

Maternal Mortality Review

A Report on
Maternal Deaths
in Washington
2014–2015

JULY 2017

In accordance
with RCW 70.54.450

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Summary of Report

Rates of maternal mortality have been on the rise in the United States. The national pregnancy-related maternal mortality ratio (number of deaths per 100,000 births) increased from 7.2 deaths per 100,000 births in 1987 to 17.3 in 2013.¹ These rates are high when compared to those in other developed countries, and as the World Health Organization report on maternal mortality trends from 1990 to 2010 indicates, are comparable to rates in Turkey and Saudi Arabia.^{2,3} The nature of the increase in maternal deaths is not quite understood; however, research suggests several causes, including changes in maternal mortality surveillance, changes in national demographics, and the rise of chronic disease among women of reproductive age in the U.S.⁴ Besides the deaths themselves, maternal mortality is an indicator of maternal morbidity and the quality of women's healthcare,⁵ and maternal mortality reviews consistently find that racial/ethnic, socioeconomic, and geographic disparities persist in maternal healthcare.⁶

Unlike national rates, maternal mortality rates in Washington have not increased over time. The Washington State pregnancy-related maternal mortality ratio was 9.0 deaths per year per 100,000 births for 2014-2015, similar to rates in the 1990's. While the rates in this state are not as high as the national rate, Washington State maternal mortality reviews indicate that Washington experiences similar disparities to those experienced in other states.

Maternal mortality reviews can help address rising rates of maternal deaths and disparities by working with experts and stakeholders to identify and better understand the factors surrounding maternal death in the state. These reviews entail examining factors that impact women's health, result in healthcare inequities, and contribute to maternal morbidity and long-term health conditions. A better understanding of these factors can help policymakers, healthcare providers, and public health leaders improve maternal health outcomes and, by extension, the overall health and well-being of Washington's women and children.

The Washington maternal mortality review was established through 2016 Senate Bill 6534 (codified at RCW 70.54.450). The bill directed the Department of Health (DOH) to convene a Maternal Mortality Review Panel (MMRP) to conduct comprehensive and multidisciplinary reviews of all maternal deaths in Washington, identify factors associated with those deaths, and make recommendations for system changes to improve healthcare services for women in the state.

¹ Center for Disease Control. (2016). Pregnancy Mortality Surveillance System. Retrieved <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>

² Singh, G.K. (2010). Maternal mortality in the United States, 1935-2007: Substantial racial/ethnic, socioeconomic, and geographic disparities persist. A 75th Anniversary Publications. Health Resources and Services Administration, Maternal and Child Health Bureau. Rockville Maryland: U.S. Department of Health and Human Services

³ World Health Organization, & UNICEF. (2012). Trends in maternal mortality: 1990 to 2010: WHO, UNICEF, UNFPA and the World Bank estimates.

⁴ MacDorman, M. F., Declercq, E., Cabral, H., & Morton, C. (2016). Is the United States Maternal Mortality Rate Increasing? Disentangling trends from measurement issues Short title: US Maternal Mortality Trends. *Obstetrics and gynecology*, 128(3), 447.

⁵ Maternal Morbidity Working Group. (2013). Measuring maternal health: focus on maternal morbidity. *Bulletin of the World Health Organization*, 91(10), 794-796.

⁶ Lu, M. C., Highsmith, K., de la Cruz, D., & Atrash, H. K. (2015). Putting the "M" back in the maternal and Child Health Bureau: reducing maternal mortality and morbidity. *Maternal and Child Health Journal*, 19(7), 1435-1439.

In collaboration with healthcare providers, and following guidelines developed by the Centers for Disease Control and Prevention (CDC) and other state maternal mortality reviews, and in accordance with legislative direction, DOH developed a four-stage process to review maternal deaths spanning calendar years 2014 and 2015.

This report summarizes the findings and recommendations of the 2014-2015 maternal mortality review for Washington State. It also outlines national data and the rise of maternal mortality in the nation, reviews historical data on maternal deaths in Washington, outlines the multi-level maternal mortality review process, and presents the findings of the review of maternal deaths in 2014 and 2015. The report closes with recommendations for healthcare and system-level changes made by the MMRP to address gaps in care and services in hopes of preventing maternal deaths and improving women's healthcare.

Summary of Findings of 2014–2015 Maternal Mortality Review

- There were 69 total maternal deaths in Washington in calendar years 2014 and 2015.
- 53 deaths were categorized as **pregnancy-associated**, which are maternal deaths that occur during pregnancy or within one year of the end of pregnancy, from a cause that is not related to pregnancy.
 - The leading manner of death for pregnancy-associated deaths was *unintentional injury*, which includes motor vehicle accidents and drug overdose.
 - For pregnancy-associated maternal deaths, Hispanic and non-Hispanic white women have the lowest rates, while the rates for non-Hispanic American Indian/Alaska Native women are more than eight times higher, and three times higher for non-Hispanic Black women.
- 16 deaths were categorized as **pregnancy-related**, which are maternal deaths that occur 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.
 - The most frequent causes of pregnancy-related death were hemorrhage (excessive bleeding) (5 deaths) and hypertensive disorders of pregnancy (complications with high blood pressure) (3 deaths).
 - While each pregnancy-related death is a tragedy for the woman as well as her family, the relatively small number of cases overall prevents making conclusions about groups at high risk. However, the scientific literature and national data show women of color, and women of low income and education are disproportionately impacted. We will continue to collect and analyze this data in our reviews and describe maternal deaths in Washington.

Although the methodologies used for the 2014 and 2015 review of maternal deaths are different than those used to calculate national rates, it appears that the maternal mortality ratio in Washington is lower than the national rate. When compared to previous state maternal mortality data, rates do not appear to have increased over time in Washington State. Factors contributing to pregnancy-related deaths identified by the MMRP included patient, provider, and healthcare system factors which affect women at all points of care. Chronic disease, specifically obesity and pregnancy-related hypertension, were common factors in this maternal death cohort. This is similar to what other state maternal mortality reviews have found.

Recommendations made by the MMRP to prevent pregnancy-related deaths and improve maternal healthcare are summarized here (details starting on page 35):

1. Improve care for women who are pregnant and have a high Body Mass Index.
 - a. Work with the Washington State Perinatal Collaborative to convene an expert panel to develop best practice guidelines for the care of women who are pregnant and have high BMI.
 - b. Explore a quality improvement process to implement these guidelines with the Washington State Perinatal Collaborative and the Washington State Hospital Association.
2. Promote and encourage the use of standardized protocols related to ectopic pregnancy (pregnancy outside of the uterus) treatment and intervention.
 - a. Increase knowledge and integration of standardized protocols for the treatment of women with ectopic pregnancies.
3. Expand access to and continuity of healthcare coverage for all women and children in Washington State.
 - a. Expand Medicaid to cover all physical and mental health needs through the first year after pregnancy to increase continuity of coverage and services.
 - b. As part of healthcare coverage, ensure all people have access to reproductive health counseling and contraception of choice.
4. Improve access to substance use treatment and mental health services for pregnant and postpartum women.
 - a. Increase capacity for substance use treatment and mental health services for pregnant and parenting women in the state.
 - b. Expand services for mothers with substance use disorders, such as Parent Child Assistance Program⁷ to assure statewide access to these or similar programs.
5. Expand and improve efforts to provide effective follow-up care for women during all points of pregnancy and through the first year postpartum.
 - a. Develop a more comprehensive, coordinated, and patient-centered system of care for women and their infants during the pregnancy and postpartum periods through the first year after birth.
 - b. Expand efforts to provide early and frequent home visits for mothers and infants which address medical, mental, and physical health needs, as well as socioeconomic needs.
 - c. Encourage facilities and providers to initiate postpartum telephone follow-up within the first 72 hours after discharge.
 - d. Promote early and frequent postpartum depression screenings of mothers by women's health providers and primary care providers, and by pediatricians during well child visits.
 - e. Explore alternative care models for mental health treatment that combine women's and parenting support services with mental health and substance use treatment services and review.
6. Improve health equity and address social determinants of health to reduce racial and ethnic, socioeconomic, and geographic disparities in maternal mortality.
 - a. Integrate frameworks of social determinants of health and equity into all recommended strategies in the MMRP.
 - b. Adopt strategies to address social biases in healthcare.

⁷ <http://depts.washington.edu/pcapuw/>

7. Improve maternal death investigation and autopsy.
 - a. Convene an expert panel to assess current pregnancy-related death investigation and autopsy processes in the state, research processes and professional guidelines used in other states for pregnancy-related death autopsy, and develop best practices for pregnancy-related death investigation and autopsy.
 - b. Explore timely reporting process for maternal deaths to assist with maternal death surveillance and to enhance quality improvement capacity for maternal health.
 - c. Explore and implement a system to ensure timely notification about maternal deaths to involved hospitals and providers.
8. Coordinate efforts with other state and non-governmental agencies that share a focus on preventing maternal death and improving maternal health.
 - a. Coordinate data collection efforts with other DOH programs which research suicide, homicide, and overdose deaths in the state.
 - b. Collaborate with current efforts by other state agencies to reduce motor vehicle accidents throughout the state.
 - c. Recruit professionals with expertise in domestic violence, mental health, and substance use to the MMRP for future reviews.

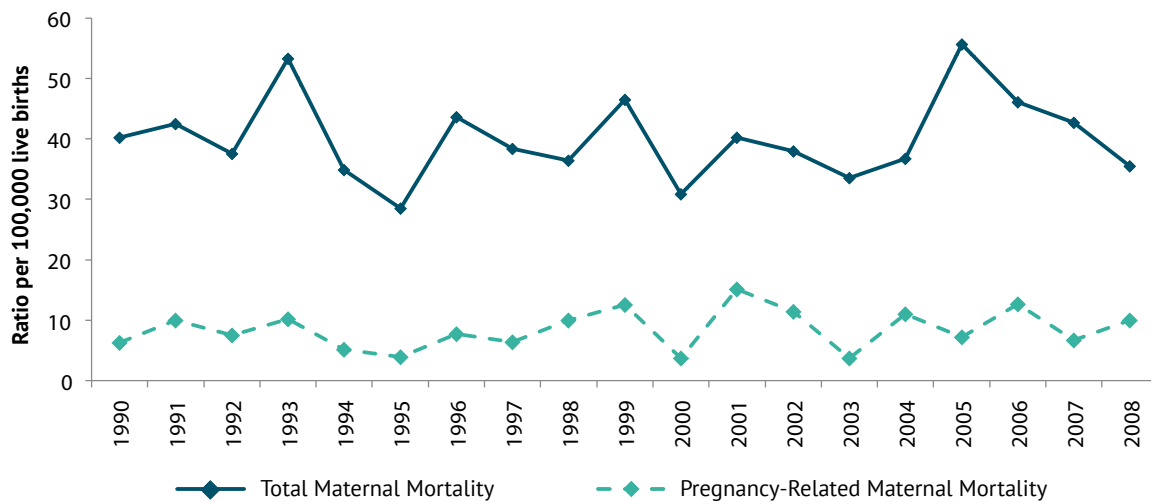
The next steps for DOH are:

- Share information about the maternal mortality review findings and recommendations to stakeholders throughout Washington.
- Work with the Washington State Perinatal Collaborative to review all clinical-level recommendations made by the MMRP to determine which can be translated into actionable steps and plans.
- Collaborate with other state agencies to better coordinate efforts for preventing maternal deaths.
- Continue work with Centers for Disease Control and Prevention (CDC) to standardize the Washington State Maternal Mortality Review (MMR) process with national efforts.
- Evaluate the Washington MMR process and develop a quality improvement plan for future reviews.
 - Explore ways to expand focus to social determinants that lead to maternal death and morbidity in the next review.
- Educate healthcare providers to increase awareness and understanding of the factors that contribute to maternal deaths in our state, and the clinical interventions that may prevent these deaths.
- Collect data for the review of 2016 maternal deaths.

Background

In the United States, nearly four million women give birth each year,^{8,9} and for most of them, it is an exciting and joyful time. Unfortunately, many women also experience complications related to pregnancy and delivery, and some of them die. The CDC reports that about 700 women die each year as a result of pregnancy- or delivery-related complications,¹⁰ and for women aged 18-44, pregnancy complications were the 10th leading cause of death in 2010.¹¹ The CDC Division of Reproductive Health reports that the national pregnancy-related maternal mortality ratio (number of pregnancy-related maternal deaths per 100,000 births) has steadily increased over the last three and a half decades, and by 2013 had reached 17.3 per 100,000 – up from 13.2 per 100,000 in 2000.¹² Maternal mortality surveillance in Washington State has been conducted sporadically due to limited resources, but data from previous reviews (1990–2008) (Figure 1) indicate that the rate of maternal deaths in Washington has been consistently lower than the national rate and was steady through 2008. Figure 1 shows that the rate of pregnancy-related maternal death has been relatively stable from 1990 to 2008. Variation in rates of overall maternal and pregnancy-related deaths are attributable to random variability due to the relatively small numbers of maternal deaths each year (Figure 1).

