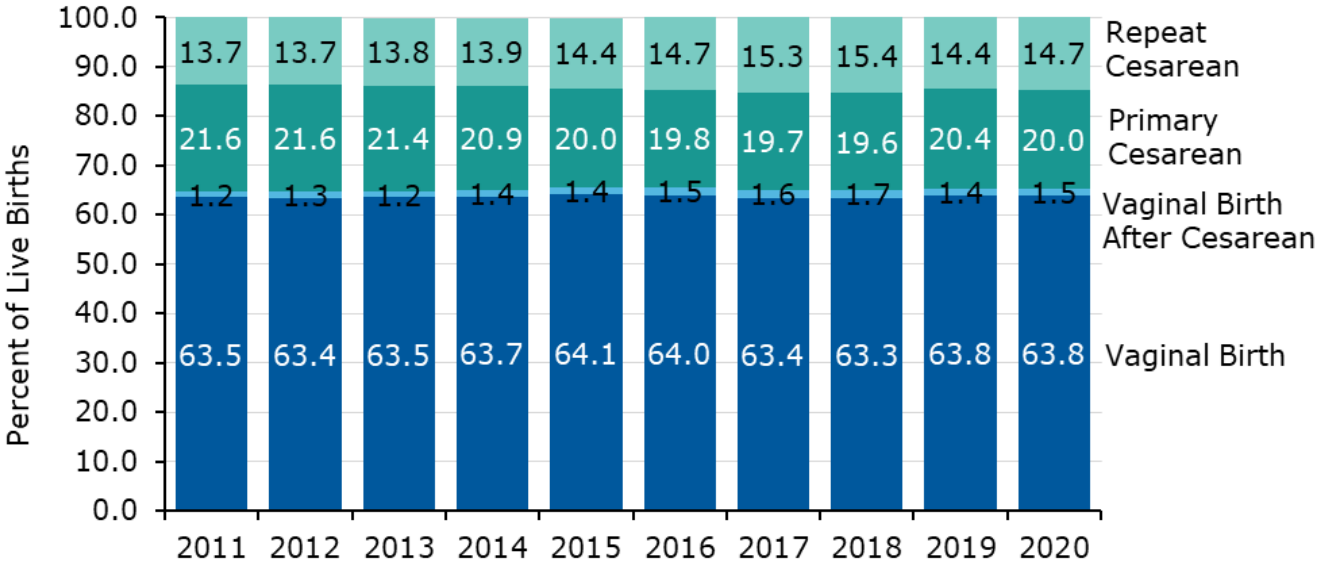
2019 Texas data are provisional
Source: 2019 Birth File
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

According to Texas PRAMS 2019 survey data, among mothers who reported that they did not receive care in the first trimester of their pregnancy, 51.8 percent (95 percent Confidence Interval (CI): 43.4-60.2) still reported that they had received prenatal care as early as they had wanted. These findings indicate a need for increased education and awareness of the importance of obtaining prenatal care starting in the first trimester.

Delivery

The method of delivery for live births in Texas has remained relatively stable from 2010 to 2019 (**Figure 34**). In 2020, 65.3 percent of all Texas deliveries were vaginal births and 34.7 percent of deliveries were by cesarean section. The percent of infants born via primary cesarean section has decreased slightly since 2011. However, the proportion of infants born via repeat cesarean increased slightly through 2018. In 2020, the cesarean delivery rate in Texas (34.7 percent) was higher than the national rate (31.8 percent).[21] The vaginal birth after cesarean (VBAC) rate in Texas (9.3 percent of mothers with previous cesarean deliveries) was lower than the national rate (13.9 percent) in 2020.[21]

Figure 34: Percent of All Births by Delivery Method, 2011-2020



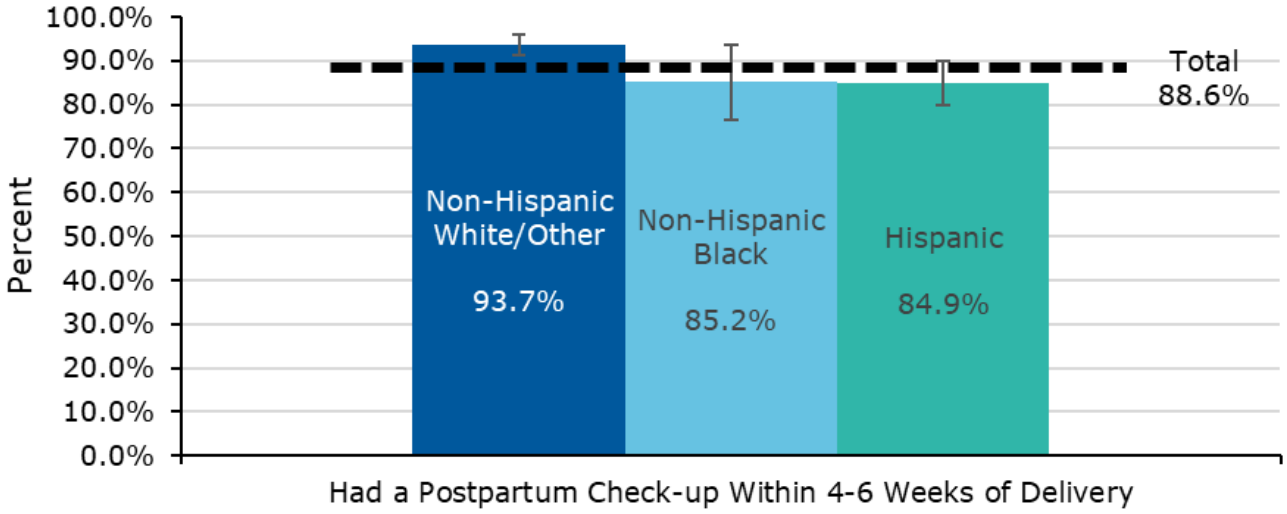
*2018, 2019, and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

PRAMS data for 2019 show similar trends in delivery method rates — 34.6 percent of mothers had their most recent birth via cesarean births. The most cited reason for a cesarean delivery was having had a previous cesarean birth. Half of mothers who had a cesarean delivery cited this as one of their reasons. The next most commonly cited reasons for a cesarean birth were pregnancy complications such as preeclampsia, placental problems, infection, or preterm labor (18.2 percent); the baby being in the wrong position for birth (17.6 percent); fetal distress (17.1 percent); and being precipitated by an unsuccessful attempt to induce labor medically (16.3 percent).

Postpartum Care

Postpartum care is an important measure to support women and infants in the critical period following birth. The American College of Obstetricians and Gynecologists (ACOG) recommends ongoing postpartum care beginning in the first three weeks after delivery, including a comprehensive postpartum visit within 12 weeks after delivery that assesses physical, social, and mental health and well-being.[39] According to PRAMS 2019 data, 88.6 percent of women reported having had a postpartum check-up within 4-6 weeks of birth. Non-Hispanic White/Other women had the highest percentage of women with postpartum check-ups at 93.7 percent, while Hispanic women had the lowest percent at 84.9 percent (**Figure 35**).

Figure 35: Percent of Texas Mothers Reporting a Postpartum Care Check-up 4-6 Weeks After Delivery by Race and Ethnicity, Texas PRAMS 2019



Error Bars: 95% Confidence Interval
Source: 2019 Texas PRAMS
Prepared by: Maternal & Child Health Epidemiology Unit
May 2021

[39] McKinney, J., Keyser, L., Clinton, S., & Pagliano, C. (2018). ACOG Committee Opinion No. 736: optimizing postpartum care. *Obstetrics & Gynecology*, 132(3), 784-785.

Maternal Health

Pregnancy Planning and Birth Spacing

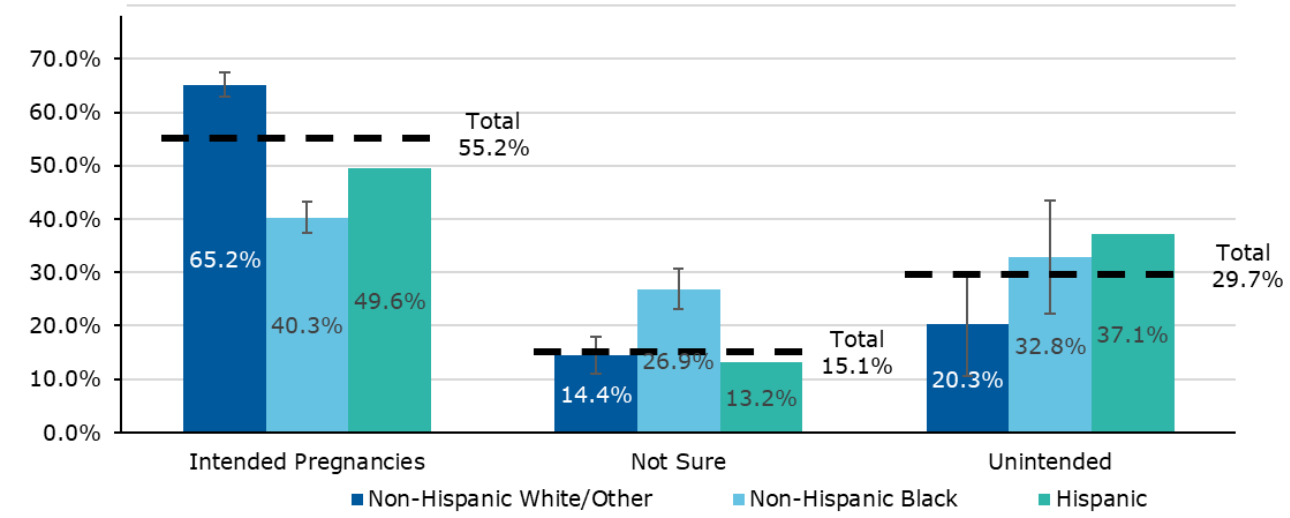
Planned pregnancies are associated with better pregnancy and infant outcomes, including reducing the risk for delayed access to prenatal care and for having children with mental and physical health problems.[40] Texas PRAMS surveys women who gave birth in a given year and categorizes women as having intended pregnancies if they said that when they became pregnant, they had wanted to become pregnant at that time or sooner. Mothers were categorized as having unintended pregnancies if they said that they wanted to become pregnant later or did not want to become pregnant at that time or at any time. Mothers who reported that they were unsure if they wanted to be pregnant or not were categorized as not sure.[41]

In 2019, 55.2 percent of mothers sampled by PRAMS had intended pregnancies, 29.7 percent had unintended pregnancies, and 15.1 were not sure. The percent of intended and unintended pregnancies varied by race/ethnicity (**Figure 36**). Non-Hispanic White and 'Other' mothers were most likely to report having intended pregnancies (65.2 percent).

[40] Healthy People 2030, Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services. Reduce the proportion of unintended pregnancies — FP-01. Retrieved from **health.gov/healthypeople/objectives-and-data/browse-objectives/family-planning/reduce-proportion-unintended-pregnancies-fp-01** [Accessed March 28, 2022].

[41] Texas Department of Health and Human Services, Maternal and Child Health Epidemiology Unit (2019, May). Pregnancy Risk Assessment Monitoring System (PRAMS) Survey, 2017 Data Book: Summary Tables. Retrieved from **dshs.texas.gov/mch/pdf/2017_PRAMS_DB_summary_tables.pdf** [Accessed March 28, 2022].

Figure 36: Percent of Texas Mothers with Intended and Unintended Pregnancies, Texas PRAMS 2019



Error Bars: 95% Confidence Interval
Source: 2019 Texas PRAMS
Prepared by: Maternal & Child Health Epidemiology Unit
May 2021

Pregnancy planning can also help with healthy birth spacing, which can reduce risks of adverse maternal and infant outcomes. Birth spacing is measured as an interbirth interval, the time between one birth and a subsequent birth, or an interpregnancy interval, the time between one birth and subsequent conception.[42] Increased risks of preterm birth, infants born at a low birth weight, neonatal morbidity, and possibly maternal morbidity and mortality have been associated with interpregnancy intervals ranging from six to 18 months.[43, 44, 45]

According to the Centers for Disease Control and Prevention (CDC) Wide-ranging Online Data for Epidemiologic Research (WONDER) database, in 2020, 62.5 percent of Texas births were to women who had a previous birth, so birth spacing is an important consideration for many.[21] Family planning services and postpartum care are important to prevent short interpregnancy intervals and to promote optimal pregnancy spacing. Of women who had a previous live birth with single deliveries in 2020, 10.1 percent had an

[42] Martinez GM, Daniels K. Fertility of men and women aged 15–49 in the United States: National Survey of Family Growth, 2015–2019. National Health Statistics Reports; no 179. Hyattsville, MD: National Center for Health Statistics. 2023. DOI: https://dx.doi.org/ 10.15620/cdc:122080.

