

**Maternal Mortality
and Morbidity Task
Force and Department
of State Health Services
Joint Biennial Report**

**As Required by
Chapter 34, Texas Health and
Safety Code, Section 34.015**

**Maternal Mortality and
Morbidity Task Force**

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Executive Summary

The Maternal Mortality and Morbidity Task Force (Task Force) and Department of State Health Services (DSHS) jointly submit the 2018 Biennial Report as required by [Chapter 34, Texas Health and Safety Code, Section 34.015](#). The Biennial Report contains Task Force and DSHS findings, and Task Force recommendations, developed in consultation with the Perinatal Advisory Council, to help reduce the incidence of pregnancy-related deaths and severe maternal morbidity in Texas.

Findings from Task Force case review, statewide trends for maternal death, maternal death trends for the most at-risk populations, and statewide trends for severe maternal morbidity show that opportunities exist to address causes and contributors to maternal death and morbidity in Texas. In addition, the Task Force and DSHS recognized potential areas for operational improvements to the maternal death case review processes.

Summary of Recommendations:

1. Increase access to health services during the year after pregnancy and throughout the interconception period to improve the health of women, facilitate continuity of care, enable effective care transitions, and promote safe birth spacing.
2. Enhance screening and appropriate referral for maternal risk conditions.
3. Prioritize care coordination and management for pregnant and postpartum women.
4. Promote a culture of safety and high reliability through implementation of best practices in birthing facilities.
5. Identify or develop and implement programs to reduce maternal mortality from cardiovascular and coronary conditions, cardiomyopathy and infection.
6. Improve postpartum care management and discharge education for patients and families.
7. Increase maternal health programming to target high-risk populations, especially Black women.
8. Initiate public awareness campaigns to promote health enhancing behaviors.
9. Champion integrated care models combining physical and behavioral health services for women and families.
10. Support strategies to improve the maternal death review process.

1. Introduction

Not later than September 1 of each even-numbered year, the Task Force and the DSHS shall submit a joint report on the findings and recommendations of the Task Force under Health and Safety Code, [Chapter 34](#), to the governor, lieutenant governor, speaker of the house of representatives, and appropriate committees of the legislature.

The Duties of the Task Force, reflected in the findings and recommendations section, were expanded by Senate Bill (SB) 17, 85th Texas Legislature, First Called Session, 2017. SB 17 added additional requirements for the Task Force to:

- study and review:
 - ▶ trends, rates or disparities in pregnancy-related deaths
 - ▶ health conditions and factors that disproportionately affect the most at-risk populations; and
 - ▶ best practices and programs operating in other states that have reduced rates of pregnancy-related deaths;
- compare rates of pregnancy-related deaths based on socioeconomic status of the mother; and
- consult with the Perinatal Advisory Council when making recommendations to help reduce the incidence of pregnancy related deaths and severe morbidity in this state.

2. Background

Senate Bill (SB) 495, 83rd Texas Legislature, Regular Session, 2013, established the Maternal Mortality and Morbidity Task Force (Task Force), and directed the Department of State Health Services (DSHS) to provide administrative support. After the infrastructure was created, the Task Force began to review cases of maternal deaths in May 2015. See [Appendix A, Table A1](#) for the full list of current Task Force members appointed by the DSHS Commissioner.

The Task Force meets quarterly, with a portion of each meeting open to the public in adherence to Government Code, Chapter 551. Additionally, under Texas Health and Safety Code, Chapter 34, the Task Force conducts closed meetings to review individual cases of maternal death to maintain case confidentiality.

Maternal death refers to cases identified by DSHS where administrative data indicates that a woman died within one year following the end of her pregnancy. The Task Force determines whether a maternal death was related to pregnancy using guidelines established by the United States' Centers for Disease Control and Prevention (CDC).

Since 2012 had the highest number of maternal deaths to date, it was determined that the Task Force would review all cases of maternal death for this calendar year. DSHS initially identified 89 cases of maternal death for the year 2012, all of which have now been reviewed by the Task Force.

Through medical record review, an enhanced method¹ identified 29 additional maternal deaths that were not identified through administrative data linkage alone, for a total of 118 confirmed maternal deaths during pregnancy or within 365 days following the end of pregnancy in the year 2012.

¹ Baeva S, Saxton DL, Ruggiero K, Kormondy ML, Hollier LM, Hellerstedt J, Hall M, Archer NP. Identifying Maternal Deaths in Texas Using an Enhanced Method, 2012. *Obstet Gynecol* 2018; 131:762-769.

3. Findings

The following section highlights findings from the Maternal Mortality and Morbidity Task Force (Task Force) maternal death case review, Department of State Health Services (DSHS) statewide maternal death trend analysis, and DSHS statewide data trends for maternal deaths for the most at-risk populations. These findings inform Task Force recommendations.

I. Findings from Task Force Maternal Death Case Review

A primary responsibility of the Task Force is to study and review cases of pregnancy-related deaths. In March 2018 the Task Force completed the review of 89 cases from the 2012 case cohort of maternal deaths. Each maternal death went through a multi-disciplinary review to determine the causes and contributing factors to death, pregnancy-relatedness, and preventability.

Finding #1 — Nearly 40 percent of maternal death cases reviewed were identified as pregnancy-related.

Of the 89 cases identified by DSHS and reviewed by the Task Force;

- 34 cases (38 percent) were determined to be pregnancy-related.
 - Pregnancy-related death is the “death of a woman while pregnant or within 1 year of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by her pregnancy or its management, but not from accidental or incidental causes” and can include deaths that result from a “pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy.”^{2,3}
- 50 cases (56 percent) were pregnancy-associated, but not pregnancy-related.

² Definition of the 1986 American College of Obstetricians and Gynecologists/Centers for Disease Control Maternal Mortality Study Group. Source: Berg C, Danel I, Atrash H, Zane S, Bartlett L (Editors). pp 5-6. Strategies to reduce pregnancy-related deaths: from identification and review to action. Atlanta: Centers for Disease Control and Prevention; 2001. Available: http://stacks.cdc.gov/view/cdc/6537/cdc_6537_DS1.pdf

³ (n.d.). Retrieved from CDC- Pregnancy Mortality Surveillance System: <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>

- Pregnancy-associated death is the “death of a woman during pregnancy or within one year of the end of pregnancy when death and pregnancy are determined to be not causally related.”⁴
- For 5 cases (6 percent), pregnancy-relatedness was unable to be determined.

The Task Force’s findings on pregnancy-relatedness are similar to other states.^{5,6}

Finding #2 — The leading causes of pregnancy-related death in 2012 included cardiovascular and coronary conditions, obstetric hemorrhage, infection/sepsis, and cardiomyopathy.

The top four leading underlying causes of pregnancy-related death identified by the Task Force were cardiovascular and coronary conditions, obstetric hemorrhage, infection/sepsis, and cardiomyopathy. These causes accounted for 76 percent of all pregnancy-related deaths.^{7,8} Preeclampsia/Eclampsia, mental health conditions, and amniotic fluid embolus were tied for 5th. This is comparable to the findings from the CDC’s Report from Nine Maternal Mortality Review Committees in other states.^{9,10}

⁴ Definition of the 1986 American College of Obstetricians and Gynecologists/Centers for Disease Control Maternal Mortality Study Group. Source: Berg C, Danel I, Atrash H, Zane S, Bartlett L (Editors). pp 6. Strategies to reduce pregnancy-related deaths: from identification and review to action. Atlanta: Centers for Disease Control and Prevention; 2001. Available: http://stacks.cdc.gov/view/cdc/6537/cdc_6537_DS1.pdf

⁵ Building U.S. Capacity to Review and Prevent Maternal Deaths (CDC Foundation, CDC, AMCHP). (2018). Report from Nine Maternal Mortality Review Committees. p.14-15. Retrieved from http://reviewtoaction.org/Report_from_Nine_MMRCs

⁶ In the recent CDC Report from Nine Maternal Mortality Review Committees, “among the 680-valid pregnancy-associated deaths for which relatedness could be determined, 34.9% of cases were determined to be pregnancy related.”

⁷ The World Health Organization (WHO) defines underlying cause of death as a “disease or injury that initiated the chain of events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury.” The task force assigned each underlying cause of death to an “Underlying Cause of Death Regrouping” category. These categories were developed by the Building U.S. Capacity to Review and Prevent Maternal Deaths partnership, to support analyses using a condensed set of causes of death.

⁸ Cardiovascular and coronary conditions are diseases that affect the heart or blood vessels. Obstetric hemorrhage is heavy bleeding during pregnancy, labor, or postpartum. Cardiomyopathy is a disease of the heart muscle.

⁹ Building U.S. Capacity to Review and Prevent Maternal Deaths (CDC Foundation, CDC, AMCHP). (2018). Report from Nine Maternal Mortality Review Committees. p.16, 20, 62. Retrieved from http://reviewtoaction.org/Report_from_Nine_MMRCs

¹⁰ As described in the CDC report, Report from Nine Maternal Mortality Review Committees, “there is a limitation to cause of death regroupings as it may mask sub- differences of importance.” However, due to the small sample size of pregnancy-related deaths, it was determined to be the best method to present the task force findings.

Finding #3 — Black women were more likely to experience pregnancy-related death in 2012.

Black women were affected by pregnancy-related death more than any other race or ethnicity as shown in [Appendix B, Figure B1](#). The pregnancy-related mortality rate for Non-Hispanic Black women was 2.3 times higher than the rate for Non-Hispanic White women (13.9 versus 6.0 per 100,000 live births). The pregnancy-related mortality rate was 9.3 per 100,000 live births for Hispanic women and 12.4 per 100,000 live births for women of Other races.¹¹

Finding #4 — The majority of maternal deaths in 2012 were to women enrolled in the Medicaid program at the time of delivery.

Based upon the birth certificate data, 61 of the 89 cases (68.5 percent) of maternal deaths for 2012 were to women enrolled in Medicaid at the time of delivery. However, the Task Force was not able to determine the insurance status at the time of death based upon the data available.

Finding #5 — Most pregnancy-related deaths were potentially preventable.

A death is considered preventable if the Task Force finds that there was at least some chance of the death being avoided by one or more reasonable changes to the circumstances of the patient, provider, facility, systems or community factors.¹² The Task Force determined that there was at least some chance for preventability in almost 80 percent of pregnancy-related deaths as shown in [Appendix B, Figure B2](#). Case review found that the majority of pregnancy-related deaths caused by cardiovascular disease, obstetric hemorrhage, and infection/sepsis were preventable, as shown in [Appendix B, Figure B3](#).