FIGURE 1: Total Maternal Mortality Ratio and Pregnancy-Related Maternal Mortality Ratio (deaths per 100,000 live births), Washington State 1990–2008



⁸ Association of Maternal and Child Health Programs. (2015). *Health for Every Mother: a Maternal Health Resource and Planning Guide for States*. Retrieved at http://www.amchp.org/AboutTitleV/Resources/Documents/Health-for-Every-Mother_FINAL_WebOptimized.pdf

⁹ Centers for Disease Control. (2016). Births and natality. FactStats. Retrieved at <https://www.cdc.gov/nchs/fastats/births.htm>

¹⁰ Centers for Disease Control. (2016). Pregnancy-related deaths. Reproductive Health. Retrieved at <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-relatedmortality.htm>

¹¹ U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau. *Women's Health USA 2013*. Rockville, Maryland: U.S. Department of Health and Human Services, 2013. Retrieved <https://mchb.hrsa.gov/whusa13/dl/pdf/whusa13.pdf>

¹² Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion. (2017). Pregnancy Mortality Surveillance System. Centers for Disease Control and Prevention (CDC). Retrieved from: <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.htm>

While it is concerning that the maternal mortality rate is on the rise nationally and has remained steady in our state, maternal deaths remain relatively rare. Maternal mortality is actually an extreme example of maternal morbidity, an issue which affects thousands of women each year, and is an indicator of the quality of women's healthcare.¹³ A bulletin published by the World Health Organization notes that for every maternal death, an estimated 20 or more women experience some form of maternal morbidity.¹⁴ The concept of maternal morbidity is difficult to define, but can be considered any acute and/or chronic health condition that is attributed to or aggravated by pregnancy, or which complicates pregnancy or childbirth, and negatively impacts the mother's and/or child's overall well-being.¹⁵ Maternal morbidity results in increased hospital stays and healthcare costs to patients and facilities, and can lead to preterm birth.¹⁶ Examples of maternal morbidity include having a heart attack during pregnancy, or developing hypertension or diabetes during pregnancy, all of which put mother and baby at risk for pregnancy or delivery complications, and increased hospitalizations during and after pregnancy. These diagnoses can increase the mother's risk for developing chronic illness later in life.¹⁷ Further, more than the obvious physical effects, the impact of morbidity extends beyond the mother, her pregnancy and childbirth by negatively impacting the whole family, and has the potential to lead to social and economic hardships.¹⁸

Maternal mortality and morbidity are intensified by the rise of chronic disease among women in the United States. Nearly half of all adults in the U.S. have a chronic disease condition,¹⁹ and according to the World Health Organization, more women than men are being diagnosed²⁰ with chronic conditions like diabetes, hypertension, and obesity. Pregnant women with these conditions are at a higher risk for pregnancy complications,²¹ as pregnancy exacerbates the effects of these diseases, complicating pregnancy and delivery, and potentially leading to long-term illness.²² For example, hypertensive disorders during pregnancy have been found to be a common problem affecting five to 10 percent of all pregnancies in the U.S.²³ This diagnosis poses risks for the development of cardiovascular disease, chronic kidney disease, and diabetes later in a mother's life.²⁴

¹³ Maternal Morbidity Working Group. (2013). Measuring maternal health: focus on maternal morbidity. *Bulletin of the World Health Organization*, 91(10), 794-796.

¹⁴ Maternal Morbidity Working Group. (2013). Measuring maternal health: focus on maternal morbidity. *Bulletin of the World Health Organization*, 91(10), 794-796.

¹⁵ Chou, D., Tunçalp, Ö., Firoz, T., Barreix, M., Filippi, V., von Dadelszen, P., & Say, L. (2016). Constructing maternal morbidity—towards a standard tool to measure and monitor maternal health beyond mortality. *BMC pregnancy and childbirth*, 16(1), 45.

¹⁶ Callaghan, W. M., Creanga, A. A., & Kuklina, E. V. (2012). Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstetrics & Gynecology*, 120(5), 1029-1036.

¹⁷ Kaaja, R. J., & Greer, I. A. (2005). Manifestations of chronic disease during pregnancy. *Jama*, 294(21), 2751-2757.

¹⁸ Koblinsky, M., Chowdhury, M. E., Moran, A., & Ronsmans, C. (2012). Maternal morbidity and disability and their consequences: neglected agenda in maternal health. *Journal of Health, Population and Nutrition*, 124-130.

¹⁹ Centers for Disease Control. (2016). Chronic diseases: the leading cause of death and disability in the United States. Chronic Disease Prevention and Health Promotion. Retrieved at <https://www.cdc.gov/chronicdisease/overview>

²⁰ World Health Organization. (2014). Obesity. Retrieved from: <http://www.wpro.who.int/mediacentre/factsheets/obesity/en/>

²¹ Center for Disease Control. (2016). Pregnancy complications. Reproductive Health. Retrieved at <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregcomplications.htm>

²² Kaaja, R. J., & Greer, I. A. (2005). Manifestations of chronic disease during pregnancy. *Jama*, 294(21), 2751-2757.

²³ Kuklina, E. V., Ayala, C., & Callaghan, W. M. (2009). Hypertensive disorders and severe obstetric morbidity in the United States. *Obstetrics & Gynecology*, 113(6), 1299-1306.

²⁴ Männistö, T., Mendola, P., Väärasmäki, M., Järvelin, M. R., Hartikainen, A. L., Pouta, A., & Suvanto, E. (2013). Elevated Blood Pressure in Pregnancy and Subsequent Chronic Disease Risk Clinical Perspective. *Circulation*, 127(6), 681-690.

Like chronic illness, mental illness and substance use during pregnancy are also major contributing factors to maternal mortality and morbidity worldwide, and pregnant women with mental health conditions face many challenges.²⁵ Women with mental health conditions are at risk for a number of complications, including those associated with pregnancy and delivery. This is because, in general, women with mental health conditions are in poorer overall physical health, and are at an increased risk for incidences of risky behavior.²⁶ Research suggests that women with psychiatric disorders like major depression or panic disorder are at a higher risk for suicide, low birth weight, and cesarean section when compared to women without these disorders.²⁷ Women with substance use disorders are at risk for other complications, too, as some research suggests that they are less likely to seek prenatal care and are more susceptible to sexually transmitted diseases.²⁸

The impact of maternal morbidity, chronic disease, and mental illness on maternal mortality reinforces the need to better understand how these conditions affect women during pregnancy and after birth. Maternal mortality reviews can help lead to a better understanding of how these issues affect maternal health outcomes and, ultimately, how to prevent maternal deaths in the first place. Maternal mortality reviews also help shed light on healthcare inequities affecting women, and how some populations are disproportionately affected by maternal death and morbidity. When specific factors contributing to maternal deaths are identified, effective recommendations can be developed to prevent future deaths. Preventing and reducing maternal deaths will improve health outcomes for women and children, in turn improving the overall quality of life for Washington's families.

To better understand maternal mortality in Washington State, and to address rising maternal mortality in the country and the issues of health equity and maternal morbidity that affect women's health, the Maternal Mortality Review Panel was instituted on June 9, 2016, following enactment of Senate Bill 6534. The MMRP is comprised of women's health professionals from across Washington State and is directed by the maternal mortality law (RCW 70.54.450) to conduct "comprehensive, multidisciplinary reviews of maternal deaths in Washington to identify factors associated with those deaths and make recommendations for system changes to improve healthcare services for women in this state."

The new law provides legal protection for panel members and the review process, authorizes DOH to collect data and records to develop deaths for the review process, and ensures confidentiality of the review process and the data collected. It also allows DOH to collect data surrounding maternal deaths so the MMRP can investigate the factors leading to maternal mortalities, address gaps in services and care, and make recommendations to improve healthcare services for women throughout Washington. The law requires a bi-annual report to be submitted to the healthcare committees in the House and the Senate outlining the previous two years' reviews. This report must include maternal death data presented in aggregate, a discussion of factors surrounding

²⁵ Khalifeh, H., Hunt, I. M., Appleby, L., & Howard, L. M. (2016). Suicide in perinatal and non-perinatal women in contact with psychiatric services: 15 year findings from a UK national inquiry. *The Lancet Psychiatry*, 3(3), 233-242.

²⁶ World Health Organization. (2008). Improving maternal mental health. Retrieved at http://www.who.int/mental_health/prevention/suicide/Perinatal_depression_mmh_final.pdf

²⁷ Farias, D. R., Pinto, T. D. J. P., Teofilo, M. M. A., Vilela, A. A. F., dos Santos Vaz, J., Nardi, A. E., & Kac, G. (2013). Prevalence of psychiatric disorders in the first trimester of pregnancy and factors associated with current suicide risk. *Psychiatry research*, 210(3), 962-968.

²⁸ Wong, S., Ordean, A., Kahan, M., Gagnon, R., Hudon, L., Basso, M. & Farine, D. (2011). Substance use in pregnancy. *Journal of Obstetrics and Gynaecology Canada*, 33(4), 367-384.

the deaths, and systems-level recommendations to improve women's health in the state. The first Maternal Mortality Review Report, due to the legislature July 1, 2017, summarizes findings of the MMRP review of maternal deaths in calendar years 2014 and 2015. The law supports the maternal mortality review and panel through July 1, 2020.²⁹

According to the law, the MMRP is required to review all maternal deaths, which is the death of a woman who is pregnant or within one year of delivering or following the end of a pregnancy, whether or not the woman's death is related to or aggravated by the pregnancy. DOH created a multi-level review process which allowed for the review of all maternal deaths at some level, and prioritized medical causes of death and cases determined to be pregnancy-related.

²⁹ Washington State Legislature. (2016). Revised Code of Washington: 70.54.450. *Maternal mortality review panel*. Retrieved at <http://app.leg.wa.gov/RCW/default.aspx?cite=70.54.450>

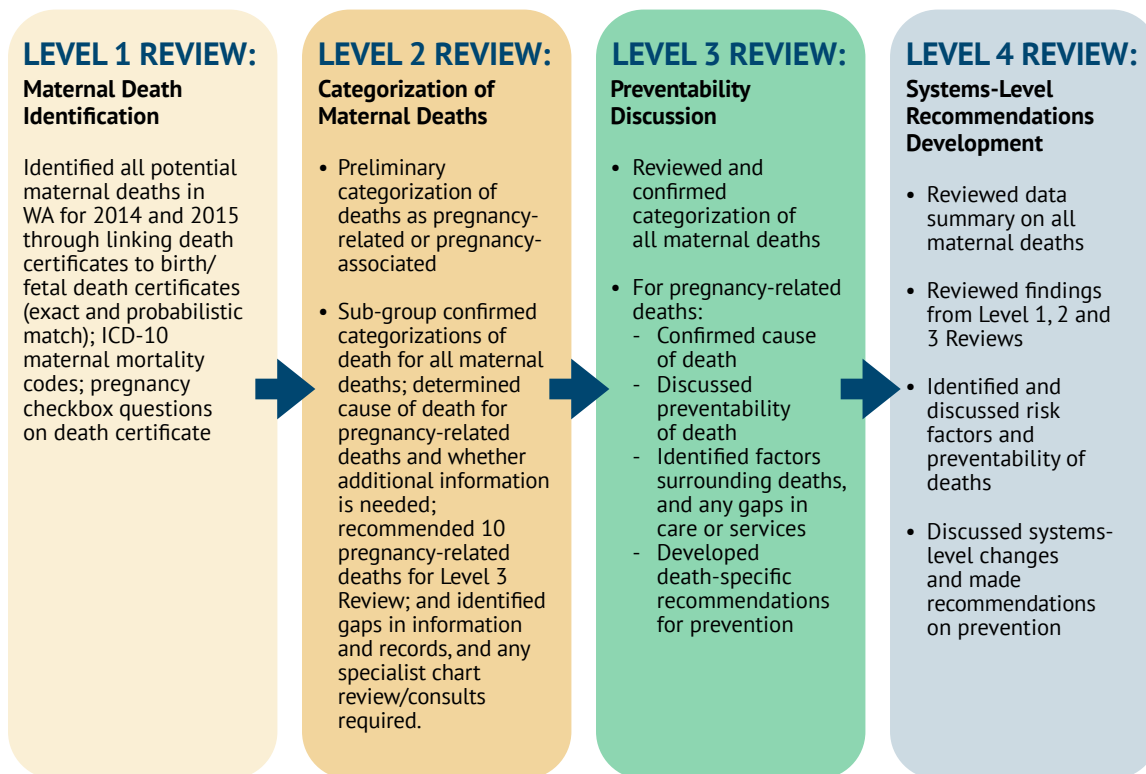
Methods

Maternal Mortality Review Panel

The Washington State Department of Health (DOH) appointed 60 women's health care and services providers to the maternal mortality panel. The members represent diverse cultural and ethnic groups, geographic regions, and professional backgrounds. All panel members were nominated by DOH and appointed by the Secretary of Health. The DOH Tribal Liaison worked with the American Indian Health Commission and tribal representatives to identify participants for the panel. Panel members represented various disciplines, including obstetrics and gynecology, forensic pathology, nurse-midwifery, maternal fetal medicine, family practice, genetic counseling, nursing, healthcare management, quality improvement, psychiatry, social work, mental/behavioral health, and public health.