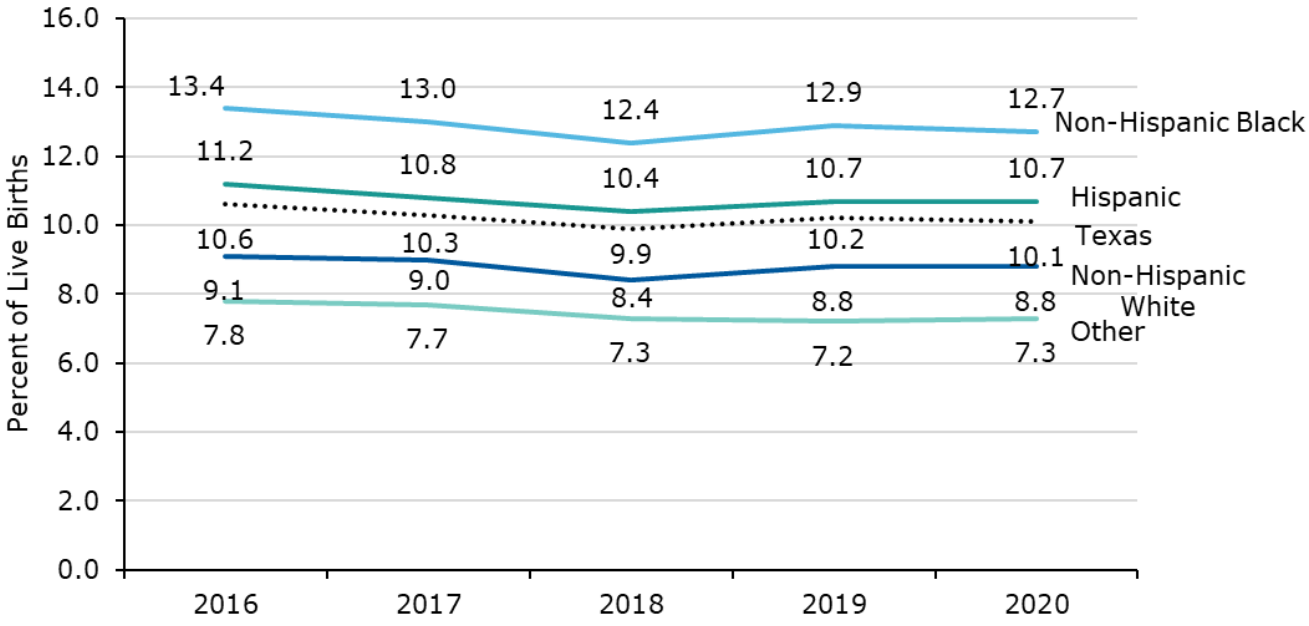
[43] March of Dimes (2015). Fact Sheet: Birth Spacing and Birth Outcomes. Retrieved from **marchofdimes.org/MOD-Birth-Spacing-Factsheet-November-2015.pdf** [Accessed March 28, 2022].

[44] Conde-Agudelo, A., Rosas-Bermudez, A., Castaño, F., & Norton, M. H. (2012). Effects of birth spacing on maternal, perinatal, infant, and child health: a systematic review of causal mechanisms. *Studies in family planning*, 43(2), 93–114. Retrieved from **doi.org/10.1111/j.1728-4465.2012.00308.x** [Accessed March 30, 2022].

[45] Conde-Agudelo, A., & Belizán, J. M. (2000). Maternal morbidity and mortality associated with interpregnancy interval: cross sectional study. *BMJ* (Clinical research ed.), 321(7271), 1255–1259. Retrieved from **doi.org/10.1136/bmj.321.7271.1255** [Accessed March 28, 2022].

interbirth interval of less than 18 months.[21] By race and ethnicity, 12.7 percent of non-Hispanic Black women, 10.7 percent of Hispanic women, 8.8 percent of non-Hispanic White women, and 7.3 percent of non-Hispanic women of 'Other' races or ethnicities had short interbirth intervals (**Figure 37**).

Figure 37: Percent of Women in Texas with Interbirth Intervals Less than 18 Months, 2016-2020

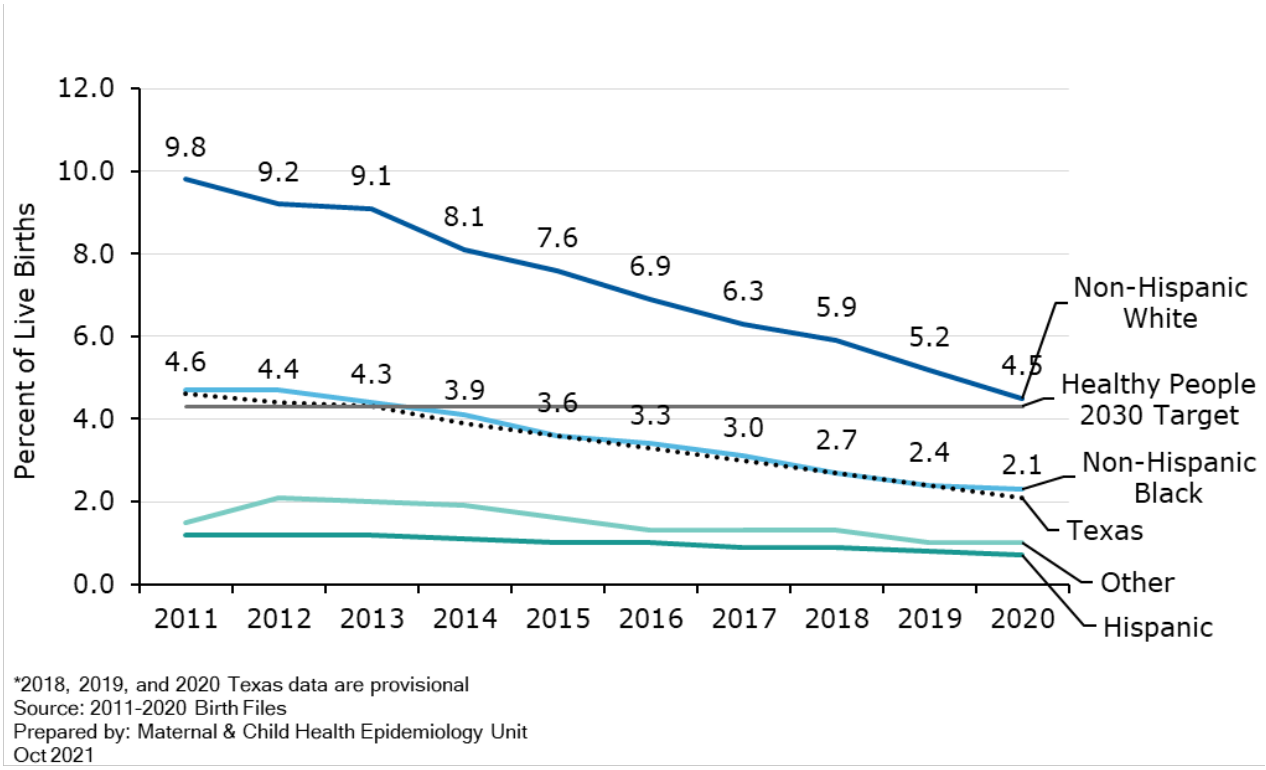


Source: 2016-2020 CDC WONDER
Prepared by: Maternal and Child Health Epidemiology Unit
Oct 2021

Smoking

With 2.1 percent of mothers smoking during pregnancy in 2020, Texas had the third lowest prevalence of smoking during pregnancy of any state. Comparatively, the national average was 5.9 percent of mothers smoking during pregnancy.[21] In Texas in 2020, Hispanic mothers and mothers of 'Other' race or ethnicity had the lowest prevalence of smoking during pregnancy, while non-Hispanic White mothers were not meeting the Healthy People 2030 (HP 2030) target of at least 95.7 percent of the population abstaining from smoking during pregnancy.[46] Overall, the proportion of mothers who smoke during pregnancy has decreased 54.0 percent in Texas over the past decade (**Figure 38**).

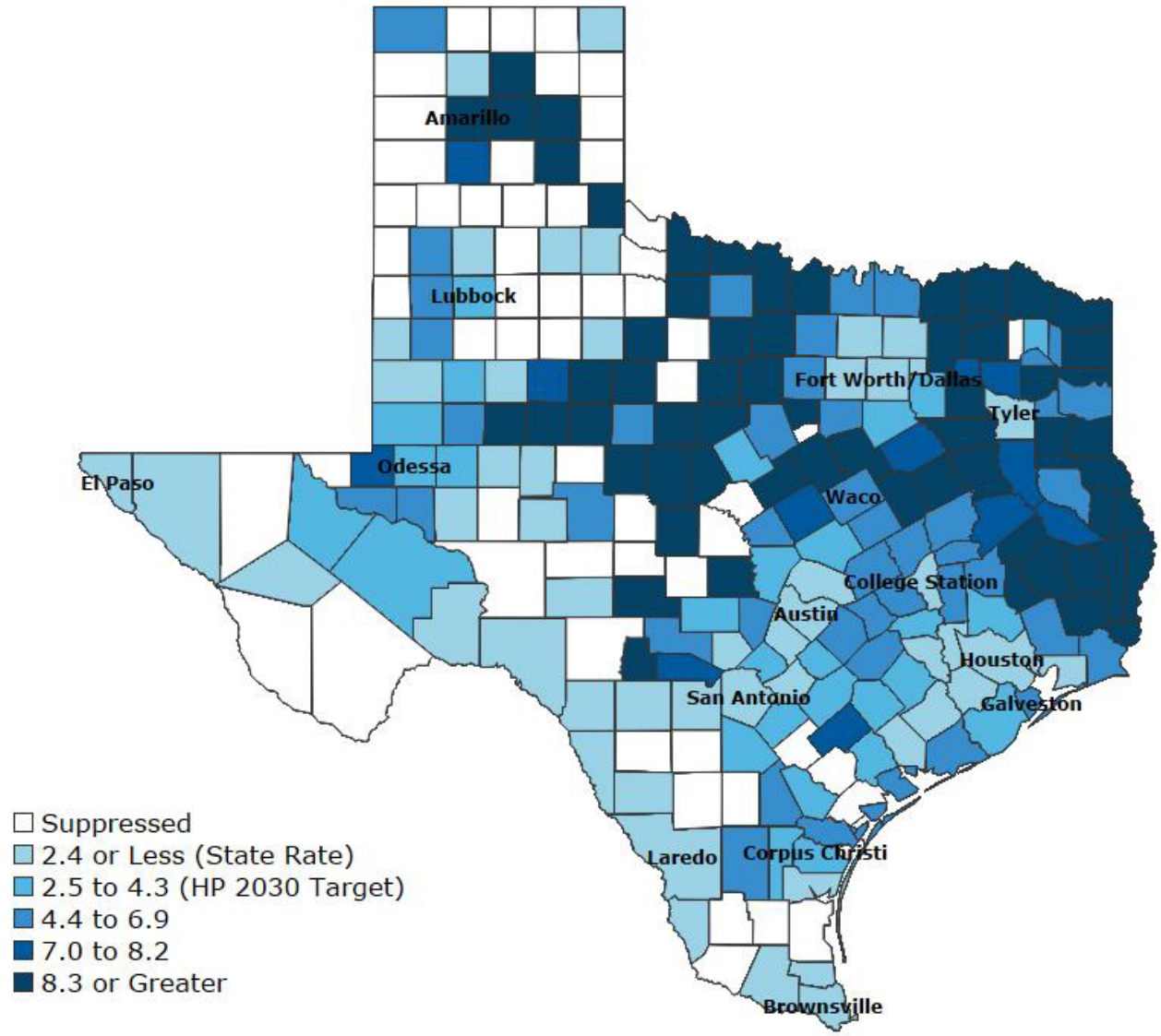
Figure 38: Percent of Live Births Where Mother Smoked Cigarettes During Pregnancy by Race and Ethnicity, 2011-2020



Regional differences in the prevalence of smoking during pregnancy existed throughout Texas (**Figure 39**). In 2019, Texas counties near the U.S.-Mexico border generally had lower rates of smoking during pregnancy, whereas higher rates of smoking during pregnancy were observed in many counties in north and east Texas.

[46] Healthy People 2030, Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services. Increase abstinence from cigarette smoking among pregnant women — MICH-10. Retrieved from **health.gov/healthypeople/objectives-and-data/browse-objectives/pregnancy-and-childbirth/increase-abstinence-cigarette-smoking-among-pregnant-women-mich-10** [Accessed March, 30, 2022].

Figure 39: Percent of Live Births Where Mother Smoked During Pregnancy by County of Residence, 2019



2019 Texas data are provisional
Source: 2019 Birth File
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Maternal Mental Health

Mental health is an important health indicator at all phases of life; however, poor mental health prior to pregnancy can have implications for pregnancy and postpartum. Maternal mental health plays a role not only in the health of the mother, but also impacts birth outcomes and the health and development of the infant throughout the life course. Research indicates associations between poor mental health before and during pregnancy and negative birth outcomes, including preterm birth, low birth weight, reduced breastfeeding initiation rates, and birth outcomes that do not result in a live birth.[47, 48, 49, 50] Postpartum depression has been associated with negative consequences for maternal health, quality of life, and personal interaction, as well as for the development of the child.[51]

Depression can affect women before and during pregnancy, or in the postpartum period. Based on Texas PRAMS 2019 data, 48.5 percent were asked about their mental health by a health care professional in the year prior to becoming pregnant. In the three months leading up to pregnancy, 12.6 percent of mothers reported experiencing depression.