Finding #6 — A complex interaction of personal, provider, facility, systems and community factors contributed to maternal death.

The Task Force identified that the factors that lead to a maternal death occur over a woman's life course. The Task Force identified 178 factors that contributed to the 34 cases identified as a pregnancy-related death, an average of 5.2 contributing

¹¹ The Texas Department of State Health Services, Vital Statistics Unit, classifies individuals based on their self-reported race and ethnicity information. If race is reported as Asian, American Indian or Alaskan Native, Native Hawaiian or other Pacific Islander, other, blank, and unknown then race/ethnicity is computed as "Other/Unknown."

¹² Berg, C.J., Harper, M. A., Atkinson, S. M., Bell, E. A., Brown, H. L., Hage, M. L., et al., Preventability of pregnancy-related deaths: results of a state-wide review. *Obstetrics & Gynecology*, 2005. 106(6): p. 1228.

factors per case. The factors that contributed to death were distributed among the following domains: individual and family factors (42 percent), provider factors (36 percent), facility factors (16 percent), and system and community factors (6 percent).

The Task Force also found that efforts to reduce maternal mortality and morbidity must address factors specific to patients and families, providers, facilities and systems and the wider community where they live. A summary of the top identified themes of contributing factors to death can be found in [Appendix B, Summary of Contributing Factors to Pregnancy-Related Deaths Identified by the Task Force](#).

The Task Force recognized that maternal mortality and morbidity is not just a medical care issue and that recommendations must also address other factors like community level drivers, that influence a woman's health throughout her life, to make lasting change.¹³

Finding #7 — Delays in receiving case records and the redaction process slowed maternal death case review.

DSHS requests comprehensive case records that are essential to develop maternal death case reports for the Task Force to review. DSHS had delayed responses to record requests and some providers/facilities sent partial or selected records. For the 2012 case cohort, the average time to receipt of complete case records was 59 days, with a range of 3 to 537 days. Out of the 89 cases reviewed by the Task Force, 26 cases had records that were not received or incomplete.

Currently, there is no incentive for providers to send requested records to the Task Force in a timely manner. In addition, the direction to redact case records prior to nurse abstraction continues to prolong the time to review maternal death cases.¹⁴

¹³ Where we live, go to school and work affects our overall health, as does the safety and livability of our communities, whether we are economically stable or struggling to get by, and whether we have strong social support networks. Together, these community level drivers explain why certain segments of our community or population experience better health outcomes.

¹⁴ Nurse abstraction of cases is the development of a case report that summarizes important and relevant information from available case records.

II. Findings from Statewide Maternal Death Trend Analysis

As directed by Senate Bill (SB) 17, Texas Legislature, First Called Session, 2017, DSHS studied state trends of maternal deaths that occurred within 42 days postpartum, as well as those that occurred within 365 days postpartum.¹⁵

A. Maternal deaths within 42 days postpartum

Maternal deaths occurring while pregnant or within 42 days postpartum are used in the calculation of maternal mortality rates (MMRs), both in Texas and nationwide.¹⁶ The MMR is calculated by counting the number of deaths due to pregnancy, as indicated on the death certificate, per 100,000 live births for a given year. Using this standard method, a sharp increase in the MMR in Texas was observed between 2010-2012, peaking in 2012 to 148 maternal deaths within 42 days postpartum (38.7 deaths per 100,000 live births).¹⁷

However, it has been suggested that rising MMRs over the past decade, both in Texas and the US, are at least partly due to errors associated with death certificate coding.^{18,19,20} DSHS recently studied Texas maternal deaths for 2012, to assess death certificate accuracy. It found that, in 2012, the number of maternal deaths within 42 days postpartum in Texas was less than half of what was previously reported: 56 maternal deaths or 14.6 deaths per 100,000 live births.^{21,22} DSHS also found maternal deaths missed by the standard method.

¹⁵ Postpartum means the time after delivery of a child.

¹⁶ World Health Organization. Maternal mortality ratio (per 100 000 live births). Available at: <http://www.who.int/healthinfo/statistics/indmaternalmortality/en/>.

¹⁷ MacDorman MF, Declercq E, Cabral H, Morton C. Recent increases in the U.S. maternal mortality rate: disentangling trends from measurement issues. *Obstet Gynecol* 2016; 128:447-55.

¹⁸ Davis NL, Hoyert DL, Goodman DA, Hirai AH, Callaghan WM. Contribution of maternal age and pregnancy checkbox on maternal mortality ratios in the United States, 1978-2012. *Am J Obstet Gynecol* 2017; 217:352.e1-7.

¹⁹ MacDorman MF, Declercq E, Thoma ME. Trends in maternal mortality by sociodemographic characteristics and cause of death in 27 states and the District of Columbia. *Obstet Gynecol* 2017; 129:811-8.

²⁰ MacDorman MF, Declercq E, Thoma ME. Trends in Texas maternal mortality by maternal age, race/ethnicity, and cause of death, 2006-2015. *Birth* 2018; 00:1-9.

²¹ Baeva S, Saxton DL, Ruggiero K, Kormondy ML, Hollier LM, Hellerstedt J, Hall M, Archer NP. Identifying Maternal Deaths in Texas Using an Enhanced Method, 2012. *Obstet Gynecol* 2018; 131:762-769.

²² Despite this lower number, in 2012, Texas still had a higher MMR than the Healthy People 2020 target of 11.4 deaths per 100,000 live births set by the U.S. Department of Health and Human Services.

The standard method of identifying maternal deaths relies solely on the cause of death listed on death certificates. In the study, DSHS used an enhanced method, by: 1) matching women's deaths to birth and fetal death records, and 2) reviewing medical and autopsy records for signs of pregnancy or miscarriage.

B. Maternal deaths within 365 days postpartum

In Texas, most maternal deaths occur more than 42 days postpartum.²³ DSHS focused data analysis on numbers and rates of maternal death while pregnant or within 365 days postpartum.

To accurately identify cases of maternal death for this analysis, DSHS used only the cases where a death certificate matched to either a birth or a fetal death record within 1 year of the woman's death (except for deaths due to motor vehicle accidents). DSHS did not review medical and autopsy records to find additional cases for this analysis, and therefore, maternal deaths identified through this method underestimate the true number of maternal deaths in Texas during this timeframe. Maternal deaths in the first half of pregnancy that are not identified by birth or fetal death certificate were not captured.

Based on this process, DSHS identified 382 maternal death cases for the years 2012-2015. Results of a timeline analysis are shown in [Appendix C, Table C1](#).

Maternal death rates (per 100,000 live births) were calculated to identify demographic characteristics and health factors associated with a higher risk for each outcome. Results of this analysis are presented in [Appendix C, Table C2](#) and [Table C3](#).

Finding #8 — Hemorrhage and Cardiac Event were the two most common causes of death while pregnant or within 7 days postpartum.

There were 80 deaths that occurred while a woman was pregnant or within 7 days postpartum. Hemorrhage and Cardiac Event accounted for 36 percent of these deaths, followed by Hypertension/Preeclampsia, Amniotic Embolism, and Other Causes. These results are shown in [Appendix C, Table C1](#).

²³ Texas Department of State Health Services. Maternal Mortality and Morbidity Task Force and Department of State Health Services Joint Biennial Report. 2016.

Finding #9 — The majority of maternal deaths occurred more than 60 days postpartum.

DSHS found that of the 382 identified maternal deaths that occurred within 365 days after the end of pregnancy between 2012 and 2015, 215 (56 percent) occurred more than 60 days postpartum.

Finding #10 — In 2012 to 2015, Drug overdose was the leading cause of maternal death from delivery to 365 days postpartum.

Drug overdose accounted for 17 percent of all maternal deaths and almost 80 percent of these deaths that occurred more than 60 days postpartum. Of the 64 maternal deaths due to drug overdose, opioids (either alone or in combination with other drugs) were found in 37 (58 percent) cases, and 42 (66 percent) cases involved a combination of drugs. The specific drugs identified from the death certificate narratives are shown in [Appendix C, Table C4](#). Risk factors for maternal death due to drug overdose can be found in [Appendix C, Table C5](#).

Finding #11 — There is a complex set of factors associated with maternal death, underscoring the need for detailed review of maternal deaths.

DSHS found that many factors were associated with an increased risk for maternal death. These included:

- age 40 years old or older;
- late or no prenatal care²⁴;
- chronic health diseases such as pre-pregnancy obesity²⁵, diabetes²⁶, and hypertension;
- smoking during pregnancy; and
- delivery by cesarean section.²⁷

In addition, as directed by SB 17, DSHS examined the effect of socioeconomic status (SES) on maternal death rates. Although income and family size could be

²⁴ Late prenatal care is when medical care for a pregnancy woman does not start until the second or third trimester of pregnancy.

²⁵ Pre-pregnancy obesity means excessive body weight before conception.

²⁶ Diabetes is a condition of the body resulting in the abnormal breakdown of sugars.

²⁷ A cesarean section is a surgery for delivering a baby through an incision in the abdomen and uterus.

used to more directly determine SES, this information is not part of the death record and is often missing from birth or fetal death records. Therefore, this analysis was based on a woman's marital status, highest education level, and health insurance at the time of delivery. Results showed that the risk for maternal death was higher among unmarried women, women who earned a high school diploma or less, and women who had no health insurance or were enrolled in Medicaid at the time of delivery.²⁸

Together, these factors suggest that the risk for maternal death is higher among women with low socioeconomic status. See [Appendix C, Table C3](#) for more information about these risk factors.

Findings from Statewide Maternal Death Trends among the Most At-Risk Populations

DSHS analyzed statewide data trends for maternal deaths for Black women that occurred in 2012-2015. There was a total of 77 maternal deaths among Black women that occurred within 365 days following the end of pregnancy during this 4-year period. As directed by SB 17, DSHS calculated maternal death rates for Black women to better understand the experiences of this population. Results from these analyses are shown in [Appendix D](#).

Finding #12 — Black women bear the greatest risk for maternal death.

When compared with other races and ethnicities, Black women continue to be at greatest risk for maternal death ([Appendix D, Table D2](#)). Over the past decade, Black women have had a much higher maternal mortality rate than women who identify as either White or Hispanic, both in Texas and in the nation as a whole.^{29,30}

²⁸ DSHS will work to hone in on insurance status at time of death to better identify prevention options. DSHS and HHSC have executed a Memorandum of Understanding to begin matching health insurance at time of death. For those enrolled in Medicaid at death, DSHS will then look at the rate of maternal death by timing.