Multi-Level Maternal Mortality Review Process

To fulfill the requirements of the law within the timeframe and with the resources provided, DOH created a multi-level process which allowed for the review of all maternal deaths at some level, and prioritized medical causes of death and those determined to be pregnancy-related for review to determine causation and preventability.



LEVEL 1: MATERNAL DEATH IDENTIFICATION

Maternal death or maternal mortality are used interchangeably in this report. DOH defined maternal death according to RCW 70.54.450 as the death of a woman while pregnant or within one year of delivery or following the end of a pregnancy, whether or not the woman's death is

related to or aggravated by the pregnancy. Potential deaths for review include all women of reproductive age (15-44) who were Washington State residents at the time of death, and who died in Washington in 2014 or 2015. Washington residents who died in other states are not included in the reviews because of the difficulty of obtaining records from other states.

DOH identified maternal deaths that occurred within 365 days of delivery or end of pregnancy through multiple methods. The Center for Health Statistics (CHS) of the Department of Health linked death certificates of women aged 18 years and above to birth/fetal death certificates using probabilistic matching of a combination of identifiers including Social Security number, infant name, date of birth, and parents' names. A probabilistic match allows the linkage of death certificates to birth/fetal death certificates when slight variations in records exist. Additional maternal deaths were identified from death certificates using 1) the underlying cause of death (ICD-10 codes (O00-O99) for maternal mortality (Appendix D, CDC Maternal Mortality Review Case Form) or 2) information from the pregnancy checkbox. Officials who certify a death use the pregnancy checkbox on death certificates to indicate if the decedent died while pregnant or within one year of a pregnancy, or if her pregnancy status was unknown. DOH identified 73 maternal deaths through these methods, of which 83% were found through probabilistic matching of linked maternal death certificates to birth/fetal death certificates, and the remainder were found through ICD-10 codes (see Appendix D for a list) for maternal mortality. Upon further review, three identified deaths did not meet the case definition and were excluded, resulting in a total of 70 maternal deaths for review for calendar years 2014-2015.

Washington State does not collect records of fetal deaths that occur within the first 20 weeks of gestation (RCW 70.58.150). In addition, DOH did not identify maternal deaths linked to abortions within the year prior to death. This is because abortion data does not have any identifiable information. A maternal death associated with abortion would be identified if a death certificate mentioned a previous abortion as a contributing cause of death or the pregnancy check box indicated pregnancy in the year prior to death and the medical record noted the abortion.

LEVEL 2 REVIEW: CATEGORIZATION OF MATERNAL DEATHS

DOH evaluated the cause of each maternal death and categorized the death as either pregnancy-related or pregnancy-associated, using a Cause of Death Decision Guideline (Appendix D).

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 (Appendix D, CDC Maternal Mortality Review Form, 2016). Specific diagnoses, and timelines of death and diagnoses, are based on Cause of Death Decision Guidelines.

Pregnancy-associated death – not related: The death of a woman from any cause during pregnancy or within one year of the end of pregnancy that is not pregnancy-related (Appendix D, CDC Maternal Mortality Review Form, 2016). This includes motor vehicle accidents (MVA), cancer, homicide, suicide, overdose, other accidents, and some seizures.

Based on preliminary categorization of maternal deaths, DOH designated 19 deaths as pregnancy-related or possibly pregnancy-related, and 51 deaths as pregnancy-associated deaths. After further investigation, DOH determined that one of the 70 maternal deaths was identified in error. This resulted in a total of 69 maternal deaths for review.

DOH abstracted information from available records including birth/fetal death and death certificates, medical records for prenatal care visits, hospitalizations, office and emergency room visits, and autopsy and/or coroner reports. All information was entered into CDC's Maternal Mortality Review Data System (MMRDS). A Core Summary with critical information – including maternal age, race/ethnicity, underlying cause of death, and pregnancy outcome – was generated for each pregnancy-related and pregnancy-associated death.

Due to time and resource constraints, DOH prioritized pregnancy-related or possibly pregnancy-related deaths for review of causation and preventability of deaths. To facilitate this process, perinatal nurse consultants at DOH reviewed and abstracted information from all available medical records and autopsy reports, and prepared a medical narrative for each of the 19 pregnancy-related and possibly pregnancy-related death. To ensure confidentiality and in accordance with the law, DOH removed all personal identifying information from the data, records, and medical narratives prior to review by the MMRP, including: patient, family, healthcare provider, healthcare facility, and healthcare staff names; all street addresses, city, and county; dates of birth, telephone numbers, social security numbers, medical and visit record numbers, insurance identification numbers, and any other item that had the potential to identify a death. Dates of service were maintained to help DOH and panel members determine a timeline of the events which led to death, and ultimately, whether a death was preventable.

A sub-group (two maternal-fetal medicine specialists, an obstetrician/gynecologist, a certified midwife, and a forensic pathologist) of the larger panel reviewed medical narratives developed from review of medical records for prenatal care visits, hospitalizations, office and emergency room visits, autopsy and/or coroner reports, and data from the birth/fetal death and death certificates to confirm the preliminary death categorizations for both pregnancy-related and associated deaths. They were asked to participate in this part of the review process because of their experience with maternal mortality reviews. The sub-group reviewed medical narratives and Core Summary data for the 19 pregnancy-related or possibly pregnancy-related deaths, and determined the underlying and immediate cause of death for each woman. They also identified deaths which required further discussion among a larger panel, including pregnancy-related deaths that were medically complex, unique or with teaching potential, or preventable. At the conclusion of this review, the group designated 16 of the deaths as pregnancy-related, and 53 of the deaths as pregnancy-associated. The group also identified additional information that was needed to support a more thorough review and determination of underlying cause of death.

LEVEL 3 REVIEW: PREVENTABILITY DISCUSSION

Eighteen panel members – including maternal-fetal medicine specialists, obstetrician/gynecologists, family practice providers, certified nurse midwives, social workers, and a forensic pathologist – participated in the Level 3 Review of pregnancy-related deaths. They were chosen strategically to ensure diversity in clinical, cultural, professional, and geographic experience. The number of members to participate at this level was chosen based on what other state

maternal mortality review programs reported worked well. The panel reviewed and discussed more complete medical narratives and Core Summary data for all 16 pregnancy-related deaths. For each of the pregnancy-related deaths, panel members confirmed the underlying and immediate causes of death, and determined whether the death was preventable and the degree to which it was preventable. If a death was preventable, the panel identified factors that may have contributed to the death and developed specific recommendations on prevention and intervention. DOH and the Washington MMRP defined preventability according to CDC guidelines. A maternal death is considered preventable when the MMRP determined that there was at least some chance of a death being averted by one or more measurable changes to the patient, family, community, provider, facility, and/or system factors. For the purposes of this maternal mortality review, the timeframe considered for preventability is during pregnancy or within the first year after the end of the pregnancy.³⁰

LEVEL 4 REVIEW: SYSTEMS-LEVEL RECOMMENDATIONS DEVELOPMENT

Over 40 panel members convened for the final stage of the review process, or Level 4 Review, including maternal-fetal medicine specialists, obstetrician/gynecologists, family practice providers, certified nurse midwives, licensed midwives, social workers, forensic pathologists, nurse managers, and healthcare administrators. The primary goal during this level of review was to develop recommendations for healthcare and systems changes to prevent maternal deaths (pregnancy-related and –associated deaths) and improve women’s healthcare based on the findings from the review of 2014-2015 maternal deaths. DOH presented summaries of findings from the prior stages of review, which included social demographic characteristics of the decedents, causes of death, and manner of death. *Cause of death* is the medical reason for a death. *Manner of death* refers to whether the death was natural, unintended, suicide, homicide, undetermined or pending.

To develop the recommendations, DOH asked the panel to participate in discussion workgroups. A total of seven workgroups were hosted, each focused on deaths with a similar diagnosis or the same broad cause of death category. Workgroup topics were identified during the review of the 2014 and 2015 deaths, and included hemorrhage, ectopic pregnancy, suicide and drug overdose. It should be noted that suicide and drug overdose are pregnancy-associated, not related, so the records available for review were less complete than those for pregnancy-related deaths. The panel members had the opportunity to participate in two self-selected workgroups, with 10-15 members in each group. Group facilitators helped panel members review findings, discuss deaths and factors surrounding the deaths, and develop potential healthcare and policy-level recommendations on the prevention of that particular cause of maternal deaths. Members had the opportunity to share individual group-level recommendations with the entire review panel.

³⁰ Snohomish County Government. (2016). Cause and Manner of Death. Retrieved at <https://snohomishcountywa.gov/806/Cause-Manner-of-Death>

DATA ANALYSIS

DOH epidemiologists calculated maternal mortality ratios for all maternal deaths, pregnancy-related deaths, pregnancy-associated deaths, and deaths by race and ethnicity. Maternal mortality ratio is the number of deaths per 100,000 live births during a specified time period and is used to describe maternal deaths in aggregate and to compare to national and other state rates of maternal deaths, as well as to look at differences across at-risk groups.

DOH did not perform statistical tests due to the relatively small number of deaths. DOH will conduct statistical testing as more deaths are identified during subsequent years of review. The results presented in this report are purely descriptive in nature. Information on mother's age, education level, marital status, race and ethnicity, insurance coverage, and rural or urban location of birth and death were obtained from birth certificates. If the information was not available in the birth certificate, available information from the medical record or death certificate (for example, race/ethnicity or BMI) was used.

DOH reviewed group discussion notes and recommendations offered during the final review process, and collated notes and recommendations from all the discussion groups under broad themes, and included the MMRP key recommendations in this report.

Findings and Results

Maternal Deaths in Washington, 2014–2015

The Department of Health completed file linkages to identify maternal deaths in 2014 and 2015. Seventy-three deaths were initially identified using the linked maternal death file. Four deaths were excluded after review, resulting in 69 maternal deaths. The four excluded maternal deaths included: a non-Washington resident who died in Washington, a Washington resident who died of Motor Vehicle Accident (MVA) in a different state, a cardiomyopathy death that occurred years post-delivery, and one case of documentation error.

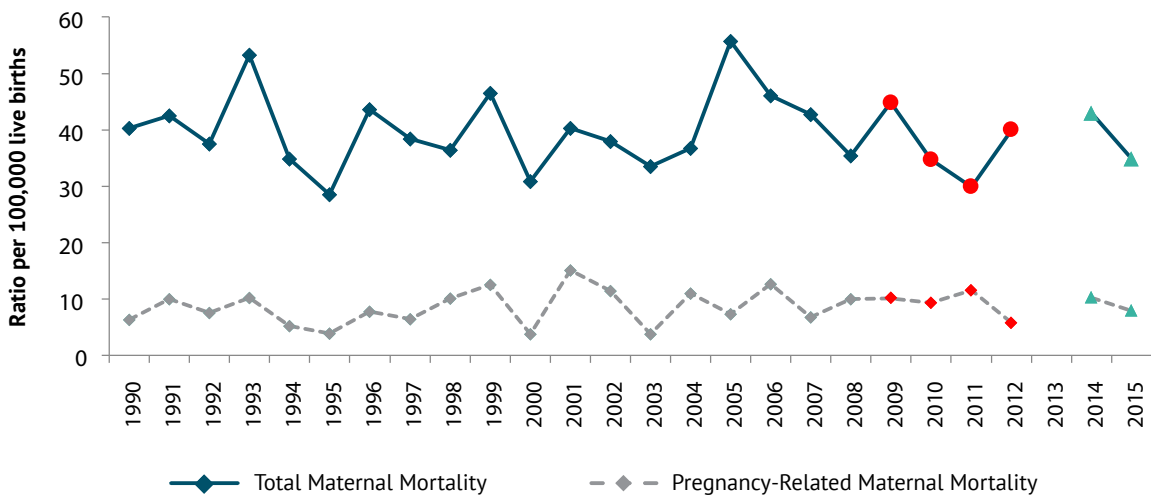
TABLE 1: Total Pregnancy-Related and Pregnancy-Associated Maternal Deaths, Washington State, 2014–2015

	2014		2015		2014–2015	
	Deaths	Ratio^ (95% CI)*	Deaths	Ratio^ (95% CI)*	Deaths	Ratio^ (95% CI)*
Total maternal deaths	38	42.9 (30.4, 58.9)	31	34.8 (23.7, 49.4)	69	38.9 (30.2, 49.2)
Pregnancy-related	9	10.2 (4.6, 19.3)	7	7.9 (3.2, 16.2)	16	9.0 (5.2, 14.6)
Pregnancy-associated	29	32.7 (21.9, 47.0)	24	27.0 (17.3, 40.1)	53	29.8 (22.4, 39.0)
Live Births	88,561		89,000		177,561	

^Ratio per 100,000 live births, *95% confidence interval

Figure 2 expands upon the mortality ratios displayed in Figure 1, and includes 2009–2012 and the 2014–2015 mortality ratios that were determined during the 2016/2017 MMRP process. It is important to note differences in the source of maternal mortality data across time periods, which may limit the comparability of the displayed maternal mortality ratios.