This survey also showed that screening for depression during pregnancy was similar across race and ethnic groups: 73.7 percent of non-Hispanic White and 'Other' women, 80.2 percent of non-Hispanic Black mothers, and 72.6 percent of Hispanic mothers reported being screened during pregnancy. A lower percentage of Hispanic women reported experiencing depression during pregnancy (9.7 percent) than non-Hispanic White or 'Other' mothers (15.0 percent), or non-Hispanic Black mothers (16.4 percent) (**Figure 40**).

Postpartum depression is treatable, and screening mothers for depression during medical visits is an important step to accessing treatment resources.[52] The PRAMS 2019 survey showed that 85.7 percent of non-Hispanic White mothers, 90.4 percent of non-Hispanic Black mothers, and 86.3 percent of Hispanic mothers reported they were screened for postpartum depression. Paralleling the trends in prenatal depression, non-Hispanic Black

[47] Witt, W. P., Wisk, L. E., Cheng, E. R., Hampton, J. M., & Hagen, E. W. (2012). Preconception mental health predicts pregnancy complications and adverse birth outcomes: a national population-based study. *Maternal and child health journal*, *16*(7), 1525–1541. Retrieved from **doi.org/10.1007/s10995-011-0916-4** [Accessed March 28, 2022].

[48] Grote, N. K., Bridge, J. A., Gavin, A. R., Melville, J. L., Iyengar, S., & Katon, W. J. (2010). A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction. *Archives of general psychiatry*, 67(10), 1012–1024. Retrieved from **doi.org/10.1001/archgenpsychiatry.2010.111** [Accessed March 28, 2022].

[49] Gavin, A. R., Chae, D. H., Mustillo, S., & Kiefe, C. I. (2009). Prepregnancy depressive mood and preterm birth in black and white women: findings from the CARDIA Study. *Journal of women's health (2002)*, *18*(6), 803–811. Retrieved from **doi.org/10.1089/jwh.2008.0984** [Accessed March 28, 2022].

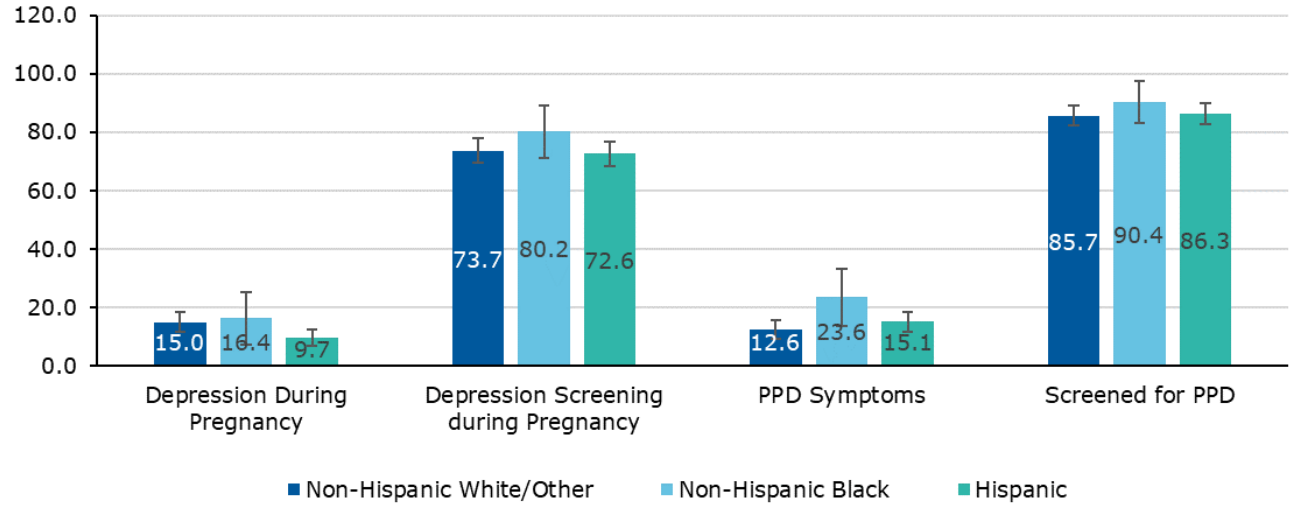
[50] Grigoriadis, S., VonderPorten, E. H., Mamisashvili, L., et al (2013). The impact of maternal depression during pregnancy on perinatal outcomes: a systematic review and meta-analysis. *The Journal of clinical psychiatry*, 74(4), 321-341.

[51] Slomian, J., Honvo, G., Emonts, P., Reginster, J.-Y., & Bruyère, O. (2019). Consequences of maternal postpartum depression: A systematic review of maternal and infant outcomes. *Women's Health*. Retrieved from **doi.org/10.1177/1745506519844044** [Accessed March 28, 2022].

[52] Centers for Disease Control and Prevention (CDC, 2019). Depression During and After Pregnancy. Retrieved from **cdc.gov/reproductivehealth/features/maternal-depression/index.html** [Accessed March 28, 2022].

mothers had the highest rate of postpartum depression symptoms (23.6 percent), followed by Hispanic (15.1 percent), and non-Hispanic White and 'Other' mothers (12.6 percent) (Figure 40).

Figure 40: Percent of Texas Mothers with Symptoms of Depression during Pregnancy and Postpartum Depression and Screened for Depression during Pregnancy or Postpartum, by Race and Ethnicity, Texas PRAMS 2019



Source: 2019 Texas Pregnancy Risk Assessment Monitoring System.
Prepared by: Maternal and Child Health Epidemiology Unit.
Nov 2020

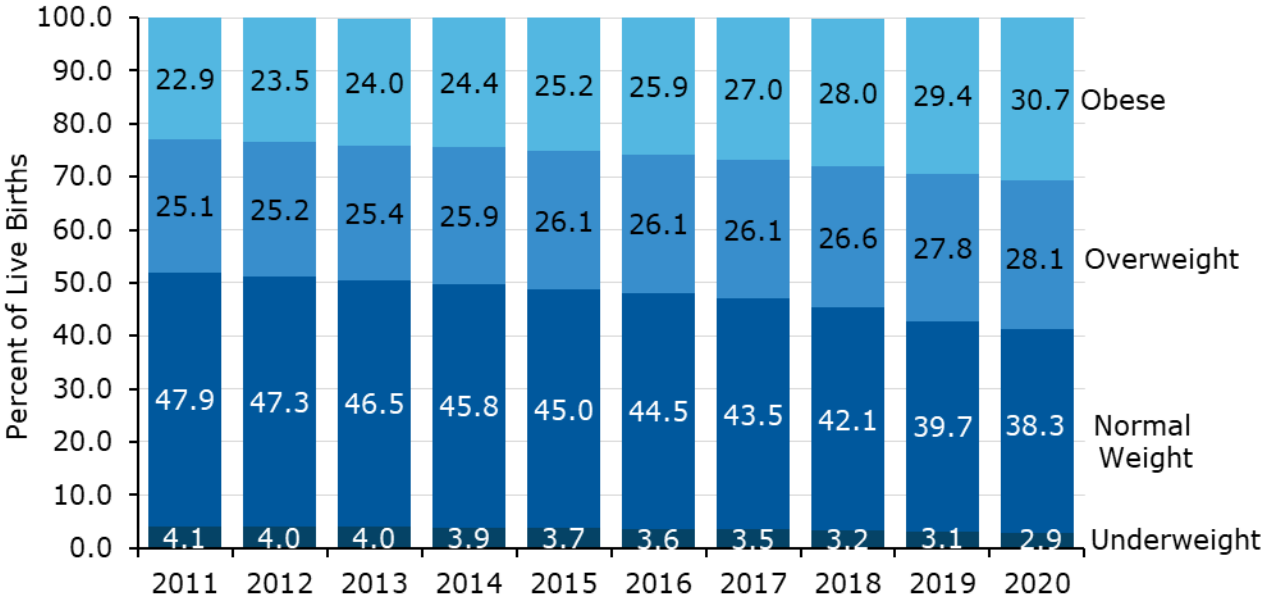
Pre-Pregnancy Obesity

Obesity is a well-known risk factor for developing hypertension, diabetes, and a variety of other medical problems during pregnancy.[53] Obesity and conditions associated with obesity during pregnancy increase the risk of developing chronic conditions later in life in both mothers and babies.[54, 55, 56, 57]

A rise in pre-pregnancy obesity has been observed over the past decade, both in Texas and in other states.[7] The percentage of mothers with a pre-pregnancy body mass index (BMI) in the obese range increased 33.8 percent in Texas between 2011 and 2020 (**Figure 41**). In 2020, the percentage of women at a normal pre-pregnancy weight was 38.3, about nine percentage points below the Health People 2030 target of 47.1 percent.[58]

[53] Gaillard, R., Durmuş, B., Hofman, A., Mackenbach, J. P., Steegers, E. A., & Jaddoe, V. W. (2013). Risk factors and outcomes of maternal obesity and excessive weight gain during pregnancy. *Obesity*, *21*(5), 1046-1055.
[54] Rath, S. R., Marsh, J. A., Newnham, J. P., Zhu, K., Atkinson, H. C., Mountain, J., Oddy, W. H., Hughes, I. P., Harris, M., Leong, G. M., Cotterill, A. M., Sly, P. D., Pennell, C. E., and Choong, C. S. (2016) Parental pre-pregnancy BMI is a dominant early-life risk factor influencing BMI of offspring in adulthood. *Obesity Science & Practice*, 2: 48– 57. doi: 10.1002/osp4.28.
[55] Papachatzi, E., Dimitriou, G., Dimitropoulos, K., & Vantarakis, A. (2013). Pre-pregnancy obesity: maternal, neonatal and childhood outcomes. *Journal of neonatal-perinatal medicine*, 6(3), 203-216.
[56] Mayo Clinic News Network (2018, April 13). Mayo Clinic Minute: Long-term health risks of gestational diabetes. Retrieved from **newsnetwork.mayoclinic.org/discussion/mayo-clinic-minute-long-term-health-risks-of-gestational-diabetes/** [Accessed March 28, 2022].
[57] Ayansina, D., Black, C., Hall, S. J., Marks, A., Millar, C., Prescott, G. J., Wilde, K., & Bhattacharya, S. (2016). Long term effects of gestational hypertension and pre-eclampsia on kidney function: Record linkage study. *Pregnancy hypertension, 6*(4), 344–349. Retrieved from **doi.org/10.1016/j.preghy.2016.08.231** [Accessed from March 28, 2022].
[58] Healthy People 2030, Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services. Increase the proportion of women who had a healthy weight before pregnancy — MICH-13. Retrieved from **health.gov/healthypeople/objectives-and-data/browse-objectives/pregnancy-and-childbirth/increase-proportion-women-who-had-healthy-weight-pregnancy-mich-13** [Accessed March 28, 2022].

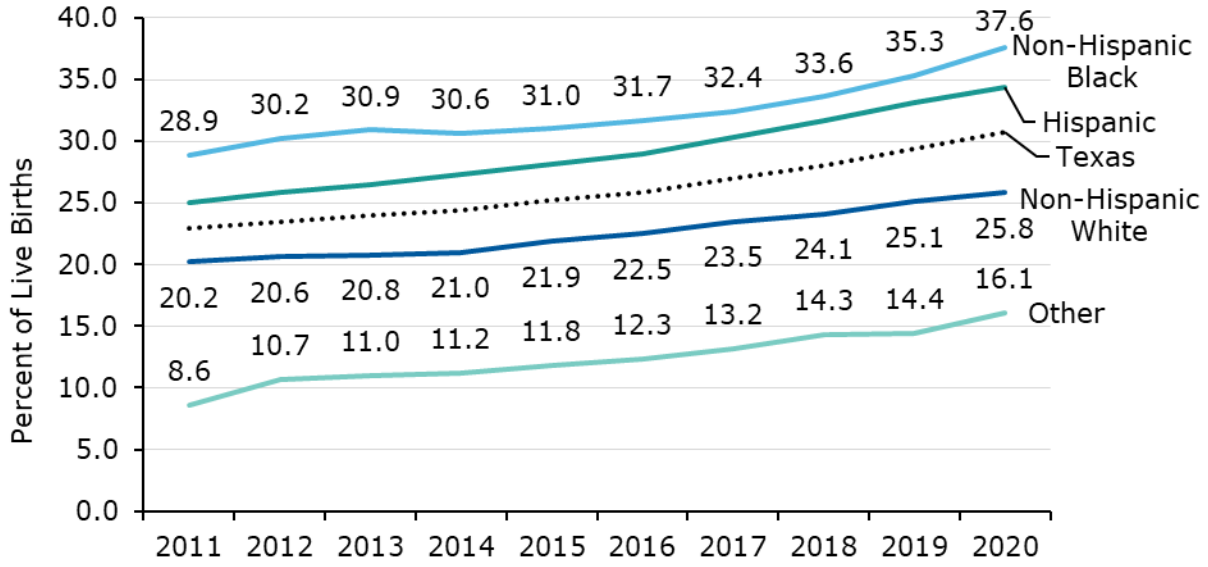
Figure 41: Maternal Pre-pregnancy Body Mass Index Distribution for All Live Births, 2011-2020



*2018, 2019, and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Pre-pregnancy obesity is more prevalent among non-Hispanic Black and Hispanic mothers than among non-Hispanic White mothers or mothers of 'Other' race or ethnicity (**Figure 42**). However, over the past decade, the rate of pre-pregnancy obesity has risen most steeply among mothers of 'Other' race or ethnicity — an 86.7 percent increase since 2011. Hispanic mothers have seen a relatively large increase in pre-pregnancy obesity between 2011 and 2020 — a 37.6 percent increase among Hispanic mothers, compared with increases of 30.1 and 28.0 percent among non-Hispanic Black and non-Hispanic White mothers, respectively.