²⁹ Creanga AA, Berg CJ, Syverson C, Seed K, Bruce FC, Callaghan WM. Pregnancy-related mortality in the United States, 2006–2010. *Obstet Gynecol* 2015; 125:5–12.

³⁰ Baeva S, Archer NP, Ruggiero K, Hall M, Stagg J, Interis EC, Vega R, Delgado E, Hellerstedt J, Hankins G, Hollier LM. Maternal Mortality in Texas. *Am J Perinatol* 2017; 34: 614-620.

Finding #13 — The increased risk for maternal death among Black women exists regardless of income, education, marital status, or other health factors.

Black women ages 40 years or older were at increased risk for maternal death, as was the case for women overall. DSHS found that the risk for maternal death among Black mothers remained high across all levels of socioeconomic status, including women who were married, were at the highest education level, and those women who had private health insurance at the time of their delivery. See [Appendix D, Table D2](#) and [Appendix D, Table D3](#) for more information about health risk factors among Black women.

Compared with other races/ethnicities, Black women have the highest rate of late entry to care; only a little more than half of Black mothers begin prenatal care in the first trimester of pregnancy. Black women also have higher rates of pre-pregnancy obesity and maternal hypertension than women of all other races/ethnicities. In addition, obstetric hypertension rates among delivery hospitalizations were highest among Black mothers as displayed in [Appendix D, Figure D4](#).

Findings from Statewide Trends of Severe Maternal Morbidity

DSHS studied statewide trends of severe maternal morbidity (SMM), which the CDC defines as unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman’s health. SMM is identified using specific information on hospital discharge records. DSHS calculated the overall rate of SMM and the rate by cause per 10,000 delivery hospitalizations for 2014. Obstetric hemorrhage is the leading cause of maternal morbidity and is also the most preventable. DSHS examined cases of obstetric hemorrhage and how its outcomes may differ with race/ethnicity and location.

Finding #14 — Obstetric hemorrhage was the leading cause of severe maternal morbidity.

The overall and leading causes of SMM for delivery hospitalizations in 2014 are displayed in [Appendix E, Figure E1](#). DSHS found that obstetric hemorrhage was the top cause of SMM during delivery hospitalizations.

Finding #15 — Black women are at a higher risk of severe maternal morbidity involving obstetric hemorrhage.

The rates of SMM due to obstetric hemorrhage are shown for 2005 to 2014 by race and ethnicity in [Appendix E, Figure E2](#). The analysis found that Black women continue to be at highest risk for SMM involving obstetric hemorrhage.

Finding #16 — Rates of SMM due to obstetric hemorrhage disorders varied by county.

DSHS estimated the rate of SMM due to obstetric hemorrhage. Based on CDC recommendations, this rate was determined by the number of times blood was given to a woman in labor per 10,000 delivery hospitalizations. To have meaningful results for the majority of Texas counties, DSHS researchers analyzed data over a five-year time period, 2010 to 2014. [Appendix E, Figure E3](#) shows the geographic distribution of the rate of SMM caused by obstetric hemorrhage by county of residence during this time period.

4. Best Practices and Programs from Other States

In 2015, the Association of Maternal and Child Health Professionals (AMCHP) released *Health for Every Mother: A Maternal Health Resource and Planning Guide for States* to share established best practices for state-level improvement in maternal health. The guide includes strategies focused on strengthening state understanding of maternal mortality, improving stakeholder coordination and collaboration, increasing public awareness about health behaviors, reducing community-level barriers to healthy living, and enhancing health care quality and systems. A list of the guide’s strategies is provided in [Appendix F, Table F1](#).

In 2006, the California Department of Public Health and California Perinatal Quality Care Collaborative partnered with Stanford University to launch the California Maternal Quality Care Collaborative (CMQCC) to reduce maternal mortality and morbidity. The CMQCC reviewed cases of maternal death to inform and develop projects to improve the quality of maternal care. Projects included developing and collecting quality measures, creating hospital toolkits, and engaging hospitals in regular bench marking and collaborative quality improvement.^{31, 32} The maternal mortality rate in California has decreased by 55 percent between 2006 to 2013 as shown in [Appendix F, Figure F2](#).

Since 2014, the Maternal and Child Health Bureau-Health Resource Services Administration has funded the Alliance for Innovation on Maternal Health (AIM) Program to support states in using maternal safety bundles — quality improvement initiatives to address specific maternal health issues. AIM states that began participation in 2015 are now reporting progress in maternal outcomes.^{33 34}

³¹ Elliot Main, M. (2018). Reducing Maternal Mortality and Severe Maternal Morbidity Through State-based Quality Improvement Initiatives. *Clinical Obstetrics and Gynecology*, 319-331.

³² *California Maternal Quality Care Collaborative* (n.d.). Retrieved from California Maternal Quality Care Collaborative: <https://www.cmqcc.org/about-cmqcc/what-we-do>

³³ *Maternal Morbidity & Mortality*. (n.d.) Retrieved from Health Resources & Service Administration: <https://www.hrsa.gov/maternal-mortality/index.html>

³⁴ Since December 2017, DSHS enrolled Texas as an AIM state and has recruited 75 percent of birthing hospitals (180 hospitals as of July 13, 2018) into the TexasAIM initiative to implement AIM maternal safety bundles. <https://www.dshs.texas.gov/mch/texasaim/>

5. Recommendations

Recommendation #1 — Increase access to health services during the year after pregnancy and throughout the interconception period to improve the health of women, facilitate continuity of care, enable effective care transitions, and promote safe birth spacing.

Preconception/interconception health refers to the health of women during their reproductive years. Optimal health during preconception/interconception years is essential to improving a woman's overall health and pregnancy and birth-related health outcomes.

In both detailed case reviews and in vital statistics data, the most common associated or contributing factor to maternal mortality included underlying medical conditions like diabetes, hypertension, and heart disease. In the reviewed cases, lack of access to quality care contributed to inadequate control of chronic medical conditions. Preventive health visits must be recognized as a key opportunity to improve the health of women over their life-course and decrease risk factors that impact morbidity and mortality.

To improve health outcomes, the Maternal Mortality and Morbidity Task Force (Task Force) recommends care planning to address acute and chronic health issues before, during, and after pregnancy.³⁵ To effectively address complex health needs, providers also need access to a patient's complete medical record and medical history. Efforts to promote effective continuity of care and care transitions among various providers must consider strategies toward promoting a unified patient chart to ensure accurate sharing of a patient's medical history and care among various facilities and providers of care.

The Task Force recommends extending access to healthcare coverage for 12 months following delivery to ensure that medical and behavioral health conditions can be managed and treated before becoming progressively severe.

³⁵ Care planning is an approach to care that includes the development of individualized goals and strategies to address patient's complex health needs.

Recommendation #2 — Enhance screening and appropriate referral for maternal risk conditions.

In many cases, both during pregnancy and at the time of delivery, opportunities existed for providers to identify risk factors associated with an increased risk of maternal death. Lack of identification of risk factors, including behavioral and chronic health conditions, resulted in missed opportunities to institute appropriate treatment and referrals.

The Task Force recommends improved risk assessment as an important part of any maternal health improvement strategy. The risk assessment should:

- include evidence-based strategies for traditional maternal risk factors, such as chronic health conditions, and under-identified maternal risk factors such as behavioral health and substance use disorders, environmental conditions, and adverse childhood experiences;
- accurately identify medical, environmental, and psychosocial risk factors including behavioral health conditions such as depression and substance use disorder;
- ensure use of validated screening tools when available; and
- be followed with appropriate referrals to other healthcare services.

Recommendation #3 — Prioritize care coordination and management for pregnant and postpartum women.

The Task Force identified opportunities for care providers to better communicate and to coordinate care. Women with complex health needs, including chronic health conditions that are associated with an increased risk of maternal mortality and morbidity, often require care or services from multiple providers and specialists.

To improve quality care coordination, the Task Force recommends expanding care management services for pregnant and postpartum women. Care navigators, case managers, and care coordinators can provide important patient education, service coordination, and advocacy for women's acute and chronic medical and psychosocial needs. They also facilitate coordination between providers to ensure health needs are met and connect women with beneficial resources and services in the community.

Recommendation #4 — Promote a culture of safety and high reliability through implementation of best practices in birthing facilities.

The Task Force found a number of provider and facility factors associated with maternal death including failure to recognize risk status, delays in diagnosis, and delays in implementation of appropriate treatment.

DSHS and its partners have begun implementation of the maternal safety initiatives of TexasAIM, which address both hemorrhage and severe hypertension. The TexasAIM initiative also includes education and implementation of the Maternal Early Warning Systems (MEWS) which prompts early diagnosis and intervention.³⁶

- TexasAIM is a framework to implement and share best practices at hospitals that serve diverse maternal health populations.
- Standardized MEWS processes in hospitals that provide maternity services and in Birthing Centers empower care teams to rapidly recognize and respond both quickly and effectively to worsening health status.³⁷

The Task Force recommends continued support and promotion of state maternal safety initiatives that foster a culture of safety and high reliability of care.

Recommendation #5 — Identify or develop and implement programs to reduce maternal mortality from cardiovascular and coronary conditions, cardiomyopathy and infection/sepsis.

For the 2012 case cohort, the Task Force found the top causes of pregnancy-related death to include cardiovascular and coronary conditions, cardiomyopathy, and infection/sepsis. Further, the 2012-2015 analysis of maternal deaths also revealed these conditions to be significant causes of death for women. The Task Force recommends identification and implementation of best-practice programs to reduce risks of maternal death from these conditions.

³⁶ According to a multidisciplinary working group convened by the National Partnership for Maternal Safety, maternal early warning systems are “a list of abnormal parameters that indicate the need for urgent bedside evaluation by a clinician with the capacity to escalate care as necessary in order to pursue diagnostic and therapeutic interventions.”

³⁷ Birthing Centers maintain minimum standards for licensing by the Health and Human Services Commission and are places, facilities, or institutions at which a woman is scheduled to give birth following a normal, uncomplicated pregnancy, but does not include a hospital or the residence of the woman giving birth.
<http://dshs.texas.gov/facilities/birthing-centers/default.aspx>

Recommendation #6 — Improve postpartum care management and discharge education for patients and families.