FIGURE 2: Total Maternal Mortality Ratio and Pregnancy-Related Maternal Mortality Ratio (deaths per 100,000 live births), Washington State 1990–2015*

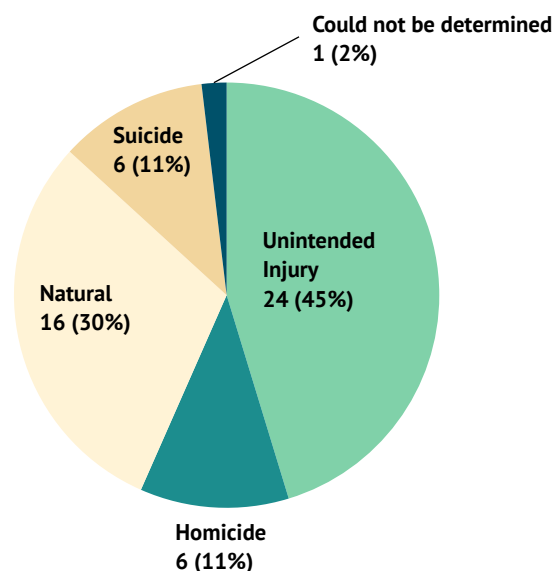


*1990-2008 Review limited to birth, death, and hospitalization records; 2009-2012 Review is limited to birth and death records and shows the maximum rate; No Review of data for 2013; 2014-2015 Review based on birth, death, hospitalization, medical records, autopsies, and other available records.

Pregnancy-Associated Deaths in Washington, 2014–2015

The MMRP determined that 53 of the 69 (76.8%) maternal deaths were pregnancy-associated, referring to the death of a woman from a cause during pregnancy or within one year of the end of pregnancy that is not related to or exacerbated by the pregnancy. The MMRP was unable to determine whether two deaths were pregnancy-related, so they were categorized as pregnancy-associated deaths. The most frequent manner of death among pregnancy-associated deaths was unintended injury (n=24 cases), and followed by 16 natural deaths, six homicide, six suicide, and one undetermined manner of death (Figure 3). Natural death is defined by the National Association of Medical Examiners (NAME) as a death “...due solely or nearly totally to disease and/or the aging process.”³¹

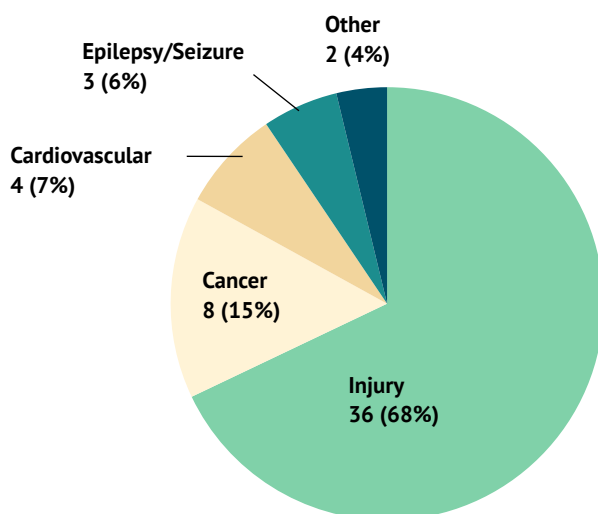
FIGURE 3: Manner of Death for Pregnancy-Associated Maternal Deaths (n= 53), Washington State, 2014–2015



³¹ Hanzlick, R., Hynsaker III, J.C., Davis, G.J. (2002). A guide for manner of death classification. First Edition. The National Association of Medical Examiners. Retrieved at <https://netforum.avectra.com/public/temp/ClientImages/NAME/4bd6187f-d329-4948-84dd-3d6fe6b48f4d.pdf>

The most frequent cause of death for the 53 pregnancy-associated maternal mortality deaths was injury (n=36 deaths), followed by cancer (n=8), cardiomyopathy or cardiovascular disease (n=4), epilepsy or seizure (n=3), and asthma (n=1) (Figure 4).

FIGURE 4: Cause of Death for Pregnancy-Associated Maternal Deaths (n= 53), Washington State, 2014–2015



Nineteen percent (n=10 deaths) of pregnancy-associated maternal mortalities occurred during pregnancy, 15% (8) occurred within 42 days of pregnancy, and 66% (35) were pregnant between 43 and 365 days of death (Table 2). Thirty-four women who died of a cause not related to pregnancy delivered a live birth, eight deliveries resulted in a fetal death, and for 11 deaths the pregnancy outcome wasn't known, was due to ectopic pregnancy or fetal demise before 20 weeks' gestation.

TABLE 2: Causes and Manner of Death and Pregnancy Status at Time of Death Based on Death Certificate, Washington State, 2014–2015

Pregnancy-associated deaths	Pregnant at time of death	Pregnant within 42 days of death	Pregnant 43 to 365 days of death	Total deaths
Intentional injury				
Suicide*	0	2	4	6
Homicide**	1	0	5	6
Unintentional injury				
Motor vehicle accident	5	0	7	12
Overdose, accidental	2	3	4	9
Non-injury related				
Cancer	0	0	8	8
Seizure	0	1	2	3
Cardiac	1	1	2	4
Other (Drowning, Asthma, Fall, Other)	1	1	3	5
Total	10	8	35	53

*Includes 1 intentional overdose

** Includes 1 Motor Vehicle Accident

Demographic Characteristics of Pregnancy-Associated Deaths

The majority of pregnancy-associated maternal deaths occurred among non-Hispanic (NH) white women (51%), followed by Hispanic/Latina women (13%), and NH black women (11%) (Table 3). The highest pregnancy-associated maternal mortality ratios were observed among NH American Indian/Alaska Native women, with 196.2 maternal deaths per 100,000 live births (95% CI: 63.7, 457.8), and among NH black women with 78.4 per 100,000 live births (95% CI: 28.8, 170.7). The maternal mortality ratio for NH American Indian/Alaska Native women was higher than the ratios for the race/ethnicity categories with the lowest maternal mortality rates, NH whites (24.9, 95% CI: 16.4, 36.3) and Hispanic/Latinos (22.0, 95% CI: 8.9, 45.4).

TABLE 3: Pregnancy-Associated Maternal Deaths and Mortality Ratios by Race/Ethnicity, Washington State, 2014–2015

Race/ethnicity	Deaths	Percent	Live births	Mortality Ratio	95% CI
Hispanic	7	13%	31,799	22.0	(8.9, 45.4)
Non-Hispanic-White	27	51%	108,255	24.9	(16.4, 36.3)
Non-Hispanic-Black	6	11%	7,650	78.4	(28.8, 170.7)
Non-Hispanic-Asian	5	9%	16,565	30.2	(9.8, 70.7)
Non-Hispanic-American Indian or Alaska Native	5	9%	2,549	196.2	(63.7, 457.8)
Non-Hispanic-Native Hawaiian or other Pacific Islander	0	0%	2,210	0	(0, 135.6)
Multiple race	3	6%	7,006	42.8	(8.8, 125.1)
Other/unknown	0	0%	1,527	0	(0, 196.2)
Total	53	100%	177,561	29.8	(22.4, 39.0)

*Deaths per 100,000 live births

Table 4 describes the age, educational attainment, and pre-pregnancy Body Mass Index (BMI) of the pregnancy-associated deaths. Eighty-seven percent (n=46 deaths) of pregnancy-associated maternal deaths were to women aged 20 to 39 years, 9% (5) were aged 40 or older, and 4% (2) were under age 20. Seventy-three percent (n=39 deaths) of the pregnancy-associated maternal deaths occurred among women who had attained a high school/GED or post-secondary education, 23% (12) had less than a 12th grade education, and 4% (2) did not specify their level of educational attainment. Pre-pregnancy BMI information was missing from 16 of the 53 pregnancy-associated deaths (30%). Of the 37 deaths for which pre-pregnancy BMI information was available, 18 (49%) were normal weight, nine (24%) were overweight, nine (24%) were obese, and 3% (1) were underweight.

TABLE 4: Pregnancy-Associated Maternal Deaths by Maternal Age, Education, and Pre-Pregnancy BMI, 2014–2015

	Deaths	Percent	Live births	Percent
Age				
Under 20 years	2	4%	7,931	4%
20-29 years	25	47%	85,580	48%
30-39 years	21	40%	78,313	44%
40 years and above	5	9%	5,718	3%
Total	53	100%	177,561	100%
Education				
Less than 12th grade	12	23%	22,136	13%
High school/GED completed	14	26%	39,433	22%
Some college or degree	25	47%	114,341	65%
Not specified	2	4%	1,651	1%
Total	53	100%	177,561	100%
Pre-pregnancy BMI*				
Normal	18	49%	76,720	46%
Underweight	1	3%	4,604	3%
Overweight	9	24%	44,377	26%
Obese class I (30–34.9)	5	14%	23,204	14%
Obese class II (35–39.9)	2	5%	11,377	7%
Obese class III (>40)	2	5%	7,899	5%
<i>Missing</i>	16	--	9,380	--
Total	37	100%	177,561	100%

*Pre-pregnancy BMI based on single source (mother's report of weight on birth or fetal death certificate). Large proportion of birth and fetal death certificates are missing this information.

Pregnancy-Related Deaths in Washington, 2014–2015

The MMRP determined that 16 of the 69 (23.2%) maternal deaths were pregnancy-related, referring to 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. The most frequent cause of death among pregnancy-related deaths was hemorrhage (n=5 deaths), followed by hypertensive disorders of pregnancy (3), amniotic fluid embolism (2), ectopic pregnancy (2), and three deaths were due to non-cardiovascular disease, including infection or sepsis (1), cancer (1), undiagnosed autoimmune disorder (1). There was one death in which the exact cause of death could not be identified because DOH did not have access to the medical records (Table 5).

TABLE 5: Causes of Death and Pregnancy Status at Time of Death Based on Death Certificate, Washington State, 2014–2015

Pregnancy-related deaths	Pregnant at time of death	Pregnant within 42 days of death	Pregnant 43 to 365 days of death	Total
Hemorrhage	2	3	0	5
Hypertensive disorders of pregnancy	0	3	0	3
Amniotic fluid embolism	0	2	0	2
Ectopic pregnancy	0	2	0	2
Infection/sepsis	1	0	0	1
Non-cardiovascular disease	1	1	1	3
Total	4	11	1	16

Ten women who died of pregnancy-related maternal causes delivered live births, four experienced fetal deaths, and two women had ectopic pregnancies (Table 6). Twenty-five percent (n=4) of pregnancy-related maternal deaths occurred during pregnancy, 69% (11) occurred within 42 days of pregnancy, and 6% (1) were pregnant between 43 and 365 days of death. Ten of the 11 (91%) maternal deaths that occurred within 42 days of pregnancy occurred during the first seven days postpartum. Among live born infants (n=10 live births), eight were delivered through medically indicated Caesarean section and two were delivered vaginally. Of the six fetal deaths, four were not delivered as a result of maternal death and fetal demise, one was delivered through Caesarean section, and one was delivered vaginally.