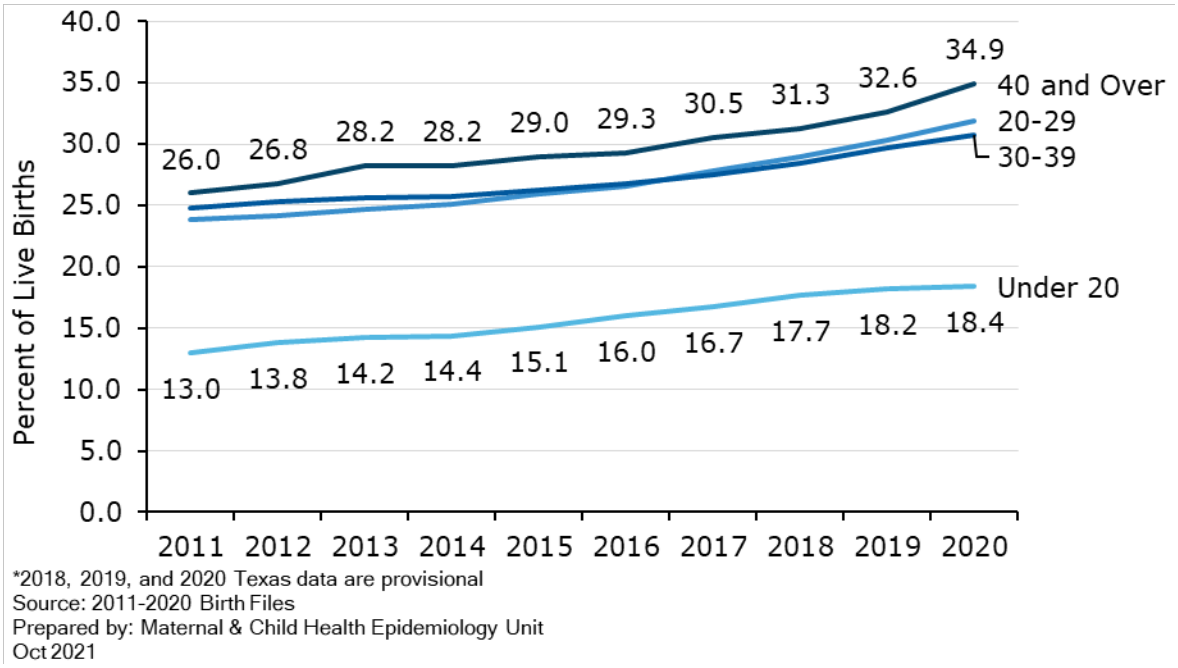
Figure 42: Maternal Pre-pregnancy Obesity by Race and Ethnicity, 2011-2020



*2018, 2019, and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Prevalence of pre-pregnancy obesity also differed by maternal age. In 2020, a much lower percentage of mothers younger than 20 years old were obese prior to pregnancy, compared with all older age groups. Mothers 40 years or older had the highest percentage of pre-pregnancy obesity. The rise in obesity rates over time has also differed by maternal age. Over the past decade, the largest percent increase in the prevalence of pre-pregnancy obesity has been observed for mothers younger than 20 years old, followed by mothers 40 years and over (**Figure 43**).

Figure 43: Maternal Pre-pregnancy Obesity by Age Group, 2011-2020

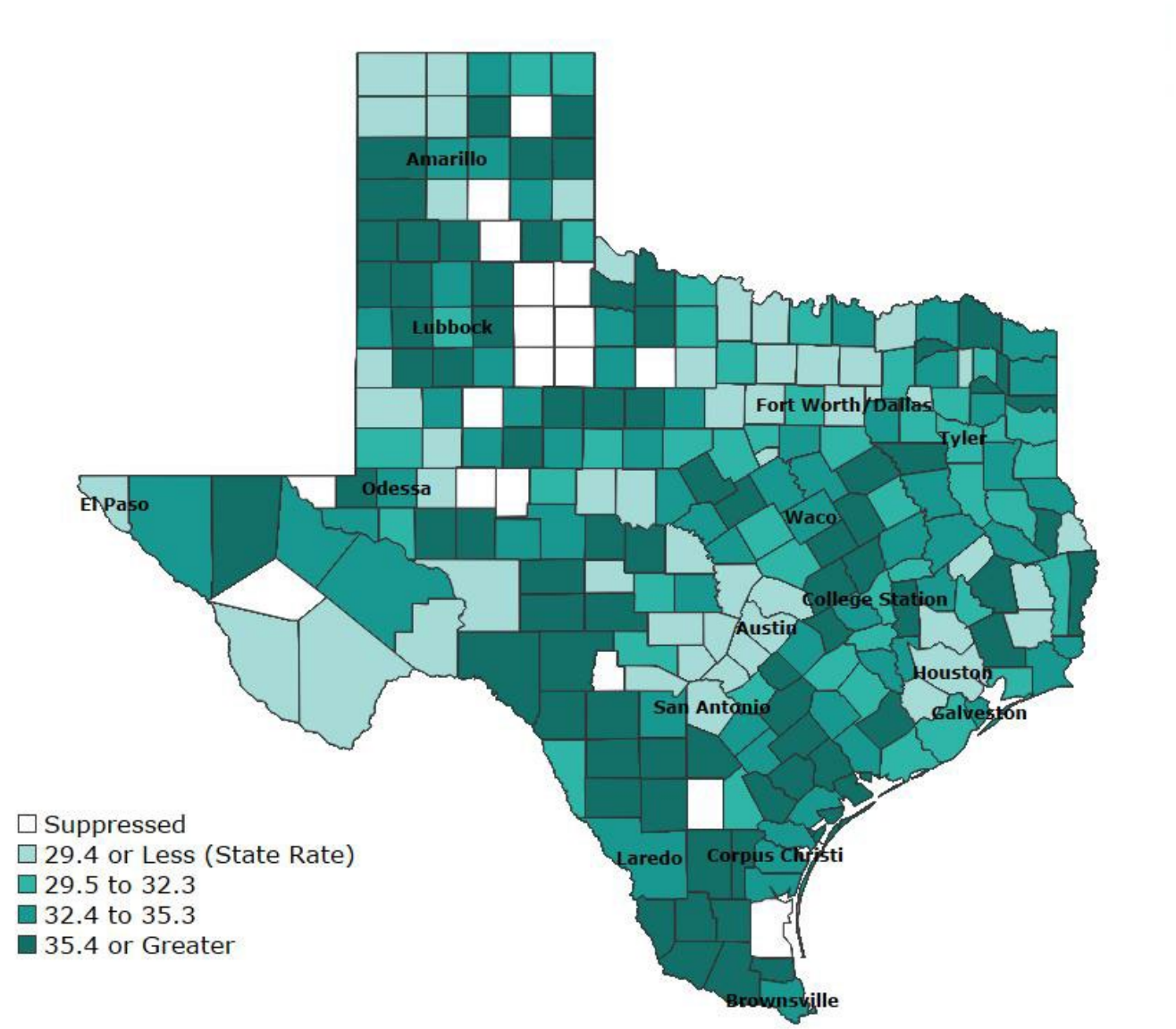


High pre-pregnancy obesity rates were observed in counties across Texas (**Figure 44**). It is likely that within-county differences also existed because neighborhood environments (walkability, access to parks/sidewalks, access to healthy food choices) and other community drivers of health can vary widely within the same county.[59, 60]

[59] Kolak, M., Bhatt, J., Park, Y. H., Padrón, N. A., & Molefe, A. (2020). Quantification of neighborhood-level social determinants of health in the continental United States. *JAMA network open*, *3*(1), e1919928-e1919928.

[60] McKey, T., Kim, D., & Seo, S. (2020). Crowdsourced Mapping for Healthy Food Accessibility in Dallas, Texas: A Feasibility Study. *Frontiers in Public Health*, *8*, 71.

Figure 44: Percent of Births to an Obese Mother by County of Residence, 2019



2019 Texas data are provisional
Source: 2019 Birth File
Prepared by: Maternal & Child Health Epidemiology Unit
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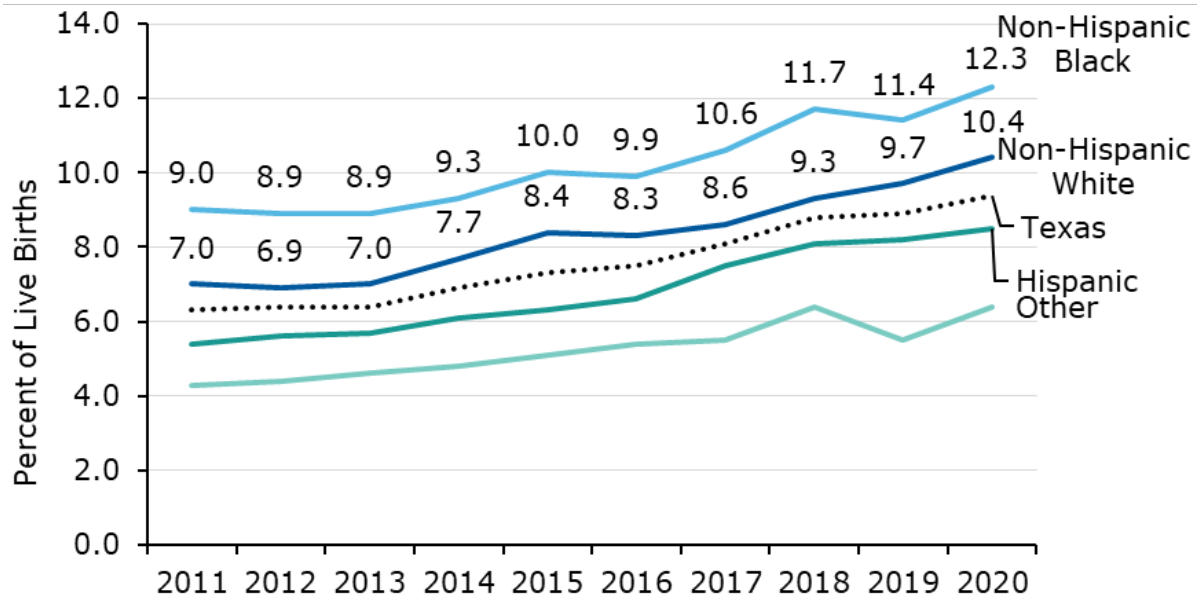
Hypertension and Diabetes

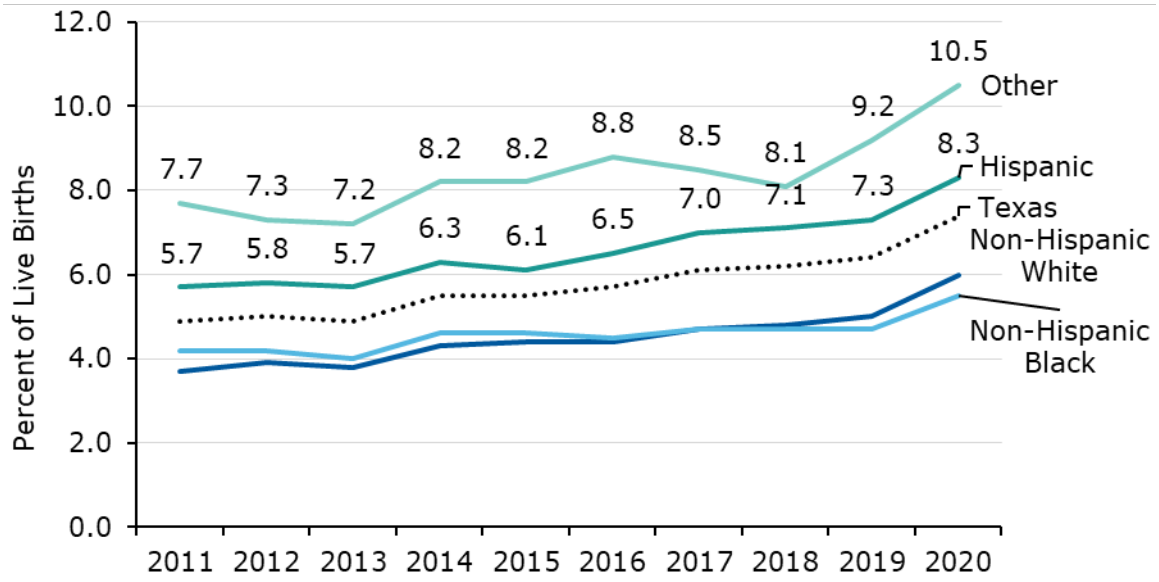
According to 2020 birth certificate data, 9.4 percent of all live births were to mothers with some form of hypertension, and 7.4 percent of all live births were to mothers who had diabetes (these mothers either had diabetes or hypertension pre-pregnancy or developed the condition over the course of the pregnancy). Rates of both hypertension and diabetes among mothers have increased in Texas over the last decade (**Figure 45** and **Figure 46**). As with many health outcomes, both hypertension and diabetes rates differ by race and ethnicity. Of all racial or ethnic groups, non-Hispanic Black women and non-Hispanic White mothers had the highest percentages of maternal hypertension (Figure 45), while mothers in the 'Other' race or ethnicity category and Hispanic mothers had the highest percentages of maternal diabetes (Figure 46).