In many of the 2012 cases, opportunities existed for better patient education and follow-up. Inadequate knowledge and lack of early recognition of postpartum complication signs frequently contributed to death. The Task Force recommends birthing facilities and providers provide comprehensive and individualized postpartum care planning for women, especially those at higher risk. Comprehensive facility discharge instructions should specifically address potential warning signs of postpartum complications. Discharge instructions are essential for providing women and their support systems tools to recognize warning signs of postpartum complications. The instructions also empower women with knowledge to seek necessary care.

Traditionally, women receive a postpartum checkup at 4-6 weeks post-delivery. The Task Force recommends implementing policies and programs that provide enhanced support during the postpartum period. This includes implementing an earlier postpartum follow-up and expanding coverage for additional postpartum visits both within the first three weeks postpartum and up to 12 weeks postpartum as needed. Recent American College of Obstetricians and Gynecologists' recommendations on postpartum care detail the importance of ongoing comprehensive postpartum care to address physical, social, and psychological well-being.³⁸

Recommendation #7 — Increase maternal health programming to target high-risk populations, especially Black women.

Case review findings and statewide trend data continue to show that health disparities exist in maternal healthcare in Texas.³⁹ Healthy People 2020 states that achieving health equity requires elimination of health disparities.⁴⁰

³⁸ Optimizing postpartum care. ACOG Committee Opinion No. 736. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2018;131:e140–50.

³⁹ Healthy People 2020 defines a health disparity as “a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion.”

⁴⁰ Healthy People 2020 defines health equity as the “attainment of the highest level of health for all people. Achieving health equity requires valuing everyone equally with focused and ongoing societal efforts to address avoidable inequalities, historical and contemporary injustices, and the elimination of health and health care disparities.”

Black women are more likely to experience pregnancy-related death and the risk for maternal death among Black women cuts across all socioeconomic levels. The Task Force recommends increasing maternal health programming strategies statewide to address maternal health disparities.

Strategies should include:

- a focus on vulnerable populations;
- support for community health worker (CHW) and other programs to bridge gaps in care, help women adhere to provider recommendations, and provide family-centered support, education, and referrals;⁴¹
- reimbursement for continuous labor support to reduce operative deliveries and delivery costs;^{42,43,44} and
- establishment of a Task Force subcommittee to analyze the factors causing the disparity and recommend solutions to address maternal mortality for Black women and other at-risk populations.

Recommendation #8 —Initiate public awareness campaigns to promote health enhancing behaviors

The Task Force identified opportunities for community health education and awareness campaigns that focus on women of reproductive age. The Task Force recommends DSHS and its partners initiate campaigns that include the following:

- importance of early prenatal care and timely postpartum care;
- self-advocacy and patient/family engagement to empower patients to be active participants in their care;
- an emphasis on knowing personal risk for developing maternal health complications;

⁴¹ The American Public Health Association defines community health workers as a “frontline public health worker who is a trusted member of and/or has an unusually close understanding of the community served. This trusting relationship enables the worker to serve as a liaison/link/intermediary between health/social services and the community to facilitate access to services and improve the quality and cultural competence of service delivery.”

⁴² Bohren MA, Hofmeyr G, Sakala C, Fukuzawa RK, Cuthbert A. Continuous support for women during childbirth. *Cochrane Database of Systematic Reviews* 2017, Issue 7. Art. No.: CD003766. DOI: 10.1002/14651858.CD003766.pub6

⁴³ Continuous labor support, provided by doulas or birth attendants, in addition to nursing care, provides the mother with emotional, informational, and physical support throughout labor and delivery. Doulas serve as advocates for patients and empower them to communicate their needs or concerns during or after birth.

⁴⁴ Backes Kozhimannil, Katy & Hardeman, Rachel & Attanasio, Laura & Blauer-Peterson, Cori & O'Brien, Michelle. (2013). Doula Care, Birth Outcomes, and Costs Among Medicaid Beneficiaries. *American journal of public health*. 103. 10.2105/AJPH.2012.301201.

- education on early management of chronic health issues such as cardiovascular disease, hypertension, and diabetes;
- an emphasis on identifying and seeking treatment for postpartum depression;
- smoking cessation; and
- healthy eating and weight management.

Recommendation #9 — Champion integrated care models combining physical and behavioral health services for women and families.

Findings from the Task Force’s case reviews and the statewide data trend analysis demonstrate the need to champion care models that recognize that mental and physical health equally impact patient health and wellness. Effective early identification and referral for behavioral health conditions, including psychiatric illnesses and substance use disorders, are critical to prevent maternal deaths impacted by these conditions.

The Task Force’s case review and the statewide trend data demonstrate the need to champion the integration of behavioral health services into well woman care. Additionally, early identification and referral for behavioral health conditions requires equitable access to providers and treatment resources.

The Task Force recommends the following:

- ensure that women with substance use disorders and mental health conditions have insurance coverage for necessary care services;
- support models of maternal healthcare that integrate behavioral health services; and
- develop strategies to ensure that behavioral health and community services to support long term disease management are readily available, including expanding the number of behavioral health care providers and services across the state.

Recommendation #10 — Support strategies to improve the maternal death review process.

Death certificate data continue to serve as the main source of information for maternal mortality reporting and analysis. Data needs to be accurate to effectively inform recommendations and public health strategies to reduce maternal mortality and morbidity. A majority of the 89 cases reviewed by the Task Force had an inaccurate pregnancy status on the death certificate. The Task Force recommends

that the state continue to support initiatives to improve maternal death coding and ensure continuing education for death certifiers.

The Task Force recommends a policy directing facilities and providers to submit all patient records to DSHS within 30 business days of a request to improve response time.

Conclusion

The findings outlined in this report, together with the Maternal Mortality and Morbidity Task Force's (Task Force) recommendations, examine and address several key issues impacting maternal health outcomes in Texas.

Increasing access to care for all reproductive aged women is important. The management of acute and chronic health conditions and preventive care are essential for healthy pregnancies and long-term health. Healthier women are healthier mothers, and healthier mothers lead to healthier infants and families.

The factors that contribute to maternal mortality and morbidity are complex and occur over the life course, so community-level drivers to health must be addressed.

State and local initiatives are important in promoting quality and standardized maternal health care. Improving access to quality prenatal, delivery, and postpartum care is a mechanism to address maternal health inequities. There is a clear need to increase programming to reduce maternal health disparities, especially for the most at-risk populations, like Black women.

Opportunities exist to improve care coordination for pregnant and postpartum women. It is necessary to explore models of care that are inclusive to behavioral health services. Improving risk screening is vital for early recognition and management of maternal risk factors that lead to mortality and morbidity.

Maternal death review processes vary among states and the best practices are always evolving. It is essential that the state continue to evaluate and improve its case review processes.

The Task Force and the Department of State Health Services (DSHS) recognize that the loss of one mother is one too many. DSHS and the Task Force are committed to improving maternal health care for the people of Texas and for those forever impacted by the loss of a mother.

List of Acronyms

Acronym	Full Name
Task Force	Maternal Mortality and Morbidity Task Force
DSHS	The Department of State Health Services
SMM	Severe Maternal Morbidity
SB	Senate Bill
CDC	Centers for Disease Control and Prevention
MMRs	Maternal Mortality Rates
SES	Socioeconomic Status
AMCHP	Association of Maternal and Child Health Programs
CMQCC	California Maternal Quality Care Collaborative
AIM	Alliance for Innovation on Maternal Health
MEWS	Maternal Early Warning Systems
CHW	Community Health Worker

Appendix A. Task Force Members

Table A1: Task Force Members as of July 1, 2018

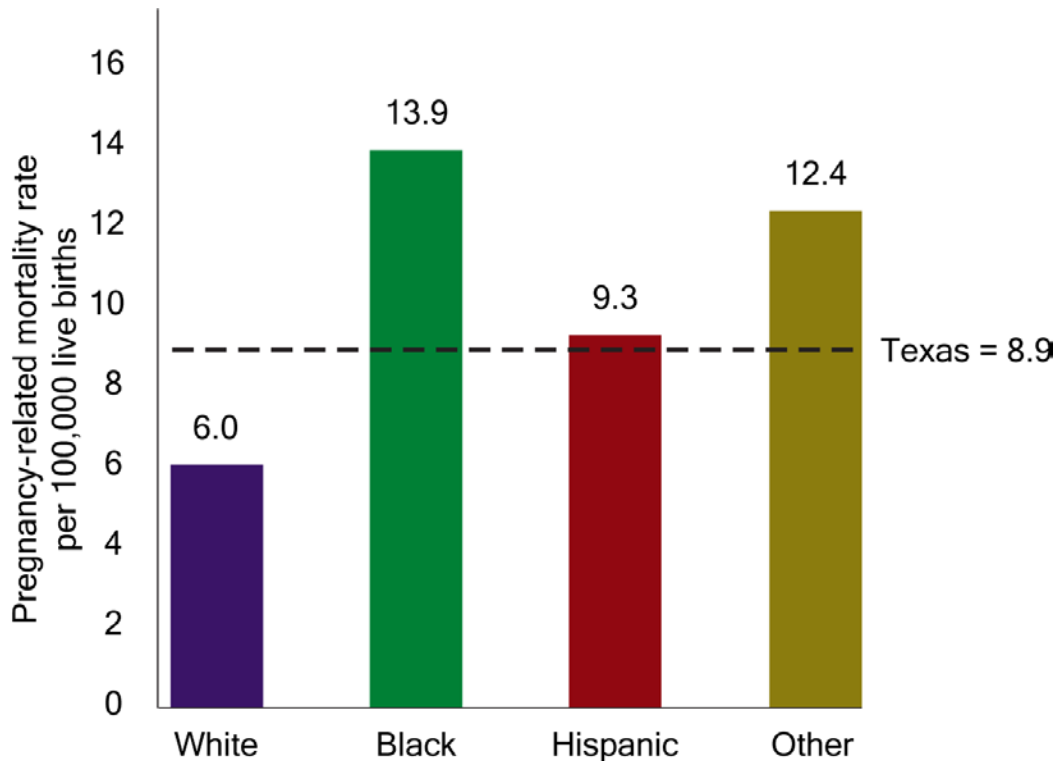
Name	Task Force Position	Positions/Location
Dr. Lisa Hollier (Chair)	Physician specializing in Obstetrics, Maternal Fetal Medicine Specialist	Professor and Medical Director, Baylor College of Medicine, Houston
Dr. Carla Ortique (Co-Chair)	Physician specializing in Obstetrics	Obstetrician/Gynecologist, Texas Children's Hospital, Houston
Dr. Manda Hall	DSHS Representative	Associate Commissioner, Community Health Improvement Division, DSHS, Austin
Dr. Linda Gaul	State Epidemiologist	State Epidemiologist, DSHS, Austin
Dr. Patrick Ramsey	Physician specializing in Obstetrics, Maternal Fetal Medicine Specialist	Professor of Obstetrics/Gynecology and Maternal-fetal Medicine, University of Texas Health, San Antonio
Dr. James Maher	Physician specializing in Obstetrics, Maternal Fetal Medicine Specialist	Associate Professor, Department of Obstetrics and Gynecology - Texas Tech University Health Sciences Center and Director of Maternal Fetal Medicine, Medical Center Hospital, Odessa
Dr. Ronald Peron	Physician specializing in Family Medicine	Chief Medical Officer, Community Health Service Agency, Inc., Greenville
Dr. Amy Raines-Milenkov	Researcher of pregnancy-related deaths	Assistant Professor, University of North Texas Health Science Center, Fort Worth