TABLE 6: Pregnancy Outcomes for Pregnancy-Related Maternal Deaths, Washington State, 2014–2015

	Ectopic Pregnancy (0-19 weeks)	Fetal Death (20+ weeks)	Live Birth	Total
Pregnant at time of death	2	2	--	4
Pregnant within 42 days of death	0	2	9	11
Pregnant 43 to 365 days of death	0	0	1	1
Total	2	4	10	16

Demographic Characteristics of Pregnancy-Related Deaths

Forty-four percent of pregnancy-related maternal deaths occurred among Hispanic/Latina women (n=7 deaths), and 38% (6) occurred among NH white women. The remaining three maternal deaths occurred to a NH American Indian/Alaska Native, one NH Native Hawaiian/Pacific Islander woman, and a woman with multiple races reported.

TABLE 7: Pregnancy-Related Maternal Deaths and Mortality Ratios by Race and Ethnicity, Washington State, 2014–2015*

Race/ethnicity	Deaths	Percent	Live births	Mortality Ratio	95% CI
Hispanic	7	44%	31,799	22.0	(8.9, 45.4)
Non-Hispanic-White	6	38%	108,255	5.5	(2.0, 12.1)
Non-Hispanic-Black	0	0%	7,650	0	(0, 39.2)
Non-Hispanic-Asian	0	0%	16,565	0	(0, 18.1)
Non-Hispanic-American Indian or Alaska Native	1	6%	2,549	39.2	(1.0, 218.6)
Non-Hispanic-Native Hawaiian or other Pacific Islander	1	6%	2,210	45.2	(1.1, 252.2)
Multiple race	1	6%	7,006	14.3	(0.4, 79.5)
Other/unknown	--		1,527		
Total	16	100%	177,561	9.0	(5.2, 14.6)

*Deaths per 100,000 live births

Table 8 describes the age, educational attainment, marital status, rural/urban status, insurance coverage, pre-pregnancy BMI, and prenatal care initiation of the pregnancy-related maternal deaths. All but one pregnancy-related death was among women aged 20-39. The remaining woman was less than 20 years at death. Thirty-one percent (n=5 deaths) of pregnancy-related deaths had less than a 12th grade education, and the remaining 69% (11) had attained a high school/GED or post-secondary education. Seventy-five percent (12) of women who died from a cause related to pregnancy-related were married at the time of their death. Fifty-six percent (9) of the pregnancy-related deaths lived in districts designated as urban cores, 6% (1) lived in a large rural community, and 38% lived in suburban (3) and small town/isolated rural areas (3). Seventy-five percent (12 deaths) of women who died from pregnancy-related causes received Medicaid benefits during their pregnancy. Other insurance coverage includes 13% (2) who had Tricare/Department of Defense insurance coverage, and 13% (2) who had private health insurance at the time of their death. One (6%) woman who died of a pregnancy-related cause was classified as “normal weight” by her pre-pregnancy BMI score. The remaining 15 women were overweight (4) or obese (9). Five of these women fell into class III obesity (BMI>40). All but one woman who died of a pregnancy-related cause initiated prenatal care in the first trimester (94%).

TABLE 8 (Part One): Pregnancy-Related Deaths by Maternal Demographics, Washington State, 2014–2015

	Deaths	Percent	Live births	Percent
Age				
Under 20 years	1	6%	7,931	4%
20-29 years	3	19%	85,580	48%
30-39 years	12	75%	78,313	44%
40 years and above	0	0%	5,718	3%
Total	16	100%	177,561	100%
Education				
Less than 12th grade	5	31%	22,136	13%
High school/GED completed	4	25%	39,433	22%
Some college or degree	7	44%	114,341	65%
Not specified	0	0%	1,651	1%
Total	16	100%	177,561	100%
Marital Status				
Married	12	75%	56,642	32%
Divorced/not married/widowed/unknown	4	25%	120,919	68%
Total	16	100%	177,561	100%
Rural/Urban				
Small town/isolated rural area	3	19%	7,383	4%
Sub-urban	3	19%	14,912	8%
Large rural	1	6%	13,994	8%
Urban core	9	56%	141,130	80%
Total	16	100%	177,419[^]	100%
Insurance Coverage				
Medicaid	12	75%	84,712*	49%
Department of Defense – TriCare	2	13%	**	--
Private health insurance	2	13%	**	--
Total	16	100%	177,561	100%

(Table 8 continued on next page)

TABLE 8 (Part 2): Pregnancy-Related Deaths by Maternal Demographics, Washington State, 2014–2015

	Deaths	Percent	Live births	Percent
Pre-pregnancy BMI***				
Underweight	0	0%	4,604	3%
Normal	1	6%	76,720	46%
Overweight	4	25%	44,377	26%
Obese class I (30–34.9)	3	19%	23,204	14%
Obese class II (35–39.9)	3	19%	11,377	7%
Obese class III (>40)	5	31%	7,899	5%
Missing	--	--	9,380	--
Total	16	100%	177,561	100%
Prenatal Care				
Early prenatal care (1st trimester)	15	94%	134,118	76%
2nd trimester	0	0%	24,005	14%
Late/no prenatal care	1	6%	8,986	5%
Unknown	0	0%	10,452	6%
Total	16	100%	177,561	100%

* Number of deliveries covered by Medicaid. There were a total of 172,968 deliveries in 2014-2015. Department of Social and Health Services, First Steps Database, 2014-2015.

** Insurance information to differentiate between DOD and Private health insurance is not available.

^ 142 births were not codeable to RUCA classification due to missing zip code or imprecise address information.

*** Multiple source: Hierarchical determination of BMI based on multiple sources – Pre-pregnancy BMI based on birth or fetal death certificate; if BMI available on Medical Record differed from birth certificate and was pre-pregnancy or at first prenatal care visit < 10 weeks gestation then Medical Record was used; if no medical record source or birth/fetal death certificate, but recorded on autopsy and significantly higher than 40, pre-pregnancy BMI was recorded as Obese class 3.

Factors Contributing to Pregnancy-Related Deaths

As part of the qualitative review process and as directed by the Washington maternal mortality review law, the multidisciplinary MMRP works to identify *factors* which contributed to pregnancy-related deaths. Factors identified by the MMRP were organized into five groups using the *CDC Case Discussion Form* as an example: individual and family factors, provider factors, facility factors, community factors, and systems-level factors. The panel also identified issues which contribute to the quality of maternal mortality surveillance and thus our ability to better understand the factors surrounding the deaths. For more information about these factors, see Berg et al., 2001.³² The following contributing factors to pregnancy-related deaths list identified by the MMRP is specific to the 2014 and 2015 pregnancy-related deaths and may change in subsequent reviews:

³² Berg, C., Danel, I., Atrash, H., Zane, S., & Bartlett, L. (2001). Strategies to reduce pregnancy-related deaths: from identification and review to action.

Washington State Maternal Mortality Review 2014-2015 Deaths: Contributing Factors to Pregnancy-Related Deaths

Individual and Family Factors

- Individual, family, cultural, and religious beliefs that guide decisions about medical treatment which affect healthcare outcomes
- Personal lifestyle choices which affect overall health, and impact pregnancy and delivery (including substance use, diet, exercise)
- Lack of social or familial support, postpartum
- Comorbidities
 - High Body Mass Index (BMI)
 - History of pregnancy complications
 - Mental illness
 - Chronic disease
- Lack of reproductive health and conception counseling (may be lack of access and/or knowledge)

Healthcare Provider Factors

- Delays in early referrals to specialists and/or to a higher level of care early during pregnancy and/or treatment of adverse event
- Late diagnosis, or failure to diagnose, hypertensive disorders of pregnancy; and inadequate medication dosage
- Inadequate follow up in the early postpartum period, or after an ED/hospital visit
 - For follow-up care needs
 - For mental health needs and care coordination
 - For women with little to no social/family support at discharge
 - During first few days after postpartum discharge and after 42-day period
- Delayed surgical intervention
- Delayed anticoagulation prophylaxis, and recognition of the need for anticoagulation prophylaxis
- Poor consideration for how pregnancy history correlates to current health risks
- During preconception visits, not all providers are helping women manage chronic disease and improve health before pregnancy
- Variations in quality of prenatal screening process and disease management during pregnancy

Healthcare Facilities Factors

- Facility lack of capacity and standardized protocols to accommodate pregnant women with high BMI
- Inadequate postpartum or post discharge follow-up protocols to assess women for overall health and well-being
- Lack of facility-based home visiting services
- Limited access to adequate language services
- Difficulty determining facility capacity for levels of maternal care

Systems Factors

- Lack of information sharing between hospital facilities and providers about maternal resources that are available
- Variability in the quality of care and treatment received by patients based on race/ethnicity, lifestyle choices, and mental health diagnosis
- Difficulty and delays in transferring patients to higher level of care due to lack of hospital bed availability
- Difficulty accessing mental health care for pregnant women when needed
- Lack of identification of maternal deaths by providers across the state
- Absence of mechanism for notifying providers/facilities of a maternal death that occurs outside of the facility
- Lack of access to universal home visiting services through existing programs due to restrictive criteria that excludes many women, and due to inconsistent availability statewide
- Variation in quality and criteria of maternal death autopsy

Community Factors

While the MMRP did not identify specific community factors that contributed to the deaths of the 2014 and 2015 cohort, DOH and the MMRP recognize that community factors (access to reliable transportation, employment, healthy food and safe outdoor recreation) affect maternal health outcomes.

Preventability of Pregnancy-Related Deaths

Once the MMRP identifies contributing factors to death, a determination is made about whether the factors are potentially avoidable, and whether there were opportunities to prevent a specific death. Similar to the CDC, the MMRP considered a maternal death *preventable* when there was at least some chance of a death being averted by one or more measurable changes to the patient, family, community, provider, facility, and/or systems factors. The timeframe of preventability is related to changes which could be made during pregnancy or within the first year after the end of the pregnancy. (Table 9)

- The MMRP found that contributing factors in eight of the 16 pregnancy-related deaths (50%) were potentially avoidable and that the deaths were preventable.
- For six of the pregnancy-related deaths, the deaths were unpreventable.
- Preventability could not be determined for two pregnancy-related deaths due to the nature of the death or the lack of access/availability of records to investigate the death.

TABLE 9: Pregnancy-Related Deaths by Cause of Death and Preventability, Washington State, 2014–2015 (as determined by MMRP)

Pregnancy-Related Deaths	Not a Preventable Death	Preventable Death	Unable to Determine Preventability	Total
Hemorrhage	2	2	1	5
Hypertensive Disorders of Pregnancy		3		3
Amniotic Fluid Embolism	2			2
Ectopic Pregnancy		2		2
Infection/Sepsis		1		1
Non-Cardiovascular Disease	2		1	3
Total	6	8	2	16

Discussion

The overall Washington State maternal mortality and pregnancy-related mortality ratios have historically been lower than the national ratios. The review of 2014 and 2015 deaths indicates that the Washington State pregnancy-related maternal mortality ratio of 9.0 per 100,000 for 2014–2015 remains lower than national estimates. Two recent articles have estimated national pregnancy-related maternal mortality ratios between 17.3 per 100,000 live births in 2013 and 23.8 per 100,000 live births in 2014.^{33, 34} While the Washington MMRP methods aren't directly comparable to the methods used by MacDorman et al. (2016), the Washington State estimate, determined using similar methodology, was 12.4 (95% CI 10.0-13.0) per 100,000 between 2005 and 2014. This was statistically lower than the national ratio for the same time period (17.2 per 100,000; 95% CI 16.8, 17.3). Overall, state ratios varied between 5.6 per 100,000 in

³³ Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion. (2017). Pregnancy Mortality Surveillance System. Centers for Disease Control and Prevention (CDC). Retrieved from: <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>

³⁴ MacDorman, M. F., Declercq, E., Cabral, H., & Morton, C. (2016). Is the United States Maternal Mortality Rate Increasing? Disentangling trends from measurement issues Short title: US Maternal Mortality Trends. *Obstetrics and gynecology*, 128(3), 447.

Massachusetts to 38.8 per 100,000 in the District of Columbia.³⁵ Washington ranked 17th among the 50 states and District of Columbia.