Figure 45: Maternal Hypertension by Race and Ethnicity, 2011-2020



*2018, 2019, and 2020 Texas data are provisional
Source: 2011-2020 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Figure 46: Maternal Diabetes by Race and Ethnicity, 2011-2020



*2018 and 2019 Texas data are provisional
Source: 2010-2019 Birth Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Pre-pregnancy obesity is associated with both hypertension and diabetes.[53] Analysis of 2020 birth files from Texas showed that 24.4 percent of all mothers with pre-pregnancy obesity also had hypertension, diabetes, or both conditions. In contrast, only 9.0 percent of mothers with normal pre-pregnancy BMI were hypertensive, diabetic, or had both (data not shown).

Mothers with diabetes or hypertension during pregnancy and their infants are at increased risk for a variety of complications, including infant or fetal death.[61, 62] In 2018, the mortality rate was 10.1 per 1,000 Texas births for infants of mothers with pre-pregnancy hypertension and 16.1 for infants of mothers with pre-pregnancy diabetes, which is higher than the mortality rate for mothers with gestational hypertension (5.4), gestational diabetes (4.3), or mothers without either form of diabetes or hypertension (5.5).[63] Additionally, mothers with these conditions experience high rates of severe maternal morbidity (SMM). Hypertension/eclampsia diagnoses were both leading indicators of SMM and were a leading cause of maternal death for non-Hispanic Black mothers.[14]

[61] Tennant, P. W., Glinianaia, S. V., Bilous, R. W., Rankin, J., & Bell, R. (2014). Pre-existing diabetes, maternal glycated haemoglobin, and the risks of fetal and infant death: a population-based study. *Diabetologia*, 57(2), 285-294.
[62] von Dadelszen, P., & Magee, L. A. (2016). Preventing deaths due to the hypertensive disorders of pregnancy. Best practice & research. Clinical obstetrics & gynecology, 36, 83–102. Retrieved from **doi.org/10.1016/j.bpobgyn.2016.05.005** [Accessed March 28, 2022].
[63]United States Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, Division of Vital Statistics. Linked Birth / Infant Death Records 2017, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program, on CDC WONDER On-line Database. Retrieved from **wonder.cdc.gov/lbd-current-expanded.html** [Accessed March 28, 2022].

Maternal Mortality

In 2020, the Department of State Health Services (DSHS) researchers and the Texas Mortality and Morbidity Review Committee (MMMRC) released a joint biennial report summarizing findings from the MMMRC case reviews (a partial review of the 2013 case cohort) and statewide rates, ratios, and trends related to maternal mortality, including maternal deaths. This section of the Healthy Texas Mothers and Babies Data Book references findings and discussions from that report.[14]

Accurate identification of maternal deaths is essential to computing the maternal mortality ratio, which is a key performance indicator to improve maternal health and safety before, during, and after delivery.

Maternal death is a vital registration term used for the death of a woman while pregnant or within 42 days after pregnancy irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes as indicated by International Classification of Diseases (ICD) coding.[14] The standard method for identifying maternal deaths relies on an obstetric cause-of-death code on the official death certificate, but because of errors associated with the death certificate, DSHS researchers developed the three-step enhanced method for the identification of maternal deaths in 2012.[64] Beginning with the 2013 death cohort, DSHS further refined this method by creating a four-step method. This method includes a review of medical records for all non-obstetric coded deaths with a pregnancy status indicating pregnancy at the time of death or within 42 days. DSHS then calculated an enhanced maternal mortality ratio for identified maternal deaths that occurred during pregnancy or within 42 days postpartum, as indicated on the death certificate, per 100,000 live births for a given year.[14]

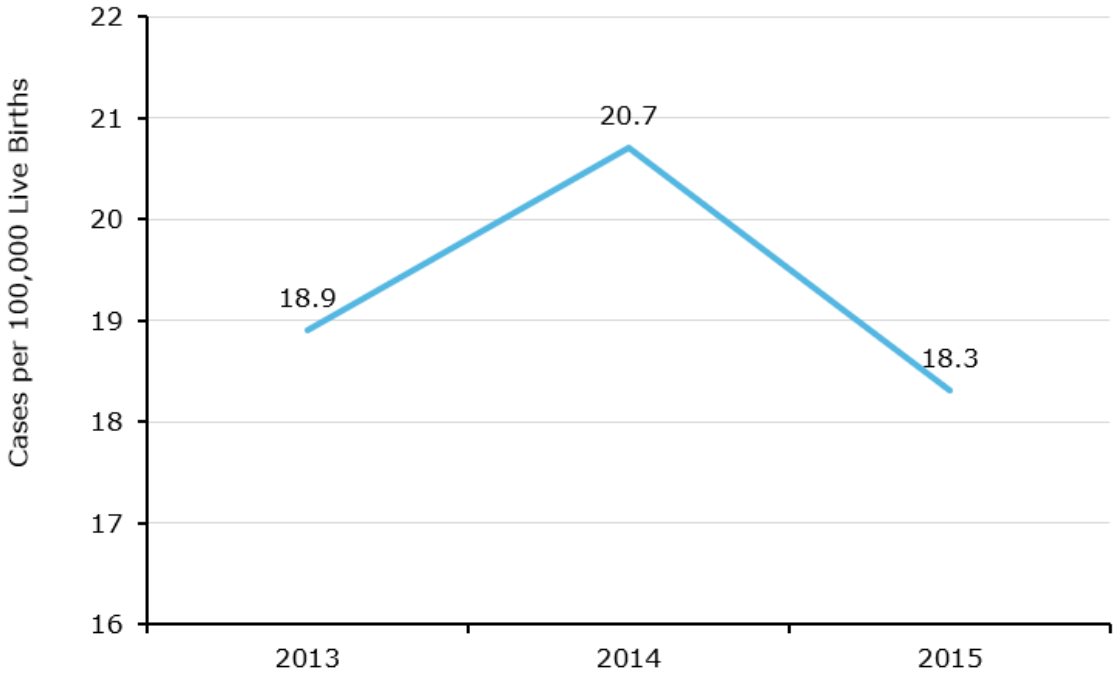
The enhanced maternal mortality ratios for Texas for 2013 through 2015 were as follows (**Figure 47**):

- 18.9 maternal deaths per 100,000 live births for 2013
- 20.7 maternal deaths per 100,000 live births for 2014
- 18.3 maternal deaths per 100,000 live births for 2015

The enhanced method is different from the method used by others to calculate maternal mortality numbers and ratios and cannot be compared with other maternal mortality ratios or rates. DSHS researchers will continue to apply this methodology for additional years so that trends can continue to be assessed.[14]

[64] Baeva, S., Saxton, D. L., Ruggiero, K., Kormondy, M. L., Hollier, L. M., Hellerstedt, J., ... & Archer, N. P. (2018). Identifying maternal deaths in Texas using an enhanced method, 2012. *Obstetrics & Gynecology*, *131*(5), 762-769

Figure 47: Enhanced Maternal Mortality Ratios for Texas, 2013-2015



Source: Texas Maternal Mortality and Morbidity Review Committee and Department of State Health Services Joint Biennial Report, 2020, revised February 2022.
Prepared By: Maternal & Child Health Epidemiology Unit
Feb 2022

A primary responsibility of the MMMRC is to review cases of pregnancy-associated death to determine pregnancy-relatedness. A pregnancy-associated death is the death of a woman while pregnant or within one year of the end of pregnancy, regardless of the cause. Pregnancy-associated deaths are classified as pregnancy-related, pregnancy-associated but not pregnancy-related, or as pregnancy-associated but unable to determine pregnancy-relatedness.

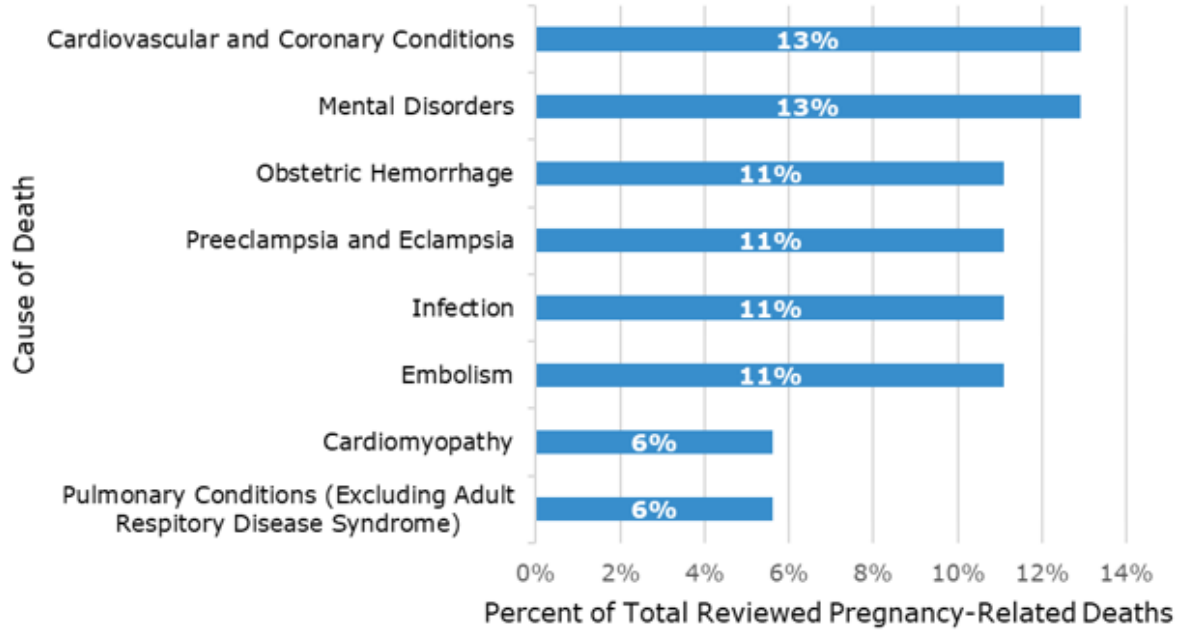
Per the 2020 Texas MMMRC and DSHS Joint Biennial Report, from June 2018 through June 2020, the MMMRC completed the review of 137 of the 175 pregnancy-associated deaths in the 2013 case cohort. The MMMRC determined that 54 of these cases (39 percent) were pregnancy-related, and 59 cases (43 percent) were pregnancy-associated but not related. The MMMRC was unable to determine pregnancy-relatedness for 24 (18 percent) of the reviewed cases. The percentage of deaths identified among reviewed cases as pregnancy-related is consistent with findings from other states.[65]

[65] CDC Foundation, CDC, AMCHP (2018). Report from Nine Maternal Mortality Review Committees: Building U.S. Capacity to Review and Prevent Maternal Deaths, p.14-15. Retrieved from **reviewtoaction.org/national-resource/report-nine-mmrcs** [Accessed March 28, 2022].

Although 11 percent of live births were to non-Hispanic Black women in 2013, this population comprised 31 percent of pregnancy-related deaths. In comparison, non-Hispanic White women had 34 percent of the live births and 41 percent of the deaths, Hispanic women had 48 percent of the live births and 26 percent of the pregnancy-related deaths, and women of 'Other' races and ethnicities had six percent of the live births and two percent of the pregnancy-related deaths.

From their initial review of the 2013 case cohort, the MMMRC found that eight underlying causes of death accounted for 82 percent of all pregnancy-related deaths. Cardiovascular/coronary conditions and mental disorders (with or without substance use) were tied for the most frequently observed leading causes of maternal mortality. Obstetric hemorrhage, preeclampsia or eclampsia, infection, and embolism were tied for second (**Figure 48**). These underlying causes of death accounted for 70 percent of the 54 pregnancy-related deaths reviewed from the 2013 case cohort. Cardiomyopathy and pulmonary conditions tied for third, collectively accounting for 12 percent of pregnancy-related deaths.