Name	Task Force Position	Positions/Location
Dr. Eumenia Castro	Physician specializing in Pathology	Associate Professor Department of Pathology and Immunology, Texas Children's Hospital and Pavilion for Women, Baylor College of Medicine, Houston
Dr. D. Kimberly Molina	Medical Examiner	Deputy Chief Medical Examiner, Bexar County Medical Examiner's Office, San Antonio
Dr. Meitra Doty	Physician specializing in Psychiatry	Faculty Physician, UT Southwestern Department of Psychiatry/Medical Center and Parkland Hospital, Dallas
Dr. Pamala Gessling	Registered Nurse	Director of Nursing, Methodist Dallas Medical Center, Dallas
June Hanke	Community Advocate	Registered Nurse and Strategic Analyst/Planner, Health Systems Strategy - Harris Health System, Houston
Nancy Jo Reedy	Certified Nurse-Midwife	Registered Nurse, Instructor and Clinical Faculty Advisor, Georgetown University, Arlington
Nancy Alderman	Licensed Clinical Social Worker	Founder and Coordinator of Central Texas Perinatal Coalition, in private practice, Cedar Park
Dr. Lavannya Pandit	Physician specializing in Critical Care	Staff Physician, Baylor College of Medicine/DeBakey VA Medical; Assistant Professor of Medicine

Name	Task Force Position	Positions/Location
Dr. Christina Murphy	Nurse specializing in Labor and Delivery	Department Chair; Women, Children and Family Health Science (09.01.18); Associate Professor Texas A&M University- Corpus Christi

Appendix B. Findings from Task Force Maternal Death Case Review

Figure B1: Pregnancy-related mortality rate by race/ethnicity, Texas, 2012



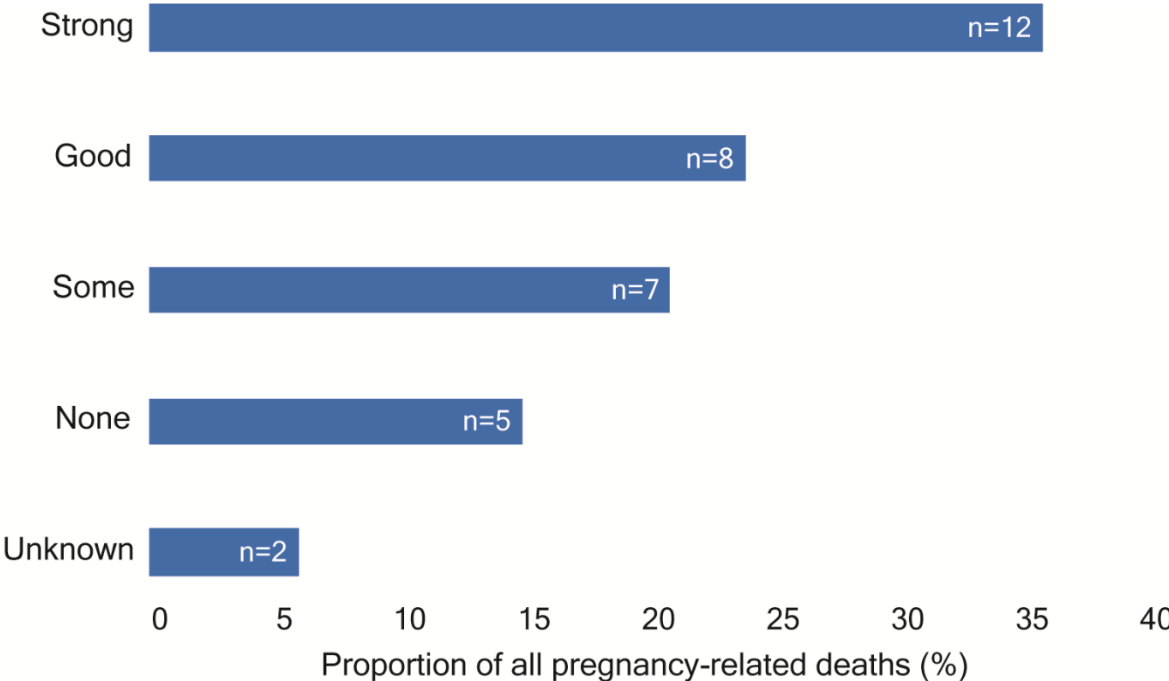
PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: 2012 Death Files, 2011-2012 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Maternal deaths were confirmed by matching each woman's death record with a birth or fetal death within 365 days. Deaths due to cancer or motor vehicle crashes were excluded from these analyses. The Task Force classified deaths as pregnancy-related through review of medical records, autopsy reports, and other records.

Results in this figure are based upon 34 pregnancy-related maternal deaths. Separating pregnancy-related deaths into categories by race/ethnicity resulted in small numbers of deaths, especially for women of Other race/ethnicity, which may make estimates unreliable.

Figure B2: Task Force rating of chance of preventing pregnancy-related deaths through better care and/or management during/after pregnancy, Texas, 2012

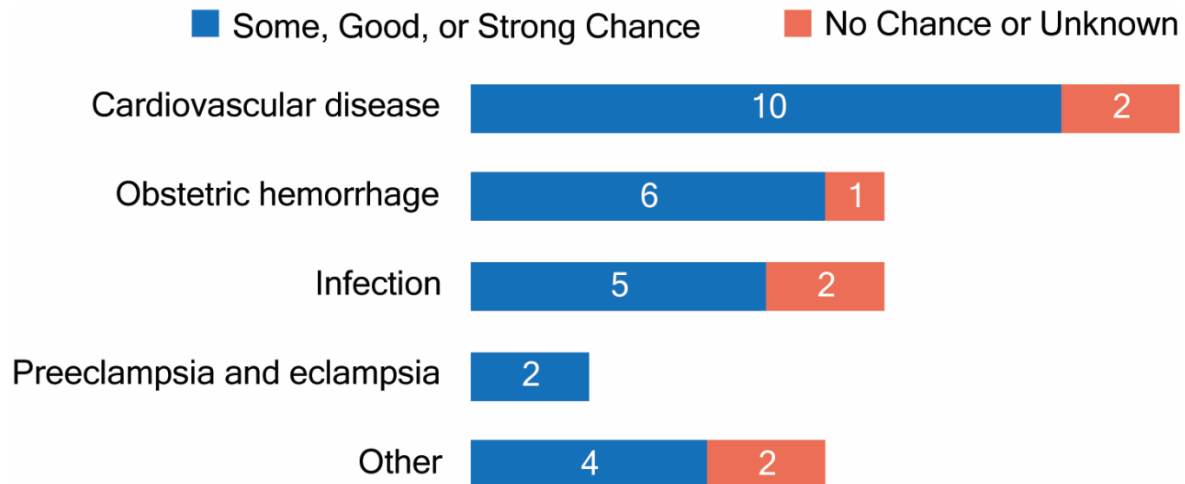


PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: 2012 Death Files, 2011-2012 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Maternal deaths were confirmed by matching each woman's death record with a birth or fetal death within 365 days. Deaths due to cancer or motor vehicle crashes were excluded from these analyses. The Task Force classified pregnancy-relatedness and preventability of deaths through review of medical records, autopsy reports, and other records. Results in this figure are based upon 34 pregnancy-related maternal deaths.

Figure B3: Task Force rating of chance of preventing pregnancy-related deaths through better care and/or management during/after pregnancy by cause of death, Texas, 2012



PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: 2012 Death Files, 2011-2012 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Maternal deaths were confirmed by matching each woman's death record with a birth or fetal death within 365 days. Deaths due to cancer or motor vehicle crashes were excluded from these analyses. The Task Force classified pregnancy-relatedness, preventability, and causes of death through review of medical records, autopsy reports, and other records.

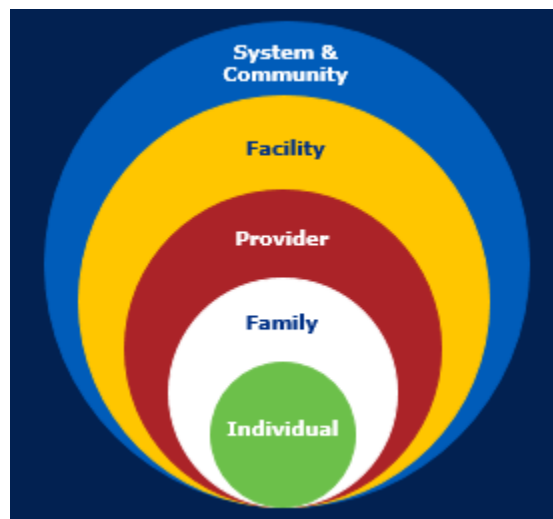
Results in this figure are based upon 34 pregnancy-related maternal deaths. Numbers of pregnancy-related deaths corresponding to each cause of death and preventability category are shown. Cardiovascular disease category includes cardiovascular and coronary conditions and cardiomyopathy. The Other category includes deaths due to accidental overdose, amniotic fluid embolism, cerebrovascular accidents, and mental health conditions.

Summary of Contributing Factors to Pregnancy-Related Deaths Identified by the Task Force

Notes: In addition to determining causation, pregnancy-relatedness, and preventability of death for each case, the Task Force is responsible for identifying factors that likely contributed to death. Identifying contributing factors to death allows the Task Force to create informed, specific, feasible, and actionable recommendations that foster the development of targeted strategies to prevent maternal mortality and severe maternal morbidity in Texas. These contributing factor themes are presented in the context of domains that reflect the levels within a social-ecological framework (Figure B4) to emphasize that it is necessary to develop recommendations that act across multiple levels for sustained prevention efforts over time.