Over the last two decades, the overall maternal mortality and pregnancy-related maternal mortality ratios in Washington have not increased statistically and remain lower than the national rate. Rates have fluctuated between 28.5 and 55.7 for the overall maternal mortality ratio and between 3.7 and 15.1 for the pregnancy-related maternal mortality ratio. Conversely, the national rate has steadily increased over the last three and a half decades. This is after a significant decline from about 1,000 deaths per 100,000 live births at the turn of the 20th century to only eight deaths per 100,000 births in the 1980s.³⁶ Some estimates suggest the maternal mortality rate in the U.S. has increased by almost 30 percent since 2000.³⁷ These rates are high when compared to other developed countries and do not seem to be improving. Specific causes for the increase in the maternal mortality ratio in the United States are not well understood. Some research attributes recent increases to changes in how maternal deaths are identified or how maternal mortality surveillance is conducted, including the addition of a pregnancy question to the standard U.S. death certificate which may have improved identification of maternal deaths.³⁸

The causes and manner of death for maternal deaths in Washington are comparable to other state findings. During 2014-2015, 70% of pregnancy-associated deaths were injury-related, including nine (13%) unintentional overdoses, 12 (17%) unintentional motor vehicle accidents, 6 (9%) suicide deaths, and six (9%) homicide deaths. Between 1990 and 2005, 8% of maternal deaths in Washington were suicide, 13% were homicide, and 27% were motor vehicle accidents. Approximately 10% were overdose deaths. Other maternal mortality reviews also indicate that drug overdose and toxicity are significant causes of death. In Florida, 25% of pregnancy-associated deaths were drug-related in 2014, 27% were drug-related in Ohio between 2008-2012, 15% were drug-related in Georgia in 2012.

The most common causes of pregnancy-related deaths were hemorrhage (31%) and hypertensive disorders of pregnancy (19%). Other causes included amniotic fluid embolism, ectopic pregnancy, and infection/sepsis. Given the small number of deaths reviewed and changes in definitions of pregnancy-related deaths, it is difficult to assess changes over time for causes of pregnancy-related deaths. Reviews between 1990 and 2005 indicated that causes of pregnancy-related death were fairly evenly distributed, with slightly more deaths due to infection or cardiac and cardiovascular conditions.³⁹ Nationally, the Pregnancy Mortality Surveillance System indicates that cardiovascular disease, infection/sepsis, hemorrhage, and cardiomyopathy are some of the most common causes of pregnancy-related deaths.⁴⁰ The causes of pregnancy-related deaths

³⁵ Moaddab, A., Dildy, G.A., Brown, H.L., Bateni, Z.H., Belfort, M.A., Sahgi-Haghpeykar, H., Clark, S.L. (2016). Health Care Disparity and State-Specific Pregnancy-Related Mortality in the United States, 2005-2014. *Obstetrics & Gynecology*, 128(4): 869-875.

³⁶ King, J. C. (2012, February). Maternal mortality in the United States-why is it important and what are we doing about it?. In *Seminars in perinatology* (Vol. 36, No. 1, pp. 14-18). WB Saunders.

³⁷ Moaddab, A., Dildy, G.A., Brown, H.L., Bateni, Z.H., Belfort, M.A., Sahgi-Haghpeykar, H., Clark, S.L. (2016). Health Care Disparity and State-Specific Pregnancy-Related Mortality in the United States, 2005-2014. *Obstetrics & Gynecology*, 128(4): 869-875.

³⁸ MacDorman, M. F., Declercq, E., Cabral, H., & Morton, C. (2016). Is the United States Maternal Mortality Rate Increasing? Disentangling trends from measurement issues Short title: US Maternal Mortality Trends. *Obstetrics and gynecology*, 128(3), 447.

³⁹ Wasserman, C. (2009). *Maternal mortality in Washington, 1990-2005*. Washington State Department of Health: Unpublished Data

⁴⁰ Centers for Disease Control and Prevention. (2016). Pregnancy Mortality Surveillance System, 2011-2013. Retrieved at <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pmss.html>

have shifted over time, and there are indications that the increase in chronic diseases is leading to increases in the contribution of cardiovascular conditions and infection/sepsis to pregnancy-related deaths.⁴¹

The review of 2014 and 2015 maternal deaths indicates that in Washington, maternal mortality disproportionately affects some populations of women, including non-Hispanic black women and non-Hispanic American Indian and Alaska Native women. Estimates from maternal mortality reviews in Washington from 1990-2005 suggest that NH-black and NH American Indian/Alaska Native women had significantly higher mortality ratios for all deaths within a year of delivery. Further, non-Hispanic Black and non-Hispanic Asian and Pacific Islander women combined had significantly higher pregnancy-related maternal mortality ratios.⁴² Nationally, NH-black and NH-Native American women experience greater pregnancy-related mortality.⁴³ These are all trends that were reflected in the 2014–2015 review of maternal deaths.

Overall, a high proportion of maternal deaths in Washington were to women who experienced significant social and health risk factors, including low educational attainment, low income (as identified by qualification for Medicaid), and chronic disease and obesity, which is similar to what is being seen nationally. These trends are echoed throughout the state. Over the past decade, there has been an overall increase in the percent of Washington deliveries covered by Medicaid, the percent of women with pre-pregnancy diabetes and gestational diabetes, and the percent who are morbidly obese (BMI > 40) prior to pregnancy.⁴⁴ Other states are also seeing these risk factors in their reviews. For example, the Virginia Maternal Mortality Review developed a special report dedicated to investigating how obesity affects maternal mortality. The 2009 report pointed out that women with high BMI were “overrepresented among women who die during or within one year of a pregnancy,” and that many overweight and obese pregnant women also suffered from cardiac and hypertension issues.⁴⁵ The Georgia Maternal Mortality Review reports similar key findings in their June 2015 report, stating that obesity was a “compounding factor in many (pregnancy-related deaths)” in that state.⁴⁶

Along with an increase in risk factors that affect pregnancy, the Washington MMRP identified provider and facility issues that may have contributed to maternal deaths, and are similar to issues seen in other states. As in Washington, the Georgia Maternal Mortality Review also found that healthcare access, contraception counseling, and delays in diagnosis and treatment were major factors contributing to deaths in the state. In Florida, the Pregnancy-Associated Mortality Review identified many of the same key issues in their 2014 review, which included problems with

⁴¹ Creanga, A. A., Berg, C. J., Syverson, C., Seed, K., Bruce, F. C., & Callaghan, W. M. (2015). Pregnancy-related mortality in the United States, 2006–2010. *Obstetrics & Gynecology*, 125(1), 5-12.

⁴² Wasserman, C. (2009). *Maternal mortality in Washington, 1990-2005*. Washington State Department of Health: Unpublished Data

⁴³ Bryant, A. S., Worjohloh, A., Caughey, A. B., & Washington, A. E. (2010). Racial/ethnic disparities in obstetric outcomes and care: prevalence and determinants. *American journal of obstetrics and gynecology*, 202(4), 335-343.

⁴⁴ Washington State Department of Health. (2014). Perinatal Indicators Report. Retrieved at http://www.doh.wa.gov/Portals/1/Documents/Pubs/950-153_PerinatalIndicatorsforWashingtonResidents.pdf.

⁴⁵ Kavanaugh, V.M. (2009). Obesity and maternal death in Virginia, 1999-2002. A report from the Virginia Maternal Mortality Review Team. Retrieved at http://www.vdh.virginia.gov/content/uploads/sites/18/2016/04/MMRT_obesity_final.pdf

⁴⁶ Georgia Department of Public Health. (2015). Georgia maternal mortality review: 2012 case review. Retrieved at https://dph.georgia.gov/sites/dph.georgia.gov/files/MCH/MMR_2012_Case_Review_June2015.pdf

delays in treatment, diagnosis, barriers to healthcare, lack of care coordination, and significant comorbidities among women.⁴⁷ Many states have also identified gaps in services and care during the postpartum period and a lack of coordinated services geared towards women and their children. The Maryland Maternal Mortality Review Committee identified inadequate follow-up care postpartum, specifically by a case worker, as a key finding related to substance use and maternal deaths;⁴⁸ and in their 2015 report, Georgia reports similar findings related to postpartum follow-up, especially for women with risks for complications.⁴⁹

MMRP Findings Discussion: Key Issues

During the qualitative review process, the MMRP identified contributing factors and opportunities for prevention. Combining these with the results of the data, the panel was able to identify several key issues surrounding the 2014–2015 pregnancy-related deaths, many of which led to the development of the recommendations in this report.

High Body Mass Index

The MMRP found that a higher than normal Body Mass Index (BMI) was a contributing factor in five (31%) of the pregnancy-related deaths. Available data from the 2014–2015 maternal deaths support these findings and indicate that 94% of the pregnancy-related deaths were overweight or obese before pregnancy (Table 8). The World Health Organization uses BMI to identify healthy weight standards and reports that more women than men are overweight or obese. They define being overweight as a BMI of 25 or greater and obese as a BMI of 30 or greater.⁵⁰ Weight gain during pregnancy is an issue for many women in the state, in general. The Washington State Perinatal Indicators Report states that in 2014, 47% of all pregnant women in the state gained more weight than is recommended during their pregnancy.⁵¹ CDC⁵² reports that during pregnancy, obesity puts women at greater risk for gestational diabetes, preeclampsia, and pregnancy and delivery complications. From an economic perspective, obesity during pregnancy has been shown to increase healthcare costs and can sometimes result in longer stays in the hospital after delivery. One study reviewed the relationship between length of hospital stays and increasing BMI and found that the length of hospital stays during pregnancy and the postpartum period was significantly higher among women who were extremely obese than among women with normal pregnancy weights⁵³ The increase of obesity nationally,⁵⁴ and the impact of obesity on pregnant women and on maternal mortality in Washington (and in the U.S.) suggests significant service gaps in the care of pregnant women with very high BMI and indicates clear opportunities for the prevention of maternal deaths.

⁴⁷ Hernandez, L., Brown, R., Morgan, A. (2014). Florida's pregnancy-associated mortality review: 2014 update. Florida Department of Health.

⁴⁸ Maryland Department of Health and Mental Hygiene. (2014). Maryland Maternal Mortality Review: 2014 annual report

⁴⁹ Georgia Department of Public Health. (2015). Georgia maternal mortality review: 2012 case review.

⁵⁰ World Health Organization. (2014). Obesity. Retrieved from: <http://www.wpro.who.int/mediacentre/factsheets/obesity/en/>

⁵¹ Washington State Department of Health. (2016) Perinatal indicators report. Retrieved from: http://www.doh.wa.gov/portals/1/Documents/Pubs/950-153_PerinatalIndicatorsforWashingtonResidents.pdf

⁵² Centers for Disease Control. (2016a). Pregnancy Complications. Maternal and infant health. Retrieved at <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregcomplications.htm>

⁵³ Chu, S. Y., Bachman, D. J., Callaghan, W. M., Whitlock, E. P., Dietz, P. M., Berg, C. J., & Hornbrook, M. C. (2008). Association between obesity during pregnancy and increased use of health care. *New England Journal of Medicine*, 358 (14), 1444-1453.

⁵⁴ Flegal, K.M., Kruszon-Moran, D., Carroll, M.D., Fryar, C.D., Ogden, C.L. (2016). Trends in Obesity Among Adults in the United States, 2005 to 2014. *JAMA*, 315(23): 2284-2291.

Postpartum and Beyond: Care and Services

During the review of the pregnancy-related deaths, the MMRP found that the quality and timeliness of postpartum follow-up care for many of the women was a contributing factor in their deaths and indicates gaps in services and care during this time. This period usually refers to the first 6 weeks (42 days) after delivery or the end of pregnancy. Through the review process itself, the panel found significant gaps in services during this time and a number of opportunities for intervention and improvement. The panel also found opportunities for intervention and improvement for women's care and services after the postpartum period and through the first year (365 days) after birth or the end of the pregnancy. As mentioned before, other state maternal mortality reviews have identified similar issues with postpartum care and follow-up, including Georgia, Florida, and Massachusetts. New mothers are extremely vulnerable to conditions like depression and complications from postpartum eclampsia during the first six weeks after delivery/end of pregnancy. Research suggests that up to 33 percent of eclampsia deaths happen during the postpartum period, which can lead to other serious pregnancy-related complications and even death.⁵⁵ Many symptoms appear within the first days and weeks after delivery or the end of pregnancy; others may not appear weeks, or even months after the end of pregnancy. For example, postpartum depression has been found to affect over 10 percent of women of reproductive age; however, its most severe symptoms may not appear for six weeks after delivery.⁵⁶ Research shows that women in the postpartum period are at greater risk for depression and suicide when compared to women who are still pregnant.⁵⁷ This risk is heightened when women have one or more mental health diagnoses, especially if it is a substance use or mood disorder that is not actively being treated.⁵⁸ The increased risk for a number of complications and issues emphasizes the need for improved support and services for new mothers. This period of time is so important to preventing maternal deaths, it has been called the “key to maternal mortality”⁵⁹ because this period presents many opportunities for intervention.