Figure 48: Leading Underlying Causes of Reviewed Pregnancy-Related Deaths in Texas, 2013 (Partial Review of Cohort)



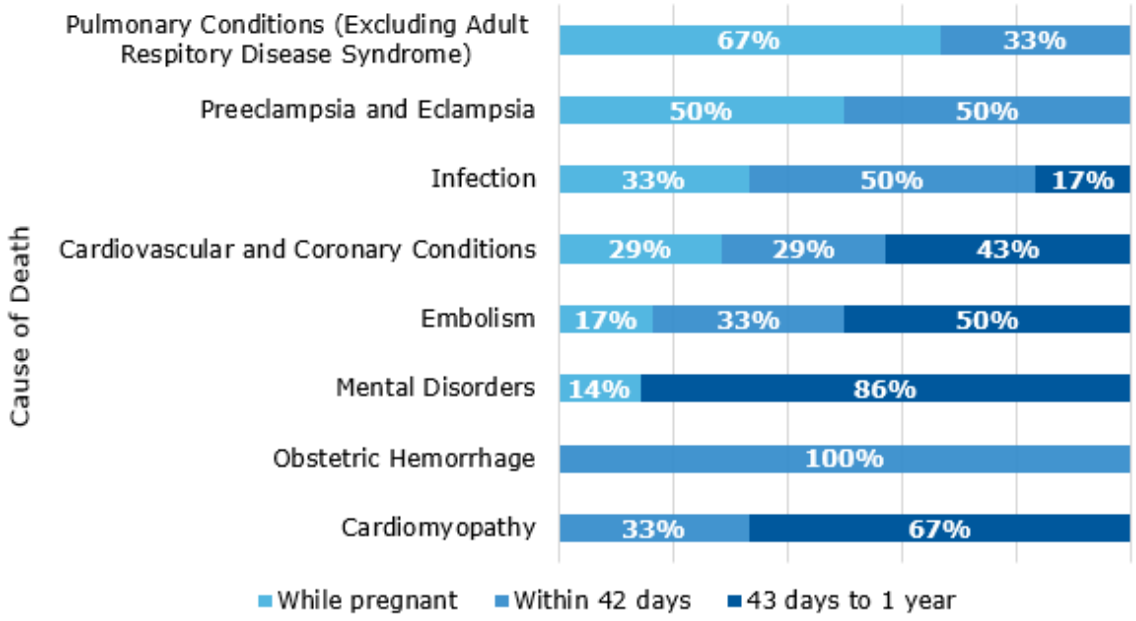
N= 44
Source: Texas Maternal Mortality and Morbidity Review Committee and Department of State Health Services Joint Biennial Report, 2020, revised February 2022
Prepared by: Maternal & Child Health Epidemiology Unit
May 2021

The MMMRC identified that the following factors also contributed to many pregnancy-related deaths:

- Obesity contributed to 35 percent of reviewed pregnancy-related deaths.
- Mental disorders, other than substance use disorder (SUD), contributed to 16 percent of reviewed pregnancy-related deaths.
- SUD, including SUD associated with mental disorders, contributed to 7 percent of reviewed pregnancy-related deaths.

Timing of death in relation to pregnancy varied across leading underlying causes of reviewed pregnancy-related deaths. Among the 54 pregnancy-related deaths reviewed from the 2013 case cohort, 29 percent occurred during pregnancy, 40 percent occurred within 42 days of the end of pregnancy, and 31 percent occurred 43 days to one year from the end of pregnancy. **Figure 49** shows how the timing of death was distributed across the leading underlying causes of pregnancy-related death.

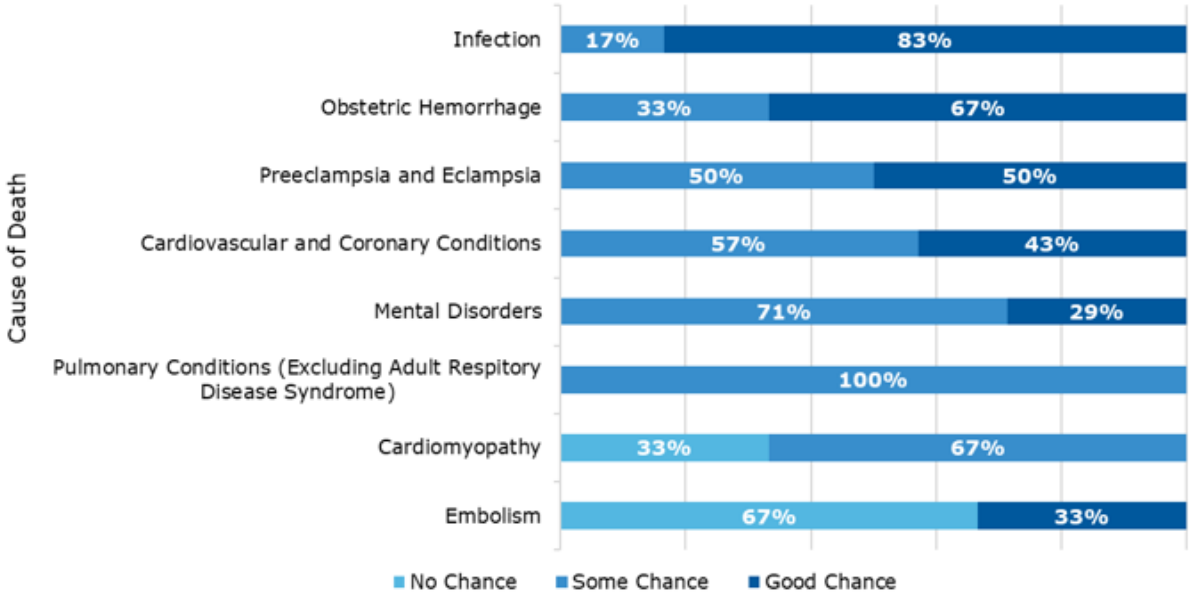
Figure 49: Top Underlying Causes of Reviewed Pregnancy-Related Deaths by Timing of Death in Relation to Pregnancy, Texas, 2013 (Partial Review of Cohort)



n = 44
Source: Texas Maternal Mortality and Morbidity Review Committee and Department of State Health Services Joint Biennial Report, 2020, revised February 2022
Prepared by: Maternal & Child Health Epidemiology
May 2021

The MMMRC determined that most reviewed pregnancy-related deaths were preventable. A death is considered preventable if the case review finds that there was at least some chance of the death being averted by one or more reasonable changes to the circumstances of the patient, provider, facility, systems, or community factors. The MMMRC determined that there was at least some chance for preventability in 89 percent of pregnancy-related deaths reviewed from the initial 2013 case cohort. Among the leading underlying causes of death, cases of pregnancy-related death with the highest chance of preventability were caused by infection, hemorrhage, preeclampsia or eclampsia, and cardiovascular/coronary conditions (**Figure 50**).

Figure 50: Degree of Preventability for Top Underlying Causes of Reviewed Pregnancy-Related Deaths by Rating of Chance to Alter Outcome, Texas, 2013 (Partial Review of Cohort)



n = 44
Source: Texas Maternal Mortality and Morbidity Review Committee and Department of State Health Services Joint Biennial Report, 2020, revised February 2022.
Prepared by: Maternal & Child Health Epidemiology
May 2021

Factors that contribute to a pregnancy-related death may impact a woman over her life course. The MMMRC identified 367 unique factors that contributed to the 54 pregnancy-related cases reviewed from the 2013 cohort, an average of 6.8 contributing factors per case. Contributing factors are categorized within domains that indicate the levels at which actions should be targeted for prevention. Identified contributing factors of pregnancy-related death were distributed among the patient and family (34 percent of cases), provider (24 percent of cases), facility (17 percent of cases), systems of care (18 percent of cases), and community (7 percent of cases) domains.

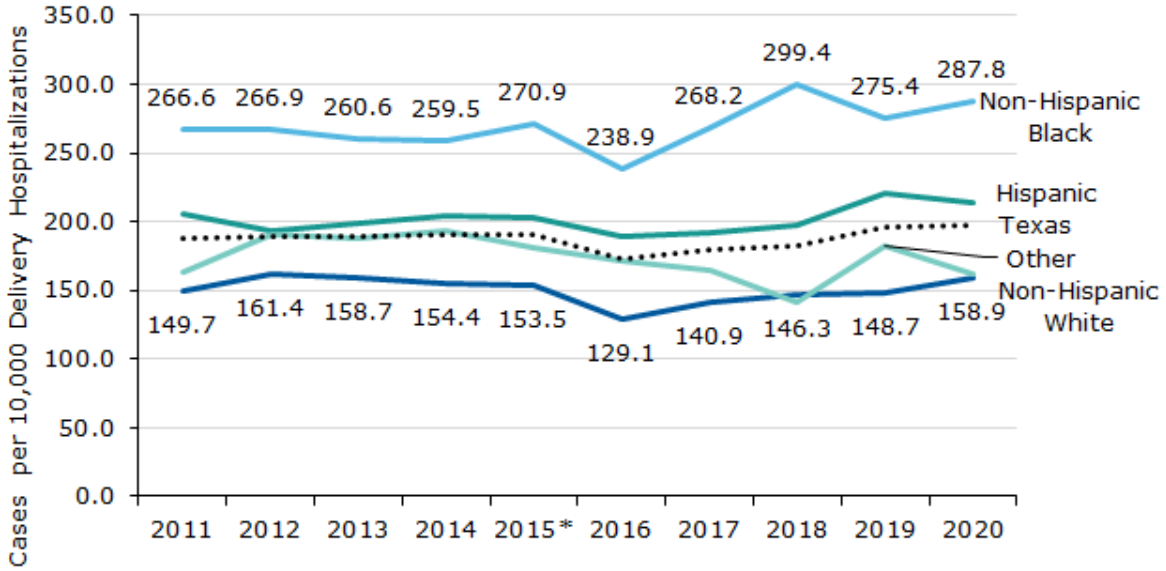
The MMMRC completed their review of the 2013 cohort in June 2021. An updated analysis of the 2013 cohort will be included in the 2022 Texas MMMRC and DSHS Joint Biennial Report that will be published by September 2022.

Severe Maternal Morbidity

Severe maternal morbidity (SMM) is intrinsically related to maternal mortality because it involves conditions that, if left untreated, could result in maternal death.[66] The CDC defines SMM as unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman's health. Rates of delivery hospitalizations involving any SMM are estimated using specific information on hospital discharge records related to 21 conditions and procedures that can indicate incidence of severe morbidity[15]. While the CDC criteria used in this publication for measuring SMM may be a reasonable metric at the population-level, there are limitations which underscore the importance of facility-based SMM review.[14] Additionally, there are multiple methods for measuring SMM rates, so comparisons with other data sources should be made with caution.

Though SMM rates in the United States have been rising in the past decade, according to data from Texas Hospital Inpatient Discharge Public Use Data Files (PUDF), the rate of delivery hospitalizations involving any SMM in Texas remained stable from 2011 to 2020 (**Figure 51**).[15] Mirroring the trends observed for maternal deaths, there are substantial disparities in the rates of mothers with serious pregnancy complications (Figure 51). Over the past decade, non-Hispanic Black mothers had higher rates of SMM than mothers of any other race/ethnic group, as reflected in the maternal mortality rates for these groups.