To summarize the Task Force findings of contributing factors to death, a content analysis was performed on all identified contributing factors for pregnancy-related deaths. The pool of factors was reviewed, quantified, and summarized and the following includes a section summary of the top contributing factor themes for the following levels of factors: *individual and family factors, provider factors, facility factors, and community and systems factors.*

Figure B4: Domains of Contributing Factor Themes in a Social-Ecological Model



Top *individual and family level factors* contributing to death included underlying medical conditions; delay in or failure to seek care or treatment; and obesity. The most identified condition contributing to death was underlying cardiovascular

disease, including cardiomyopathy and chronic hypertension followed by preeclampsia and eclampsia. Depression was the most identified mental health condition contributing to pregnancy-related death. The most identified issues with delay in or failure to seek care were lack of patient recognition of early warning signs of worsening condition and delay in seeking medical care. Finally, obesity contributed to pregnancy-related death as it increased the patient's risk for development of hypertensive disease, cardiovascular disease, and preeclampsia.

Provider level factors contributing to death included inadequate response to or management of triggers leading to delayed and poorly coordinated response to diagnosis and treatment in the pregnancy, delivery, and the postpartum period; ineffective treatment; and complications from current C-section or labor induction or augmentation. Failure to recognize maternal early warning signs and high risk maternal health status were identified. Delays in treatment and inadequate or ineffective treatment of hypertension, hemorrhage, and infection were identified. Lack of leadership and communication contributed to missed diagnoses and ineffective treatment. Failure to recognize high-risk patients contributed to failure to refer high risk patients to appropriate care specialties and a delay in or lack of bedside clinician presence. Prioritization of the pregnancy outcome over the maternal condition in some cases of pregnancy-related death led to emergent delivery despite declining maternal health status.

At the *facility level*, inadequate knowledge, judgement, or performance by facility personnel; lack of recognition of high risk status; and lack of continuity of care were top contributing factors to death. Lack of recognition of high-risk status by facility staff, poor documentation in the patient's chart, and delayed response to warning signs of declining health status by nursing staff was observed. Lack of recognition of risk factors for hemorrhage and delayed or no response to warning signs were observed. Finally, continuity of care was impacted by the inability to secure appropriate outpatient care and lack of appropriate hand-off of patients between hospital staff and outpatient providers.

Lack of continuity of care and access to care were top *systems and community level factors*. Issues identified were lack of access to interconception care services and transitional care services. Poor care coordination from the inpatient to outpatient setting was identified.

Appendix C. Statewide Trends of Maternal Deaths

Table C1. Maternal Death by Cause and Timing of Death, Texas, 2012-2015

Cause of Death	TIMING OF DEATH					TOTAL
	While Pregnant	0-7 Days Postpartum	8-42 Days Postpartum	43-60 Days Postpartum	61+ Days Postpartum	
Drug Overdose	0	3	7	5	49	64
Other Causes	5	5	6	3	44	63
Cardiac Event	2	12	9	5	27	55
Homicide	2	1	5	2	32	42
Infection/Sepsis	1	3	14	3	11	32
Suicide	0	1	2	2	28	33
Cerebrovascular Event	0	8	9	1	9	27
Hemorrhage	3	12	2	0	3	20
Hypertension/Eclampsia	0	7	4	0	7	18
Pulmonary Embolism	2	3	4	2	2	13
Amniotic Embolism	1	9	0	0	0	10
Substance Use Sequelae (e.g., liver cirrhosis)	0	0	2	0	3	5
TOTAL	16	64	64	23	215	382

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Maternal deaths were confirmed by matching each woman's death record with a birth or fetal death within 365 days. Deaths due to cancer or motor vehicle crashes were excluded from these analyses. Timing of death was determined using a combination of pregnancy status on the death record and days elapsed between delivery and death. If a woman was identified as pregnant at time of death and 0 days elapsed between delivery and death, then this was counted as death while pregnant. All other deaths were identified as postpartum maternal deaths, and were further categorized based on the number of days

that elapsed between delivery and death. Note that 1 death due to fatal, ruptured, ectopic pregnancy had 295 days elapsed between delivery and death because of a previous delivery, but this death was counted as death while pregnant. Cause of death was taken directly from the death record.

Table C2: Maternal Death Rates by Demographic Characteristics, Texas, 2012-2015

Demographic Characteristic	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
RACE/ETHNICITY			
Black	180,714	77 (20%)	42.6
White	539,177	149 (39%)	27.6
Hispanic	748,644	144 (38%)	19.2
Other	103,934	12 (3%)	11.5
AGE			
<20	218,240	20 (5%)	9.2
20-24	322,975	77 (20%)	23.8
25-29	443,547	100 (26%)	22.5
30-34	376,051	113 (30%)	30.0
35-39	171,533	50 (13%)	29.1
40+	40,029	22 (6%)	55.0
MARITAL STATUS			
Married	911,004	184 (48%)	20.2
Not married	661,227	196 (51%)	29.6
Unknown	-	2 (1%)	-
HIGHEST EDUCATION LEVEL			
No High School Diploma	328,710	95 (25%)	28.9
High School Diploma	417,864	149 (39%)	35.7
Some College, No Degree	352,068	61 (16%)	17.3
Associate's Degree	89,385	24 (6%)	26.9
Bachelor's Degree	264,256	33 (9%)	12.5
Master's Degree/PhD	118,016	15 (4%)	12.7
Unknown	-	5 (1%)	-
HEALTH INSURANCE AT DELIVERY			
Medicaid	728,359	219 (57%)	30.1
Self-Pay/No Insurance	125,599	31 (8%)	24.7
Private Insurance	596,330	86 (23%)	14.4
Unknown	-	46 (12%)	-

Demographic Characteristic	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
GEOGRAPHIC LOCATION			
Region 1 (Texas Panhandle)	49,955	17 (5%)	34.0
Region 2/3 (includes Dallas-Ft Worth)	437,165	111 (29%)	25.4
Region 4/5N (East Texas)	76,674	19 (5%)	24.8
Region 6/5S (includes Houston)	418,686	91 (24%)	21.7
Region 7 (Central Texas)	177,643	45 (12%)	25.3
Region 8 (includes San Antonio)	158,531	47 (12%)	29.6
Region 9/10 (West Texas)	96,633	20 (5%)	20.7
Region 11 (South Texas)	157,182	28 (7%)	17.8
Unknown	-	4 (1%)	-

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Maternal deaths were confirmed by matching each woman's death record with a birth or fetal death within 365 days. Deaths due to cancer or motor vehicle crashes were excluded from these analyses.

Rates were suppressed for unknown/missing values for each variable.

Table C3: Maternal Death Rates by Health Factor, Texas, 2012-2015

Health Factor	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
PRE-PREGNANCY WEIGHT			
Underweight (BMI: less than 18.5)	61,184	12 (3%)	19.6
Normal weight (BMI: 18.5-24.9)	721,208	159 (42%)	22.0
Overweight (BMI: 25.0-29.9)	401,025	80 (21%)	19.9
Obese (BMI: 30.0 or greater)	380,077	111 (29%)	29.2
Unknown	-	20 (5%)	-
DIABETES			
Yes	82,779	33 (9%)	39.9
No	1,489,690	349 (91%)	23.4
HYPERTENSION			
Yes	106,612	60 (16%)	56.3
No	1,465,857	322 (84%)	22.0
SMOKING DURING PREGNANCY			
Yes	63,919	55 (14%)	86.0
No	1,508,550	327 (86%)	21.7
TRIMESTER PRENATAL CARE BEGAN			
First Trimester	1,001,704	187 (49%)	18.7
Second Trimester	389,492	111 (29%)	28.5
Third Trimester	102,971	21 (5%)	20.4
Unknown	-	63 (17%)	-
LABOR AND DELIVERY PRACTITIONER			
Medical Doctor	1,496,777	364 (95%)	24.3
Certified Nurse-Midwife/ Certified Midwife	48,830	4 (1%)	8.2
Other/Unknown*	-	14 (4%)	-
MODE OF DELIVERY			
Vaginal	1,022,608	195 (51%)	19.1
Cesarean	549,528	183 (48%)	33.3
Unknown	-	4 (1%)	-

* Attendants in the Other/Unknown category included medical and administrative staff, family members, and unknown/unidentified persons. Due to the heterogeneity of this category, and small numbers within its subcategories, rates are unreliable and have been suppressed.

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Maternal deaths were confirmed by matching each woman's death record with a birth or fetal death within 365 days. Deaths due to cancer or motor vehicle crashes were excluded from these analyses.

Rates were suppressed for unknown/missing values for each variable.

Table C4. Specific Drugs Identified from Death Certificate Narratives for Drug Overdose Confirmed Maternal Deaths, 2012-2015

Specific Drugs	Count
OPIOIDS	
Opioid	23
Heroin †	18
Fentanyl †	1
NON-OPIOIDS	
Sedative	22
Cocaine	12
Methamphetamine	9
Alcohol	3
Acetaminophen	2
Antidepressant	1
Anticonvulsant	1
Inhalant	1
Caffeine	1
UNKNOWN	1

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: 42 of the 64 drug overdose maternal deaths involved a combination of drugs, and were therefore counted more than once.

† Although considered opioids, heroin and fentanyl are each listed separately, because different tests are used to verify these two drugs.

Table C5: Drug Overdose Maternal Death Rate by Demographic Characteristics, Texas, 2012-2015

Demographic Characteristic	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
RACE/ETHNICITY			
White	539,177	41 (64%)	7.6
Black	180,714	7 (11%)	3.9
Hispanic	748,644	16 (25%)	2.1
Other	103,934	0 (0%)	0.0
AGE			
<20	218,240	2 (3%)	0.9
20-24	322,975	11 (17%)	3.4
25-29	443,547	20 (31%)	4.5
30-34	376,051	21 (33%)	5.6
35-39	171,533	6 (9%)	3.5
40+	40,029	4 (6%)	10.0
COUNTY OF RESIDENCE			
Urban	1,413,615	62 (97%)	4.4
Rural	158,854	2 (3%)	1.3
REGION OF RESIDENCE			
Region 1 (Panhandle)	49,955	3 (5%)	6.0
Region 2/3 (includes Dallas-Ft Worth)	437,165	28 (44%)	6.4
Region 4/5N (East Texas)	76,674	1 (2%)	1.3
Region 6/5S (includes Houston)	418,686	10 (16%)	2.4
Region 7 (Central Texas)	177,643	5 (8%)	2.8
Region 8 (includes San Antonio)	158,531	7 (11%)	4.4
Region 9/10 (West Texas)	96,633	5 (8%)	5.2
Region 11 (South Texas)	157,182	5 (8%)	3.2
HEALTH INSURANCE AT DELIVERY †			
Medicaid	728,359	48 (75%)	6.6
Private Insurance	596,330	9 (14%)	1.5
Self-Pay/No Insurance	125,599	4 (6%)	3.2
Unknown	-	3 (5%)	-

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

NOTES: Percentages of drug overdose maternal deaths may not sum to exactly 100 percent due to rounding error.