Substance Use and Mental Health

Substance use and mental health issues were found to be a contributing factor in at least 25% of the maternal deaths in Washington from 2014–2015. The magnitude of these issues is compounded because of the ripple effect they have that impact the mothers, their children, and their families. Further, the World Health Organization⁶⁰ reports that women with mental health diagnoses have three to five times the risk of experiencing interpersonal violence and related social problems than women without mental health diagnoses. Other state maternal mortality reviews also identify mental health and substance use as factors in maternal deaths, including

⁵⁵ Ginzburg, V.E., Wolff, B. (2009). Headache and seizure on postpartum day 5: late postpartum eclampsia. *CMAJ*. 180 (4), 425-428

⁵⁶ Robertson, E., Grace, S., Wallington, T., & Stewart, D. E. (2004). Antenatal risk factors for postpartum depression: a synthesis of recent literature. *General hospital psychiatry*, 26(4), 289-295.

⁵⁷ Gold, K.J., Singh, V., Marcus, S.M., and Palladino, C.L. (2012). Mental health, substance use, and intimate partner problems among pregnant and postpartum suicide victims in the National Violent Death Reporting System. *Gen Hosp Psychiatry* 34(2):139-145.

⁵⁸ Khalifeh, H., Hunt, I. M., Appleby, L., & Howard, L. M. (2016). Suicide in perinatal and non-perinatal women in contact with psychiatric services: 15 year findings from a UK national inquiry. *The Lancet Psychiatry*, 3(3), 233-242.

⁵⁹ Li, X. F., Fortney, J. A., Kotelchuck, M., & Glover, L. H. (1996). The postpartum period: the key to maternal mortality. *International Journal of Gynecology & Obstetrics*, 54(1), 1-10.

⁶⁰ World Health Organization (2008). *Improving maternal mental health*. Millennium development goal 5. Retrieved at http://www.who.int/mental_health/prevention/suicide/Perinatal_depression_mmh_final.pdf

Georgia,⁶¹ Florida,⁶² and Massachusetts.⁶³ Fourteen percent of all the maternal deaths in Washington State from 2014–2015 were the result of drug overdose. Substance use disorder among all populations in this state has been on the rise since 2000, and Washington regularly sees higher rates than the rest of the country.⁶⁴ The rate of death from substance use for all women in the state was 12 per 100,000 people in 2009–2011. High rates of drug overdose have been found to disproportionately affect racial, economic and geographic populations in the state. Low socioeconomic status indicators, like receipt of Medicaid benefits, can be indicative of a higher risk of death from drug overdose.^{65,66} Eight percent (n=6) of the total maternal deaths from 2014–2015 were from suicide. Suicide among women who are pregnant or postpartum, in general, is not that common;⁶⁷ however, postpartum depression is among the most common postpartum complications.⁶⁸ For 2014, the national rate of suicide among reproductive aged women (15-44 years) was 7.4 per 100,000 women. The suicide rate among reproductive aged women (15-44 years) in Washington State ranged from 4.6 to 11.2 per 100,000 women during the time period 2011-2015. The prevalence of suicide and overdose deaths in the 2014-2015 maternal death cohort indicates a clear need for improved care and services for pregnant and postpartum women with these conditions and disorders.

Disparities: Race, Ethnicity and Income Backgrounds

Along with factors surrounding maternal deaths, maternal mortality reviews throughout the U.S., including Washington's, indicate that significant racial, socioeconomic, and geographic disparities may exist in maternal healthcare throughout the United States.⁶⁹ The number of cases in the 2014-2015 review are too low to draw conclusions about differences in maternal mortality rates based on race, ethnicity, or socioeconomic status. We will continue to track these data in future reviews. These additional years of data may allow DOH and the MMRP to make more concrete conclusions about racial, ethnic, and socioeconomic disparities. The need for more data over a longer period of time underscores the importance to continue maternal mortality reviews in Washington State to better understand the disparities which affect maternal mortality, and to develop actions to address them and improve the health of women and their families. Further, identifying disparities, even when the numbers are small, is an important step in working to improve health equity for people of all backgrounds.

⁶¹ Georgia Department of Public Health. (2015). Georgia maternal mortality review: 2012 case review.

⁶² Hernandez, L., Brown, R., Morgan, A. (2014). Florida's pregnancy-associated mortality review: 2014 update. Florida Department of Health.

⁶³ Massachusetts Department of Public Health (2014). *Maternal mortality and morbidity review in Massachusetts: A bulletin for healthcare professionals*. Pregnancy-associated mortality 2000-2007. Retrieved at <http://www.mass.gov/eohhs/docs/dph/com-health/prego-newborn/pregnancy-mortality-report-2000-2007.pdf>

⁶⁴ Washington State Department of Health. (2014). Drug abuse and overdose. *Health of Washington State*. Retrieved at <http://www.doh.wa.gov/Portals/1/Documents/5500/RPF-Drg2014.pdf>

⁶⁵ Xing, J., Mancuso, D., Felver, B.E.M. (2015). Overdose deaths among Medicaid enrollees in Washington State: the role of behavioral health needs. Washington State Department of Social and Health Services. Retrieved at https://www.dshs.wa.gov/sites/default/files/SESA/rda/documents/research-4-92_0.pdf

⁶⁶ Metz, T.D., Rovner, P., Hoffman, M.C., Allshouse, A.A., Beckwith, K.M., Binswanger, I.A. (2016). Maternal Deaths from Suicide and Overdose in Colorado, 2004-2012. *Obstetrics & Gynecology*, 0(0): 1-8.

⁶⁷ Appleby, L. (1991). Suicide during pregnancy and in the first postnatal year. *Bmj*, 302(6769), 137-140.

⁶⁸ Robertson, E., Grace, S., Wallington, T., & Stewart, D. E. (2004). Antenatal risk factors for postpartum depression: a synthesis of recent literature. *General hospital psychiatry*, 26(4), 289-295.

⁶⁹ Bryant, A. S., Worjolah, A., Caughey, A. B., & Washington, A. E. (2010). Racial/ethnic disparities in obstetric outcomes and care: prevalence and determinants. *American journal of obstetrics and gynecology*, 202(4), 335-343.

Despite the need for more data to make more definitive statements about disparities associated with race/ethnicity and income, it is still important to discuss them and how they affect maternal mortality in the U.S. and in our state. These are important issues to the MMRP and DOH as these factors can have a significant impact on women and children's overall health and well-being and can be an indicator of the quality of care they receive. Further, they continue to impact maternal outcomes for women and create greater risk for maternal death.^{70,71} In the United States, researchers report that between 2005 and 2014 the largest increase in maternal deaths occurred among non-Hispanic black women and non-Hispanic American Indian/Alaska Native women.⁷² The U.S. Department of Health and Human Services' report on *Maternal Mortality in the United States: 1935-2007*, supports these findings, and suggests that non-Hispanic black women are actually three to four times more likely to die as a result of pregnancy-related complications.⁷³ The findings of the Washington review of 2014–2015 maternal deaths seems to be very similar to national findings and trends^{74,75} and it appears that racial/ethnic and income-based disparities in maternal mortality do exist in the state and that some groups in Washington are disproportionately affected by maternal mortality. However, specific numbers of women in racial categories are small, and minute changes in death categorization as *pregnancy-related* or *pregnancy-associated* can dramatically alter data and interpretation of maternal outcomes.

While socioeconomic data is often incomplete or difficult to gather, one federal report on maternal mortality⁷⁶ suggests that higher poverty rates increase maternal mortality, especially among non-Hispanic white and non-Hispanic black women. Within high-poverty groups, non-Hispanic black women are still more likely to die than non-Hispanic white women. This information indicates disparity for these population groups, and highlights the persistence of healthcare inequities throughout the country. Medicaid coverage was used to look at poverty among the 2014-2015 maternal death cohort. In 2017, to be eligible for Medicaid, women qualified with incomes up to 138% of federal poverty levels,⁷⁷ during the years of this review the women likely had higher levels of poverty because the Affordable Care Act was not yet fully implemented. Looking at this indicator helps create a clearer picture of each woman's quality of life, overall health, and social and economic inequities. Medicaid coverage also offers insight

⁷⁰ Chang, J., Elam-Evans, L. D., Berg, C. J., Herndon, J., Flowers, L., Seed, K. A., & Syverson, C. J. (2003). Pregnancy-related mortality surveillance – United States, 1991–1999. *MMWR Surveill Summ*, 52(2), 1-8.

⁷¹ Bryant, A. S., Worjoh, A., Caughey, A. B., & Washington, A. E. (2010). Racial/ethnic disparities in obstetric outcomes and care: prevalence and determinants. *American journal of obstetrics and gynecology*, 202(4), 335-343.

⁷² MacDorman, M. F., Declercq, E., Cabral, H., & Morton, C. (2016). Is the United States Maternal Mortality Rate Increasing? Disentangling trends from measurement issues Short title: US Maternal Mortality Trends. *Obstetrics and gynecology*, 128(3), 447.

⁷³ Singh, G.K. (2010). Maternal mortality in the United States, 1935-2007: Substantial racial/ethnic, socioeconomic, and geographic disparities persist. A 75th Anniversary Publications. Health Resources and Services Administration, Maternal and Child Health Bureau. Rockville Maryland: U.S. Department of Health and Human Services

⁷⁴ Creanga, A.A., Berg, C.J., Syverson, C., Seed, K., Bruce, F.C., and Callaghan, W.M. (2012). Race, ethnicity, and nativity differentials in pregnancy-related mortality in the United States. *Obstet Gynecol* 120:261-268.

⁷⁵ MacDorman, M.F., Declercq, E., and Thoma, M.E. (2017). Trends in maternal mortality by sociodemographic characteristics and cause of death in 27 states and the District of Columbia. *Obstetric and Gynecology* 129(5):811-818.

⁷⁶ Singh, G. K. (2010). Maternal mortality in the United States, 1935-2007: Substantial racial/ethnic, socioeconomic and geographic disparities. U.S. Department of Health and Human Services. Health Resources and Services Administration.

⁷⁷ Washington Apple Health. (2017). Eligibility overview Washington Apple Health (Medicaid) programs. Retrieved from: <https://www.hca.wa.gov/assets/free-or-low-cost/22-315.pdf>

into healthcare coverage, in general, and the challenges women receiving these services face. Among 2014-2015 maternal deaths, healthcare coverage information is complete for all pregnancy-related deaths; coverage information for pregnancy-associated deaths is incomplete.

Based on the information available on pregnancy-related deaths, it appears that all of the women were covered by some form of health insurance; 75% were covered by Medicaid, suggesting that the majority of women were from low income backgrounds. Investigations revealed that some of the women who died of pregnancy-related causes became eligible for Medicaid as a result of their pregnancy or as a result of the Affordable Care Act (ACA). The Medicaid expansion and federal subsidies for privately purchased insurance provided through ACA began in 2014. Prior to this expansion, many women qualified for Medicaid only after they became pregnant, suggesting they may have had limited options for preconception and contraception services, and the potential for late-entry into prenatal care, all of which are factors that contribute to maternal mortality and morbidity, in general. Moreover, these women may have received sporadic coverage and access to healthcare over the course of their lives based on ability to pay for private insurance coverage or meet the criteria for Medicaid coverage, which can complicate the management of pregnancy risks, like chronic diseases or mental health issues for both women and their providers.

It is important to note that healthcare coverage, in general, is a protective factor. This extends to Medicaid coverage as it works to protect vulnerable populations by providing access to healthcare for those at the greatest risk for negative outcomes. The recent expansion of Medicaid under the Affordable Care Act allowed more people access to healthcare coverage in the state,⁷⁸ and reduced the uninsured rate for women from 12.7% in 2013 to 4.7% in 2015.⁷⁹ Further, the uninsured rates for people from racial/ethnic communities most affected by health disparities also decreased,⁸⁰ suggesting that the increased and expanded healthcare coverage has the potential to reduce healthcare disparities due to race and income. Medicaid coverage helps to improve healthcare access and use, and can also help lower the costs of healthcare, overall.⁸¹ When people have access to healthcare services and resources, there are a number of positive impacts, including the prevention of disease progression and improving overall health and well-being. It is also an indicator of a woman's capacity to engage with local agencies to potentially access other needed social service, medical and economic resources. Most importantly, Medicaid coverage (and healthcare coverage, in general), has the potential to reduce disparities.