Figure 51: Rate of Severe Maternal Morbidity in Texas by Race and Ethnicity, 2011-2020



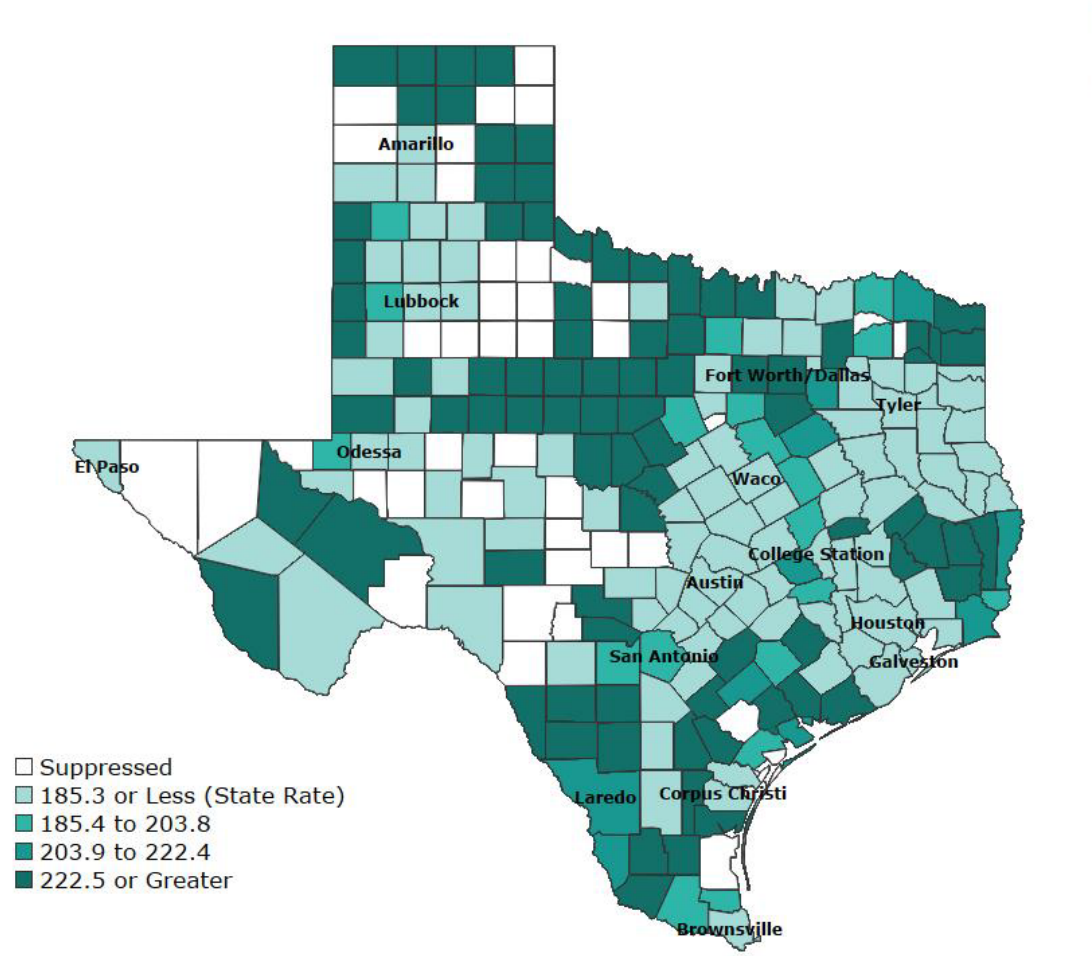
*Data transitioned to ICD-10-CM in the last quarter of 2015.
Source: 2011-2020 Texas Hospital Inpatient Public Use Data Files
CDC SMM codes list as of March 2019 was used to identify SMM
Prepared by: Maternal & Child Health Epidemiology Unit
Nov 2021

[66]Kilpatrick, S. K., Ecker, J. L., & American College of Obstetricians and Gynecologists. (2016). Severe maternal morbidity: screening and review. *American journal of obstetrics and gynecology*, *215*(3), B17-B22.

Several indicators, identified using ICD-10 codes, are used to classify a delivery as potentially involving SMM, including receipt of blood transfusions, which is usually related to a response for excessive bleeding around the time of delivery.[16] Blood transfusion, with or without other indicators of SMM, was the most common SMM indicator during 2020. Other common SMM indicators included adult respiratory distress syndrome, disseminated intravascular coagulation, sepsis, acute renal failure, and eclampsia.

When looking at combined 2016-2020 SMM data, there were clear geographic differences in the rate of SMM. Considering the suppression of counties with fewer than five SMM cases, SMM rates varied from 60.5 per 10,000 delivery hospitalizations in Burnet County to the highest rate of 760.2 in Hardeman County. Many metropolitan counties had lower rates of SMM when compared to non-metropolitan areas (**Figure 52**).

Figure 52: Rate of Severe Maternal Morbidity per 10,000 Delivery Hospitalizations by County of Residence, 2016-2020



Data transitioned to ICD-10CM in the last quarter of 2015
Source: 2016-2020 Texas Hospital Inpatient Public Use Data Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Neonatal Abstinence Syndrome

Opiate use during pregnancy is associated with an increase in infants born with neonatal abstinence syndrome (NAS), a group of conditions that cause neonatal withdrawal such as body shakes, seizures, fever, and low birth weight.[67] Newborns with NAS are more likely than other infants to have low birth weight, respiratory and feeding problems, and other complications.[68] Mothers who use drugs such as opioids during pregnancy are more likely to have complications, like prolonged hospital stays and death before hospital discharge.[69] Since drug overdose is a frequent cause of pregnancy-associated death, it is important to monitor the rate of maternal drug use during pregnancy. Because not all newborns whose mothers use drugs will develop NAS, the true incidence of drug use during pregnancy can be expected to be higher than the observed rate of NAS.[68]

Texas Hospital Inpatient Discharge PUDF data indicate that the rate of infants born each year experiencing NAS increased from 1.6 per 1,000 hospital births to 2.2 between 2010 and 2019, though in recent years it has remained relatively stable, and there was even a small decline in 2019 (**Figure 53**). This was less than the increase observed in the rest of the U.S. where NAS rates increased from 4.0 to 7.3 from 2010 to 2017. Texas had lower rates of NAS than the national average over the past decade.[70]

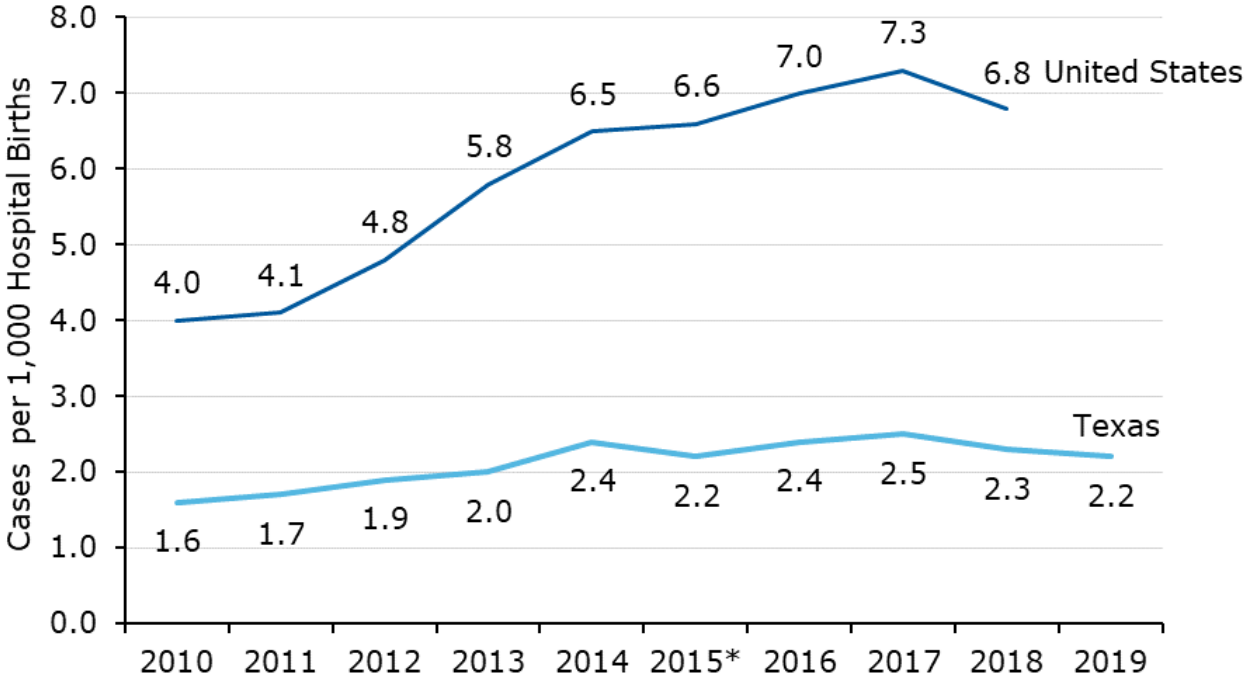
[67] March of Dimes (2019) Neonatal Abstinence Syndrome (NAS). Retrieved from **marchofdimes.org/complications/neonatal-abstinence-syndrome-(nas).aspx#** [Accessed March 28, 2022].

[68] National Institute on Drug Abuse. Dramatic Increases in Maternal Opioid Use and Neonatal Abstinence Syndrome. Retrieved from **drugabuse.gov/related-topics/trends-statistics/infographics/dramatic-increases-in-maternal-opioid-use-neonatal-abstinence-syndrome** [Accessed March 28, 2022].

[69] Whiteman, V. E., Salemi, J. L., Mogos, M. F., Cain, M. A., Aliyu, M. H., & Salihu, H. M. (2014). Maternal opioid drug use during pregnancy and its impact on perinatal morbidity, mortality, and the costs of medical care in the United States. *Journal of pregnancy*, *2014*.

[70] United States Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, Division of State and Community Health (2019, April 1). Federally Available Data (FAD) Resource Document. Retrieved from **mchb.tvisdata.hrsa.gov/Home/Resources** [Accessed March 28, 2022].

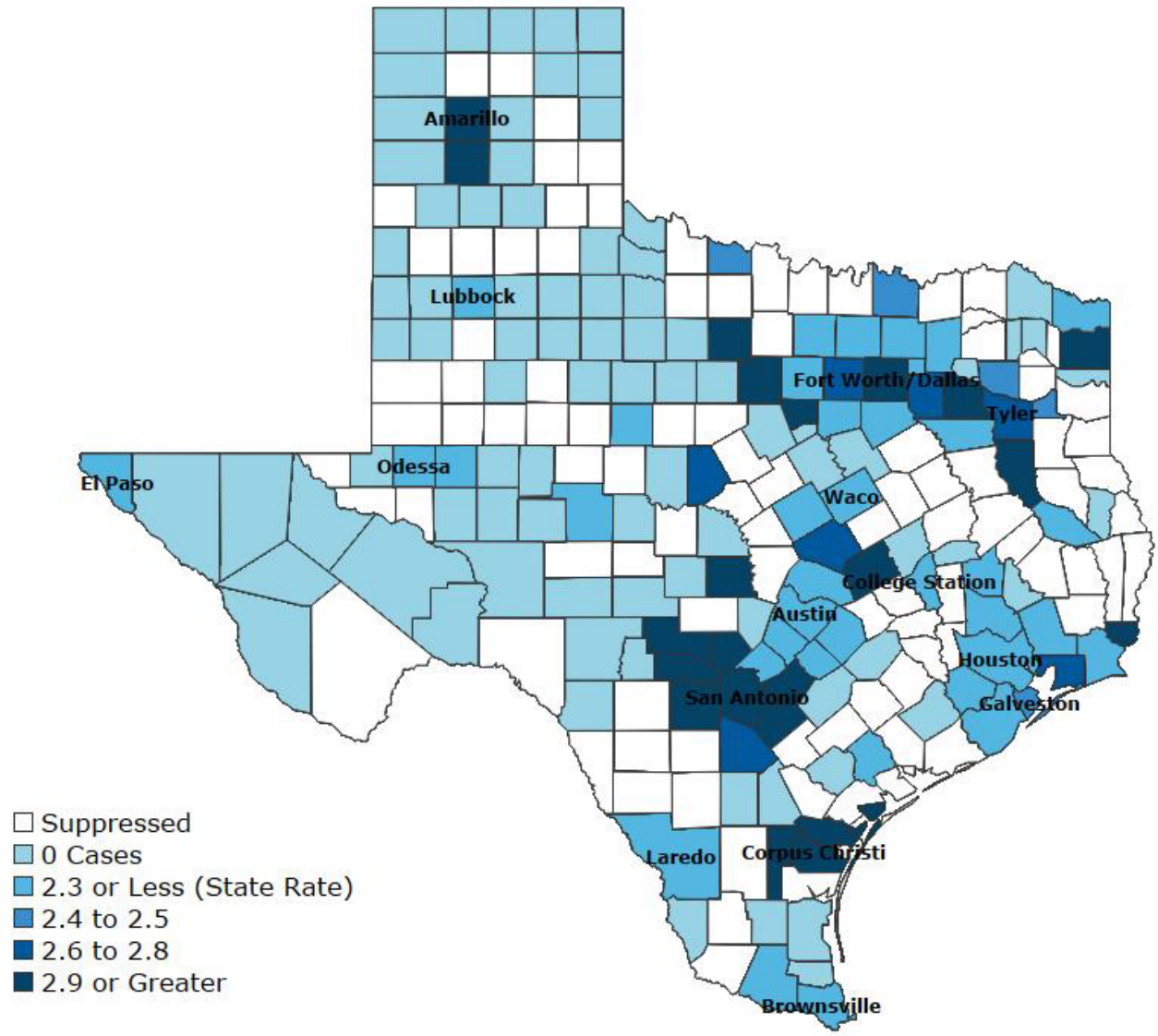
Figure 53: Rate of Neonatal Abstinence Syndrome in Texas and the U.S., 2010-2019



*Data transitioned to ICD-10-CM in the last quarter of 2015
Source: 2010-2019 Health Care Utlization Project
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Based on combined data from 2016 to 2020, the county with the highest NAS rate in the state was Bexar County (7.9 per 1,000 hospital births). Bexar County accounted for more than 24 percent of Texas's total NAS cases during 2016 to 2020 (**Figure 54**).

Figure 54: Neonatal Abstinence Syndrome Rate per 1,000 Hospital Births by County of Residence, 2016-2020



Data transitioned to ICD-10CM in the last quarter of 2015
Source: 2016-2020 Texas Hospital Inpatient Public Use Data Files
Prepared by: Maternal & Child Health Epidemiology Unit
Oct 2021

Conclusion

The Department of State Health Services (DSHS) Healthy Texas Mothers and Babies Data Book provides an overview of a variety of infant health indicators, as well as several indicators of maternal health during pregnancy. Over the past decade, Texas has seen a reduction in the teen birth rate and the percentage of women who smoke during pregnancy. However, during this same time period, the state has experienced an increase in pre-pregnancy obesity, maternal diabetes, and maternal hypertension.