† The maternal death rate was suppressed for 3 maternal deaths involving fetal death with 'unknown' health insurance status. DSHS is working with the Health and Human Services Commission (HHSC) to hone in on insurance status at time of death to better identify prevention options for those enrolled in Medicaid.

Rates were suppressed for unknown/missing values for each variable.

Appendix D. Statewide Maternal Death Trends among the Most At-Risk Populations

Table D1. Maternal Death among Black Women by Cause and Timing of Death, Texas, 2012-2015

Cause of Death	TIMING OF DEATH					TOTAL
	While Pregnant	0-7 Days Postpartum	8-42 Days Postpartum	43-60 Days Postpartum	61+ Days Postpartum	
Other Causes	2	1	0	0	11	14
Cardiac Event	0	2	4	1	6	13
Homicide	2	0	3	1	4	10
Hypertension/Eclampsia	0	2	2	0	5	9
Drug Overdose	0	0	2	1	4	7
Cerebrovascular Event	0	0	3	0	2	5
Infection/Sepsis	0	0	4	0	1	5
Amniotic Embolism	3	1	0	0	0	4
Pulmonary Embolism	2	0	1	0	1	4
Hemorrhage	0	1	1	0	1	3
Suicide	0	0	0	0	3	3
Substance Use Sequelae (e.g., liver cirrhosis)	0	0	0	0	0	0
TOTAL	9	7	20	3	38	77

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

Table D2: Maternal Death Rates among Black Women by Demographic Characteristics, Texas, 2012-2015

Demographic Characteristic	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
RACE/ETHNICITY			
Black	180,714	77 (100%)	42.6
AGE			
<20	18,744	2 (3%)	10.7
20-24	55,486	15 (20%)	27.0
25-29	48,534	18 (23%)	37.1
30-34	36,569	25 (32%)	68.4
35-39	17,041	13 (17%)	76.3
40+	4,337	4 (5%)	92.2
MARITAL STATUS			
Married	63,665	29 (38%)	45.6
Not married	117,026	48 (62%)	41.0
Unknown	-	0 (0%)	-
HIGHEST EDUCATION LEVEL			
No High School Diploma	26,107	9 (12%)	34.5
High School Diploma	54,319	30 (39%)	55.2
Some College, No Degree	55,011	20 (26%)	36.4
Associate's Degree	10,848	5 (6%)	46.1
Bachelor's Degree	22,241	7 (9%)	31.5
Master's Degree/PhD	11,953	5 (6%)	41.8
Unknown	-	1 (1%)	-
HEALTH INSURANCE AT DELIVERY			
Medicaid	111,885	53 (69%)	47.4
Self-Pay/No Insurance	46,202	7 (9%)	15.2
Private Insurance	13,202	12 (16%)	90.9
Unknown	-	5 (6%)	-
GEOGRAPHIC LOCATION			
Region 1 (Texas Panhandle)	2,875	1 (1%)	34.8
Region 2/3 (includes Dallas-Ft Worth)	64,152	31 (40%)	48.3
Region 4/5N (East Texas)	12,011	5 (6%)	41.6
Region 6/5S (includes Houston)	72,093	26 (34%)	36.1
Region 7 (Central Texas)	17,864	11 (14%)	61.6
Region 8 (includes San Antonio)	7,957	2 (3%)	25.1

Demographic Characteristic	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
Region 9/10 (West Texas)	2,858	1 (1%)	35.0
Region 11 (South Texas)	904	0 (0%)	-

PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

Table D3: Maternal Death Rates among Black Women (N = 77) by Health Factor, Texas, 2012-2015

Health Factor	Number of Live Births	Number (%) of Maternal Deaths	Rate (per 100,000 live births)
PRE-PREGNANCY WEIGHT			
Underweight (BMI: less than 18.5)	6,443	-	-
Normal weight (BMI: 18.5-24.9)	70,386	31 (40%)	44.0
Overweight (BMI: 25.0-29.9)	47,253	13 (17%)	27.5
Obese (BMI: 30.0 or greater)	54,894	23 (30%)	41.9
Unknown	-	10 (13%)	-
DIABETES			
Yes	7,863	9 (12%)	114.5
No	172,851	68 (88%)	39.3
HYPERTENSION			
Yes	16,825	14 (18%)	83.2
No	163,889	63 (82%)	38.4
SMOKING DURING PREGNANCY			
Yes	7,537	11 (14%)	145.9
No	173,177	66 (86%)	38.1
TRIMESTER PRENATAL CARE BEGAN			
First Trimester	101,450	38 (49%)	37.5
Second Trimester	51,962	23 (30%)	44.3
Third Trimester	16,905	3 (4%)	17.7
Unknown	-	13 (17%)	-
LABOR AND DELIVERY PRACTITIONER			
Medical Doctor	173,422	74 (96%)	42.7
Certified Nurse-Midwife/ Certified Midwife	4,567	1 (1%)	21.9
Other/Unknown*	-	2 (3%)	-
MODE OF DELIVERY			
Vaginal	110,969	36 (47%)	32.4
Cesarean	69,714	38 (49%)	54.5
Unknown	-	3 (4%)	-

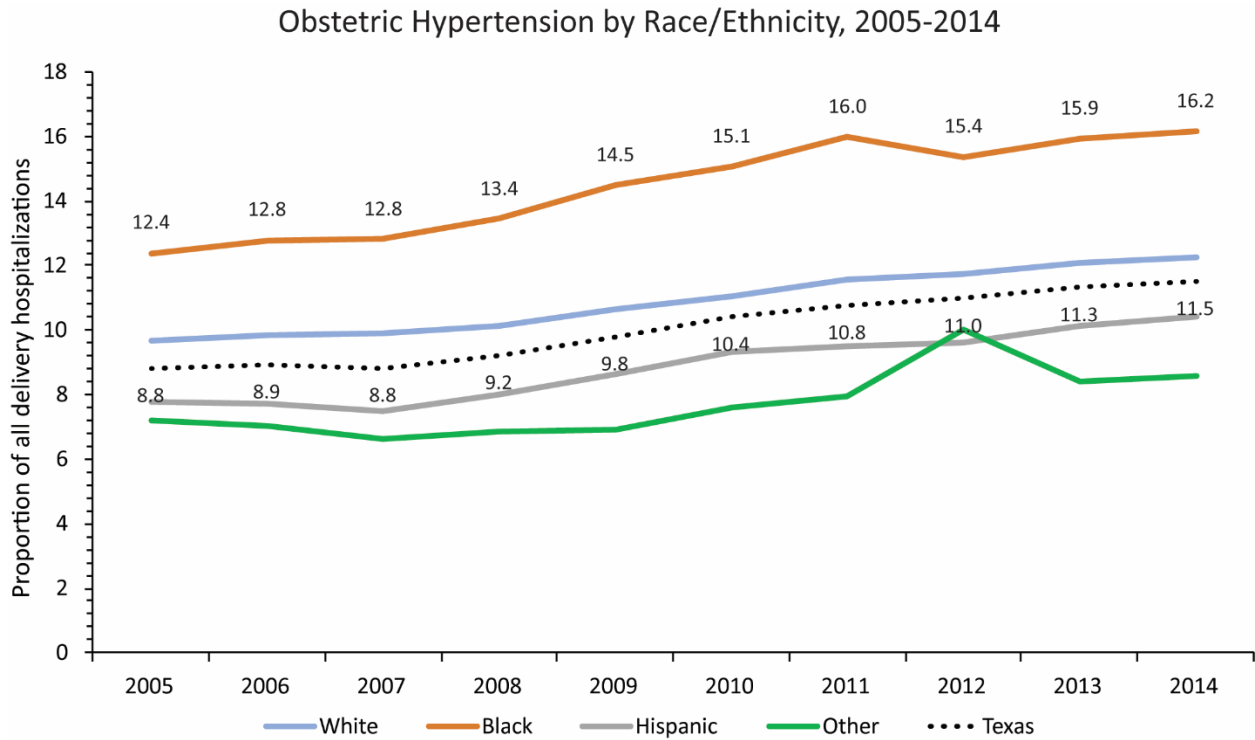
* Attendants in the Other/Unknown category included family members and unknown/unidentified persons. Due to small numbers, rates are unreliable and have been suppressed.

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DATA SOURCES: 2012-2015 Death Files, 2011-2015 Live Birth and Fetal Death Files. Center for Health Statistics, DSHS.

Rates were suppressed for unknown/missing values for each variable.

Figure D4: Obstetric hypertension per 10,000 delivery hospitalizations by race/ethnicity, Texas, 2005-2014



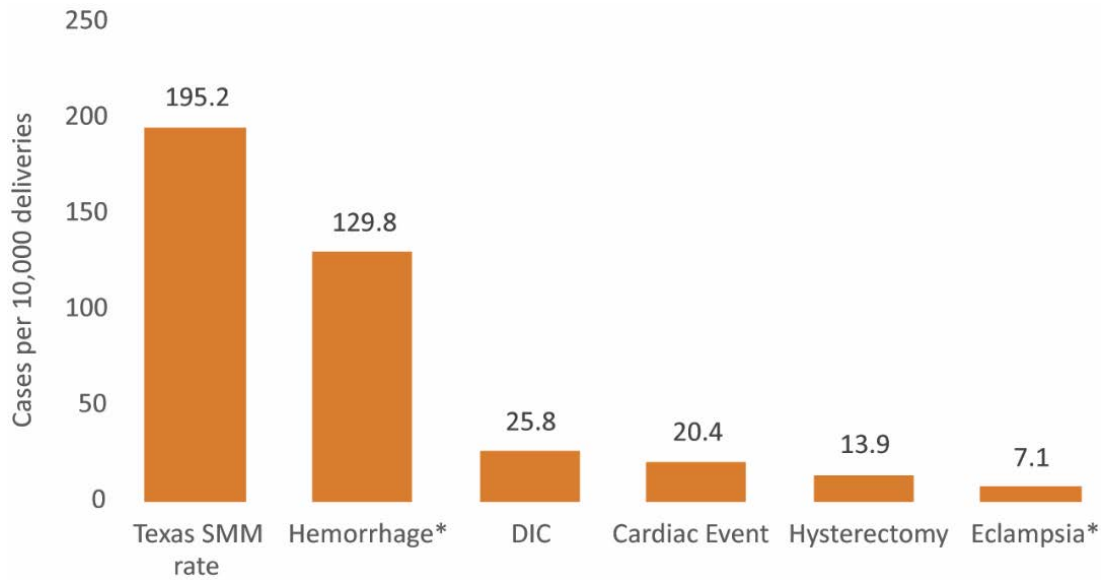
PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: Hospital Inpatient Discharge Public Use Data File (PUDF), 2005-2014. Center for Health Statistics, DSHS.