After remaining relatively stable for several years, the Texas birth rate provisionally decreased in 2020 for the fifth year in a row. Also, in 2020, the percent of preterm births in Texas provisionally decreased after increasing for the four previous consecutive years.

Substantial disparities persist for infant and maternal health indicators, including rates of infant mortality, preterm birth, safe sleep practices, breastfeeding practices, and severe maternal morbidity. Non-Hispanic Black mothers and infants have significantly higher rates of each of these adverse health outcomes than do other racial or ethnic groups. Hispanic women experience higher rates of teen births and report accessing postpartum care less than non-Hispanic White women.

Infant health practices and maternal health indicators also differ by race and ethnicity in Texas. A lower percentage of non-Hispanic Black women initiate and continue breastfeeding and report safe infant sleep practices, and a higher percentage experience pre-pregnancy obesity and maternal hypertension. In addition, geographic and regional differences were observed throughout Texas, especially for maternal age, teen birth rates, infant mortality rates, prevalence of smoking during pregnancy, severe maternal morbidity, and neonatal abstinence syndrome rates.

Compared with other states, Texas has one of the lowest rates of maternal smoking during pregnancy. Texas also observed a decline in neonatal abstinence syndrome from 2018 to 2019 while national rates continued to rise. Conversely, Texas's teen birth rate and preterm birth rate continued to be higher than national rates, and the percent of mothers receiving early prenatal care in Texas was the lowest in the nation in 2020.

The information presented in this report can help public health workers, researchers, and policymakers identify trends and disparities in infant and maternal health outcomes in Texas so that they are better able to make data-driven decisions on where best to allocate resources and efforts to improve these outcomes.

List of Acronyms

Acronym	Full Name
ARR	Adjusted Risk Ratio
BMI	Body Mass Index
CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
DSHS	Texas Department of State Health Services
F-IMR	Feto-Infant Mortality Rate
HHS	U.S. Department of Health and Human Services
HP2030	Healthy People 2030
ICD	International Classification of Diseases
IFPS	WIC Infant Feeding Practices Survey
IH	Infant Health (Prenatal Period of Risk)
IMR	Infant Mortality Rate
MC	Maternal Care (Prenatal Period of Risk)
MCH	Maternal and Child Health
MHP	Maternal Health/Prematurity (Prenatal Period of Risk)
MMMRC	Maternal Mortality and Morbidity Review Committee
NAS	Neonatal Abstinence Syndrome
NC	Neonatal Care (Prenatal Period of Risk)
NCHS	National Center for Health Statistics
NIS	National Immunization Survey

Acronym	Full Name
NMI	Non-medically indicated
PAR	Population Attributable Risk
PHR	Public Health Region
PPD	Pregnancy and Postpartum Depression
PPOR	Perinatal Periods of Risk
PRAMS	Pregnancy Risk Assessment Monitoring System
PUDF	Public Use Data File
SDOH	Social Determinants of Health
SIDS	Sudden Infant Death Syndrome
SMM	Severe Maternal Morbidity
SUD	Substance Use Disorder
THCIC	Texas Health Care Information Collection
VLBW	Very Low Birth Weight
VBAC	Vaginal Birth After Cesarean
WIC	Women, Infants and Children
WONDER	Wide-ranging Online Data for Epidemiologic Research (A CDC Database)

Appendix A: Information on Maternal and Infant Health in Texas

Diabetes Prevention and Control Reports and Data:

dshs.texas.gov/txdiabetes/data.shtm

hhs.texas.gov/sites/default/files/documents/laws-regulations/reports-presentations/2018/sb1-rider25-texas-medicaid-diabetes-council-coord-report-aug-2018.pdf

dshs.texas.gov/legislative/2014/TexasDiabetesCouncil-Statewide-Assessment-Report-120514.pdf

The above links contain data sources and reports released since 2014, focusing on the prevalence, prevention, and treatment of diabetes in Texas, including reports focusing on gestational diabetes. This includes a report titled *Gestational Diabetes in Medicaid: Prevalence, Outcomes, and Costs* from 2014 that showed the rate of diabetes among pregnant women enrolled in Medicaid was underestimated on the birth certificate and provided a clearer estimate of the impact of gestational diabetes on this population. Links also navigate to reports on Texas Medicaid recipients and diabetes, including information on screening for gestational diabetes for pregnant women enrolled in Medicaid and the latest available assessment of existing programs for diabetes prevention and treatment across Texas.

Center for Health Statistics: Direct links to health-related data:

dshs.texas.gov/chs/links-to-health-related-data.shtm

The above Department of State Health Services (DSHS) webpage contains vital statistics tables and reports providing basic health-related data at the state and county level.

Texas DSHS Legislative Reports:

dshs.texas.gov/Legislative/Reports.aspx

DSHS legislatively-mandated reports are available on the above DSHS webpage. This includes the *Maternal Mortality and Morbidity Review Committee and Department of State Health Services Joint Biennial Report, 2020, revised February 2022* and *Maternal Health and Safety Activities Report*. DSHS posts reports upon completion.

Texas Health and Human Services (HHS) Laws and Regulations Reports and Presentations

hhs.texas.gov/regulations/reports-presentations

The above HHS webpage contains reports and presentations provided to the Texas Legislature and other governing bodies on how it is spending taxpayer funds.

Texas Health Data:

healthdata.dshs.texas.gov/Home

This online query tool from DSHS allows the visitor to create tables of basic birth statistics at the state or county level. The tool can be used to compare race/ethnicities, education level, marital status, and a variety of other demographics across major birth outcome indicators.

Maternal & Child Health Epidemiology:

dshs.texas.gov/mch/epi/MCH-Epidemiology.aspx

The above DSHS webpage contains the Pregnancy Risk Assessment Monitoring System (PRAMS) annual reports as well as links to other information and presentations about maternal and child health and related community-based initiatives.

March of Dimes Peristats:

marchofdimes.org/peristats/Peristats.aspx

This online query tool from the March of Dimes covers a variety of infant health indicators that can be compared across different states in the country or across years for single regions/states.

Appendix B: Tables for Select Figures

Table B-1: Teen (15-19 Years of Age) Birth Rate per 1,000 Females by Race and Ethnicity, 2010-2019 (Figure 5)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	26.9	48.9	64.7	8.5	**45.9**
2012	24.4	43.0	59.9	14.9	**42.3**
2013	23.9	39.9	54.3	15.0	**39.7**
2014	21.8	36.9	49.4	13.4	**36.3**
2015	20.5	33.1	44.3	12.0	**33.0**
2016	17.6	29.5	39.4	10.9	**29.3**
2017	15.7	27.4	37.6	9.9	**27.1**
2018[ii]	13.8	26.3	34.7	9.3	**25.0**
2019[iii]	13.4	24.8	32.8	8.7	**23.7**
2020[iv]	12.3	23.4	30.2	7.3	**21.9**

[i] Rate per 1,000 population. Source: 2010-2019 Texas Birth Files
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Table B-2: Infant Mortality Rate in Texas by Race and Ethnicity, 2011-2019 (Figure 8)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	4.8	11.0	5.2	3.7	**5.7**
2012	5.3	11.6	5.2	3.4	**5.8**
2013	5.0	11.9	5.2	4.0	**5.8**
2014	4.9	11.1	5.4	4.2	**5.8**
2015	4.9	10.9	5.2	3.4	**5.6**
2016	5.0	11.1	5.2	3.9	**5.7**
2017	4.8	11.0	5.4	3.9	**5.8**
2018[ii]	4.6	10.8	4.9	3.8	**5.5**
2019[iii]	4.6	10.7	5.1	3.6	**5.5**

[i] Rate per 1,000 live births. Source: 2010-2018 Texas Birth and Death Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.

Table B-3: Percent of Births that are Low Birth Weight (less than 2,500 grams) in Texas by Race and Ethnicity, 2011-2020 (Figure 17)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	7.6	13.6	7.8	9.5	**8.5**
2012	7.3	13.9	7.5	9.1	**8.3**
2013	7.3	13.2	7.7	9.7	**8.3**
2014	7.2	13.4	7.5	9.1	**8.2**
2015	7.1	13.3	7.7	9.1	**8.3**
2016	7.2	13.5	7.9	9.0	**8.4**
2017	7.1	13.9	7.9	8.9	**8.4**
2018[ii]	7.0	14.1	7.9	9.0	**8.5**
2019[iii]	7.0	14.2	7.9	8.9	**8.4**
2020[iv]	6.8	13.6	7.7	9.0	**8.3**

[i] Source: 2010-2019 Texas Birth Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Table B-4: Percent of Live Births Where Mother Received Prenatal Care in the First Trimester by Race and Ethnicity, 2011-2020 (Figure 32)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	75.0	57.0	61.6	69.8	**66.3**
2012	75.2	55.6	61.6	68.7	**66.2**
2013	75.0	56.1	61.5	67.9	**66.1**
2014	74.2	56.0	60.2	67.2	**65.2**
2015	75.2	56.6	61.1	67.0	**65.9**
2016	74.6	54.9	60.7	66.2	**65.1**
2017	75.7	56.3	62.5	65.9	**66.4**
2018[ii]	76.2	7.7	64.0	67.5	**67.5**
2019[iii]	76.4	57.3	62.7	69.8	**67.1**
2020[iv]	76.8	8.2	63.2	71.5	**67.7**

[i] Computed using the obstetric estimate of gestation. Source: 2010-2019 Texas Birth Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Table B-5: Percent of Live Births Where Mother Smoked Cigarettes During Pregnancy by Race and Ethnicity, 2011-2020 (Figure 38)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	9.8	4.7	1.2	1.5	**4.6**
2012	9.2	4.7	1.2	2.1	**4.4**
2013	9.1	4.4	1.2	2.0	**4.3**
2014	8.1	4.1	1.1	1.9	**3.9**
2015	7.6	3.6	1.0	1.6	**3.6**
2016	6.9	3.4	1.0	1.3	**3.3**
2017	6.3	3.1	0.9	1.3	**3.0**
2018[ii]	5.9	2.7	0.9	1.3	**2.7**
2019[iii]	5.2	2.4	0.8	1.0	**2.4**
2020[iv]	4.5	2.3	0.7	1.0	**2.1**

[i] Source: 2010-2019 Texas Birth Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Table B-6: Maternal Hypertension by Race and Ethnicity, (Figure 45)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	7.0	9.0	5.4	4.3	**6.3**
2012	6.9	8.9	5.6	4.4	**6.4**
2013	7.0	8.9	5.7	4.6	**6.4**
2014	7.7	9.3	6.1	4.8	**6.9**
2015	8.4	10.0	6.3	5.1	**7.3**
2016	8.3	9.9	6.6	5.4	**7.5**
2017	8.6	10.6	7.5	5.5	**8.1**
2018[ii]	9.3	11.7	8.1	6.4	**8.8**
2019[iii]	9.7	11.4	8.2	5.5	**8.9**
2020[iv]	10.4	12.3	8.5	6.4	**9.4**

[i] Source: 2009-2018 Texas Birth Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Table B-7: Maternal Diabetes by Race and Ethnicity, (Figure 46)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	3.7	4.2	5.7	7.7	**4.9**
2012	3.9	4.2	5.8	7.3	**5.0**
2013	3.8	4.0	5.7	7.2	**4.9**
2014	4.3	4.6	6.3	8.2	**5.5**
2015	4.4	4.6	6.1	8.2	**5.5**
2016	4.4	4.5	6.5	8.8	**5.7**
2017	4.7	4.7	7.0	8.5	**6.1**
2018[ii]	4.8	4.7	7.1	8.1	**6.2**
2019[iii]	5.0	4.7	7.3	9.2	**6.4**
2020[iv]	6.0	5.5	8.3	10.5	**7.4**

[i] Source: 2010-2019 Texas Birth Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Table B-8: Rate of Severe Maternal Morbidity in Texas by Race and Ethnicity, 2011-2020 (Figure 51)[i]

Year	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Texas
2011	149.7	266.6	205.7	163.7	**188.4**
2012	161.4	266.9	193.7	191.0	**189.4**
2013	158.7	260.6	199.4	187.4	**189.8**
2014	154.4	259.5	203.6	193.4	**190.9**
2015	153.5	270.9	202.5	180.4	**190.8**
2016	129.1	238.9	189.7	171.4	**172.4**
2017	140.9	268.2	191.9	165.1	**179.7**
2018[ii]	146.3	299.4	197.4	141.2	**182.3**
2019[iii]	148.7	275.4	220.4	183.0	**196.6**
2020[iv]	158.9	287.8	213.4	161.4	**196.8**

[i] Source: 2010-2019 Texas Birth Files.
[ii] 2018 data are provisional and subject to change.
[iii] 2019 data are provisional and subject to change.
[iv] 2020 data are provisional and subject to change.

Maternal and Child Health Epidemiology

dshs.texas.gov/mch/epi