NOTES: ICD-9 diagnosis code 642.xx (Hypertension Complicating Pregnancy, Childbirth, and the Puerperium) was used to calculate proportions of hypertensive disorder in delivery hospitalizations.

Appendix E. Statewide Trends of Severe Maternal Morbidity

Figure E1: Overall and leading causes of severe maternal morbidity cases per 10,000 delivery hospitalizations, Texas, 2014

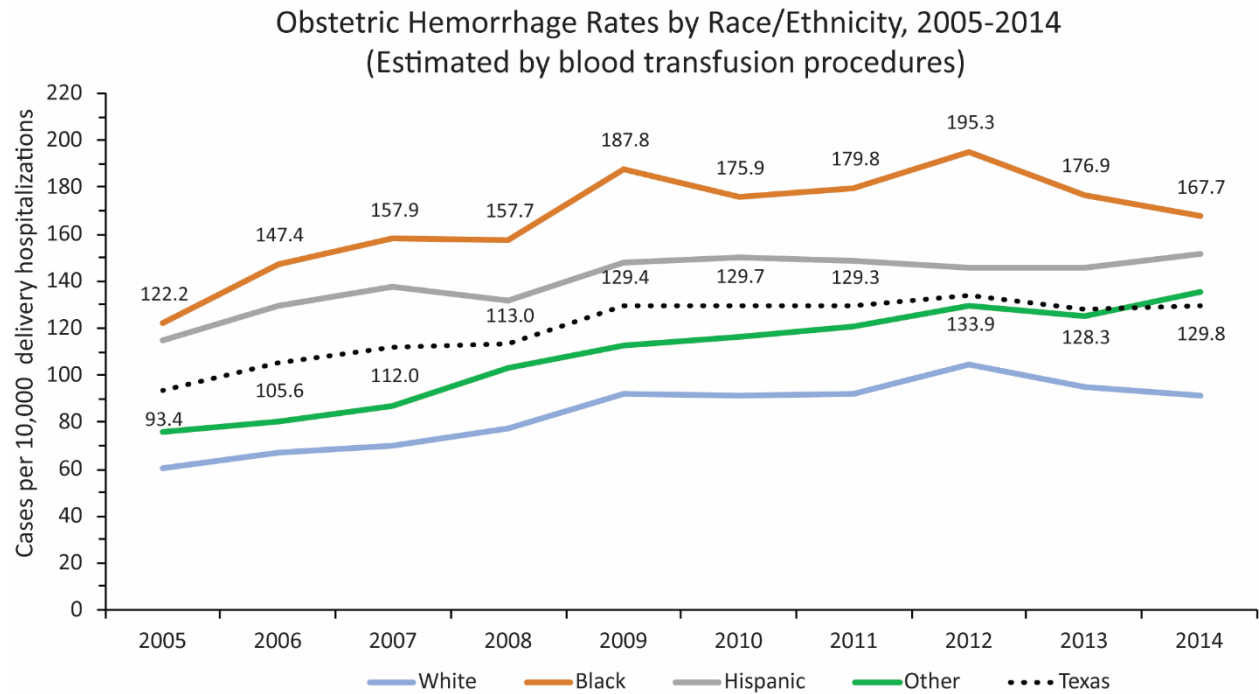


PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: Hospital Inpatient Discharge Public Use Data File (PUDF), 2014. Center for Health Statistics, DSHS.

NOTES: * AIM Patient Safety Bundle is available for this condition.

Figure E2: Severe maternal morbidity due to obstetric hemorrhage per 10,000 delivery hospitalizations (estimated by blood transfusion procedures) by race/ethnicity, Texas, 2005-2014

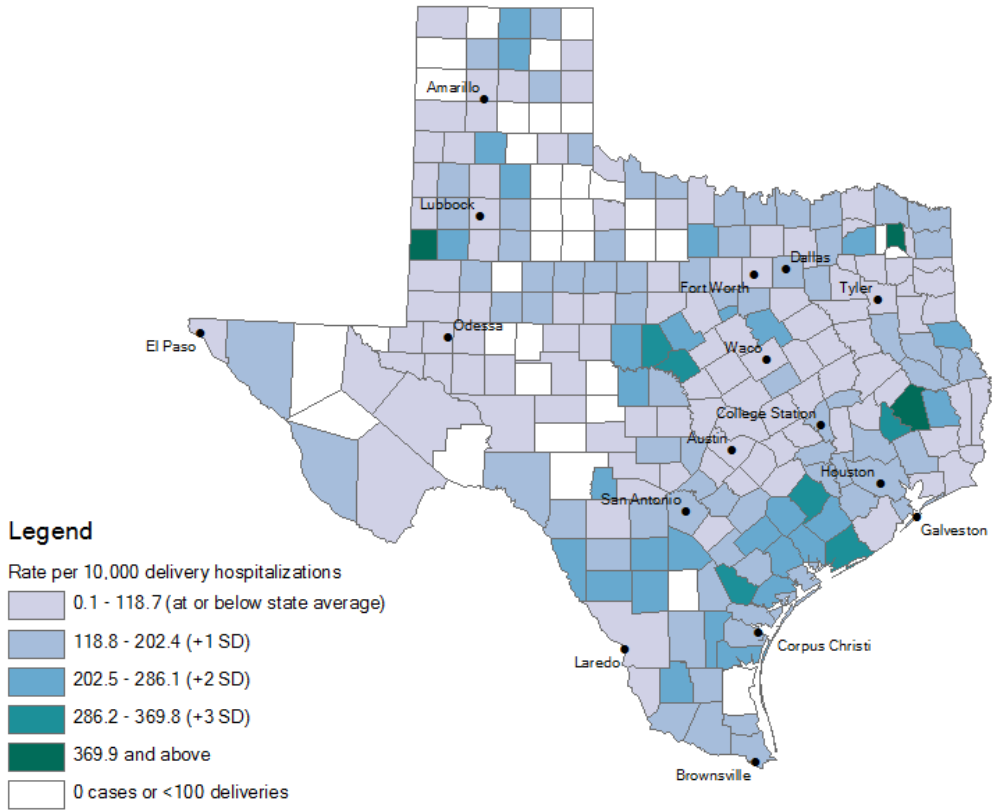


PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: Hospital Inpatient Discharge Public Use Data File (PUDF), 2005-2014. Center for Health Statistics, DSHS.

NOTES: ICD-9 procedure code 99.0x (Blood and Blood Component Transfusion) was used to calculate rates of severe maternal morbidity due to hemorrhage in delivery hospitalizations.

Figure E3: Severe maternal morbidity due to obstetric hemorrhage per 10,000 delivery hospitalizations (estimated by blood transfusion procedures) by county of residence, Texas, 2010-2014



PREPARED BY: Maternal & Child Health Epidemiology, Division for Community Health Improvement, DSHS.

DATA SOURCE: Hospital Inpatient Discharge Public Use Data File (PUDF), 2010-2014. Center for Health Statistics, DSHS.

NOTES: ICD-9 procedure code 99.0x (Blood and Blood Component Transfusion) was used to calculate rates of severe maternal morbidity due to hemorrhage in delivery hospitalizations.

Appendix F. Best Practices and Programs from Other States that Reduced Rates of Pregnancy-Related Deaths

Table F1: Summary Table- Elements and Strategies of Health for Every Mother: A Maternal Health Resource and Planning Guide for States

Recommended practices were organized into two parts, including two elements that support effective maternal health efforts (Infrastructure Elements) and four program and policy elements that states can consider implementing to improve outcomes in maternal health (Action Elements). These elements and recommended strategies are summarized here.

More detailed information on best practices, recommendations and resources for state action are available here:

http://www.amchp.org/AboutTitleV/Resources/Documents/Health-for-Every-Mother_FINAL_WebOptimized.pdf

Part 1. Infrastructure Elements

Element 1.

Strengthen Maternal Data Systems

Strategy:

1. Build Capacity to Learn from Each Maternal Death
2. Use Administrative Data to Monitor Performance and Outcomes
3. Apply Data from Surveys and Qualitative Sources

Element 2.

Increase the Value of an Investment in Maternal Health

Strategy:

1. Convene and Mobilize Maternal Health Partnerships
2. Demonstrate Impact and Share What Works

Part 2. Action Elements

Element 3.

Enable Healthy Living

Strategy:

1. Address Fundamental Social Conditions and Community-Level Drivers
2. Build Environments That Support Healthy and Active Living
3. Implement Community-Based Health Promotion Efforts

Element 4.

Improve Access to Care

Strategy:

1. Promote Comprehensive Health Coverage
2. Improve the Availability and Acceptability of Services

Element 5.

Ensure High Quality Health Care for Women

Strategy:

1. Support provider Capacity to Deliver High Quality Well-Woman Care
2. Support Provider Capacity to Deliver High Quality, Routine Maternity Care
3. Promote Coordinated Systems Across the Care Continuum

Element 6.

Ensure Readiness and Response to Obstetric Emergencies

Strategy:

1. Ensure Facility Readiness for Obstetric Complications
2. Improve Clinical Recognition and Response to Adverse Events

Figure F2: California maternal mortality rate per 100,000 live births, 1999-2013



Maternal Mortality Rate, California and United States; 1999-2013



DATA SOURCE: State of California, Department of Public Health, California Birth and Death Statistical Master Files, 1999-2013.