Social Bias

To protect the identity of the women in this cohort and the providers who cared for them, several important findings are discussed here without connecting the deaths to data or to a specific diagnosis/cause of death. Records review indicated that some of the women in this

⁷⁸ Washington Health Alliance. (2016). Increasing health equity in Washington State. Retrieved at <http://wahealthalliance.org/wp-content/uploads/2017/02/2016-Disparities-in-Care-Report.pdf>

⁷⁹ Washington State Office of Financial Management. (2016). Washington State Health Services Research ProjectL Second year impact of ACA on Washington State's healthcare coverage. Research Brief No. 80. Retrieved at <http://www.ofm.wa.gov/researchbriefs/2016/brief080.pdf>

⁸⁰ Washington State Office of Financial Management. (2016). Washington State Health Services Research ProjectL Second year impact of ACA on Washington State's healthcare coverage. Research Brief No. 80. Retrieved at <http://www.ofm.wa.gov/researchbriefs/2016/brief080.pdf>

⁸¹ Washington Health Alliance. (2016). Increasing health equity in Washington State. Retrieved at <http://wahealthalliance.org/wp-content/uploads/2017/02/2016-Disparities-in-Care-Report.pdf>

cohort were struggling with social issues that affect health at the time of their death, including low income, homelessness, substance use, addiction and mental illness. In addition, the MMRP thought that underlying, and perhaps unidentified, social biases among healthcare providers about these social issues may have also contributed to their deaths. Though data limitations prevent drawing conclusions or making recommendations around this. Social biases about social issues like substance use and homelessness are embedded in our society through cultural, economic and even political forces.⁸² Because these biases are part of our social world, we are not always aware of them; however, they still have the potential to affect medical decisions and quality of care. After review of these deaths and their medical records, some panel members felt that some of women did not receive prompt and sufficient treatment, or experienced other gaps in services due to social bias towards the social issues outlined above. This is an important issue to continue to explore, and emphasizes the need to continue maternal mortality reviews and develop a better understanding of how biases affect maternal outcomes and identify trends in our state. The MMRP will continue to consider and study this as part of future work.

Death Investigation and Autopsy

The MMRP noted that of the 16 pregnancy-related deaths, only seven received an autopsy. Of these seven deaths, without the autopsy report, three causes of death would not have been able to be determined. The importance for autopsy in determining the cause of death (especially for those that may possibly be pregnancy-related) was emphasized through the review process. Without an autopsy, the underlying and contributing causes of death are not always clear, and there are several causes of death that can be determined *only* during an autopsy. Currently, not all pregnancy-related deaths are reported to the local coroner for death investigation and/or receive an autopsy, and as such, the opportunity to conduct an autopsy is not always explored. A death cannot adequately lead to the appropriate quality improvement measures by providers or facilities unless the causes are understood.

⁸² Marmot, M. G., Kogevinas, M., & Elston, M. A. (1987). Social/economic status and disease. *Annual review of public health*, 8(1), 111-135.

Maternal Mortality Review 2014–2015

Recommendations

High Body Mass Index and Pregnancy

Recommendation: Improve care for women who are pregnant and have a high Body Mass Index

Rationale: A significant finding of the maternal mortality review process was that many maternal deaths occurred to women with a higher than normal Body Mass Index (BMI) measurements before pregnancy. The CDC (2016) writes that BMI is the ratio of a person's weight and height and is an inexpensive method used to identify weight-related risks; a high BMI may indicate that other weight-related screenings and interventions should take place. During the maternal mortality review, two themes emerged surrounding the care of pregnant women with very high BMI. The first was that some providers and facilities seemed to be underprepared and underequipped to properly care for women with extremely high BMI. Second, some providers seemed to be struggling to determine the proper specialist to whom these women should be referred, and the most appropriate time during care to make that referral. The MMRP recommends the following actions to ensure both hospitals and providers are prepared to care for pregnant women of all body types:

1. Work with the Washington State Perinatal Collaborative to convene an expert panel to develop best practice guidelines for the care of women who are pregnant and have high BMI.
2. Explore a quality improvement process to implement these guidelines in partnership with the Washington State Perinatal Collaborative and the Washington State Hospital Association.

Ectopic Pregnancy

Recommendation: Promote and encourage the use of standardized protocols related to ectopic pregnancy treatment and intervention

Rationale: In theory, deaths due to ectopic pregnancy should be preventable if the pregnancy is identified early, treatment is provided promptly, and women are properly followed up on to minimize complications. To ensure providers and facilities assess and treat women with ectopic pregnancies appropriately, the MMRP recommends the following action:

1. Increase knowledge and integration of standardized protocols for the treatment of women with ectopic pregnancies.

Access to Healthcare Coverage

Recommendation: Expand access to and continuity of healthcare coverage for all women and children in Washington State

Rationale: The MMRP recognizes the significant advances made by Washington State in insurance coverage for women of reproductive age. During the maternal mortality review process, the MMRP found that many women in the maternal death cohort for 2014–2015 received insurance coverage through Medicaid. Some women only became eligible for coverage after becoming pregnant, or through Medicaid expansion under the Affordable Care Act (ACA) in 2014. Despite having coverage during pregnancy, many women still faced risks associated with discontinuous healthcare coverage, and may not have had consistent access to contraception, reproductive health counseling, and preconception counseling. Access to reproductive services play an important role in helping women become pregnant when they are physically, emotionally, and financially prepared. Preconception services help women manage their chronic diseases, adjust medications, stop smoking, ensure adequate folic acid consumption and improve nutrition

and physical activity before becoming pregnant or between pregnancies. Both lead to better maternal and infant pregnancy outcomes. To ensure all women have access to healthcare the MMRP recommends the following actions:

1. Expand Medicaid to cover all physical and mental health needs through the first year after pregnancy to increase continuity of coverage and services.
2. As part of healthcare coverage, ensure all people have access to reproductive health counseling and contraception of choice.

Substance Use, Mental Health, and Pregnancy

Recommendation: Improve access to substance use and mental health services for pregnant and postpartum women

Rationale: The MMRP found critical gaps in care and services for women struggling with substance use and/or other mental health disorders. Women facing these issues encounter a number of barriers, including timely access to mental health and substance use services, overcoming the stigma of mental health diagnoses and the biases of healthcare providers, and accessing the support services needed to initiate and follow through with substance use and mental health intervention and treatment. Alternative care and treatment models are one way to address some barriers and access issues, and can include co-locating mental health and women’s or parenting support services, and enlisting a wider range of providers to help screen women for mental health needs. For example, the American Academy of Pediatrics recommends that pediatricians conduct maternal depression screenings at the 1-month, 2-month, 4-month, and 6-month well child visits.⁸³ The MMRP recommends the following actions:

1. Increase capacity for substance use treatment and mental health services for pregnant and parenting women in the state.
2. Expand services for mothers with substance use disorders, such as Parent Child Assistance Program (PCAP),⁸⁴ to assure statewide access to these or similar programs.
3. Promote early and frequent postpartum depression screenings of mothers by women’s health providers, primary care providers, and by pediatricians during well-child visits.
4. Explore alternative care models for mental health treatment that combine women’s and parenting support services with mental health and substance use treatment services and reviews.

Follow-Up Care During and After Pregnancy

Recommendation: Expand and improve efforts to provide effective follow-up care for women during all points of pregnancy and through the first year postpartum

The MMRP found the largest gap in care and services for women occurred after the end of pregnancy and within the first year after birth. During the first year after pregnancy, women are highly susceptible to depression, postpartum complications, and stress. For women with existing mental health conditions, they are also at increased risk for mental health setbacks and domestic violence. The period after delivery also presents opportunities for the prevention of adverse outcomes as women intersect with the healthcare system through their child’s well-child visits. The MMRP recommends the following actions:

⁸³ The American Academy of Pediatrics recommends pediatricians screen mothers for postpartum depression at their child’s one, two and four month well child checks. <https://womensmentalhealth.org/posts/american-academy-of-pediatrics-recommends-screening-for-postpartum-depression/>

⁸⁴ <http://depts.washington.edu/pcapuw/>

1. Develop a more comprehensive, coordinated, and patient-centered system of care for women and their infants during the pregnancy and postpartum periods through the first year after birth.
2. Expand efforts to provide early and frequent home visits for mothers and infants which address medical, mental, and physical health needs, as well as socioeconomic needs.
3. Encourage facilities and providers to initiate postpartum telephone follow-up to occur within the first 72 hours after discharge.

Health Disparities

Recommendation: Improve health equity and address social determinants of health to reduce racial and ethnic, socioeconomic, and geographic disparities in maternal mortality

Rationale: The maternal mortality review process confirmed that healthcare disparities persist in Washington State, and that specific populations of women are at greater risk of maternal death. Throughout the U.S., healthcare and health outcome disparities persistently affect specific populations of people because they are a reflection of the current social values of the community, state, and nation. As such, these social inequities are embedded in society and our daily lives, and manifest in healthcare as unrecognized biases and prejudice, which can affect quality of care. Identifying and examining disparities in maternal mortality will continue to be a priority for the Washington State Maternal Mortality Review Panel, especially because disparities cannot be addressed without identifying and understanding the nature of them. To continue efforts to address these issues, the MMRP recommends the following actions:

1. Integrate frameworks of social determinants of health and equity into all strategies presented in recommendations of the MMRP.
2. Adopt strategies to address social biases in healthcare.

Maternal Death Autopsy and Investigation

Recommendation: Improve maternal death investigation and autopsy

Panel members found several key issues surrounding death investigation and autopsies during the review. Not all pregnancy-related deaths were reported to the local medical-legal jurisdiction (medical examiner or coroner office), autopsies were not always performed on pregnancy-related deaths, and the quality of autopsies was variable and sometimes suboptimal as assessed by examination of the reports. These deficiencies made some aspects of the maternal death review difficult to complete and limited the usefulness of autopsy reports. Hospitals and providers were sometimes not aware that a patient they had cared for died at another facility or at home, and as such were unable to conduct their own investigation for assessment of care and quality improvement. To address these issues, the MMRP recommends the following:

1. Convene an expert panel to assess current pregnancy-related death investigation and autopsy processes in the state, research processes used in other states and professional guidelines for pregnancy-related death autopsy, and develop best practices for pregnancy-related death investigation and autopsy.
2. Explore the development of a timely reporting process for maternal deaths to assist with maternal death surveillance and to enhance quality improvement capacity for maternal health.
3. Explore and implement a mechanism to ensure timely notification about maternal deaths to involved hospitals and providers.

Injury-Related Maternal Deaths

The MMRP found that while there are many opportunities for injury- and accident-related death prevention, additional expertise is needed to develop recommendations for the prevention of injuries and accidents among pregnant and postpartum women. Because of this, the MMRP recommends coordinated efforts with other state and non-governmental agencies that share a focus on preventing maternal death and improving maternal health. Some collaborations may include:

1. Coordinate data collection efforts with other DOH programs which research suicide, homicide, and overdose deaths in the state.
2. Collaborate with current efforts with other state agencies to reduce motor vehicle accidents throughout the state.
3. Recruit professionals with expertise in domestic violence, mental health, and substance use to the MMRP for future reviews.

Review and Process Limitations

Despite efforts to develop a systematic and comprehensive process, limitations exist:

- Resource and time constraints prevented the same level of review of all maternal deaths, leading to the prioritization of pregnancy-related deaths for more in-depth review for this report.
- At the time of this review, two deaths were in litigation and were not reviewed beyond Level 2 due to incomplete information available.
- Medical records were not available for all pregnancy-related deaths. In some cases, they did not arrive in time for review. In other cases, facilities refused to release them, citing federal laws.
- The actual monetary cost of obtaining and reviewing medical records was higher than anticipated.
- Determining whether a death was pregnancy-related or -associated based solely on the underlying cause of death listed on the birth certificate is difficult. The MMRP found several instances where their categorization of deaths as either pregnancy-related or -associated differed from the CDC guidelines because of exceptional circumstances and/or lack of information. The panel also found that sometimes ambiguity cannot be reconciled, and is an indicator of the complexity of the medical conditions, causes of deaths, and the lives of women who have died. For this reason, the panel created a third death category (pregnancy-associated – unable to determine if pregnancy-related).

Conclusion and Next Steps

The findings of the Maternal Mortality Review of 2014 and 2015 deaths illuminate the complexity of maternal mortality, and the social, economic, and health factors that contribute to these deaths. Reviews of maternal death are complicated, and require a significant investment of time and resources. However, causes of, and contributing factors to, maternal deaths can only be identified and understood through maternal mortality surveillance and review processes, and thus, emphasize the importance of this work. Other state maternal mortality reviews, as well as research on the subject of maternal deaths and pregnancy-related complications, support the need for these types of reviews. One reason includes improving maternal mortality surveillance and standardization of that process, but especially continuing to improve and refine our understanding of the causes of and contributing factors to maternal deaths and to begin work towards prevention. Overall, there is a great need for providers to understand the complexity of a woman's social, mental, and physical health in order to appropriately address these issues and treat underlying conditions while also effectively managing pregnancy.⁸⁵

Understanding maternal mortality in our state to learn not only how to prevent death, but also how to decrease severe morbidity and improve maternal health is the goal of the Washington State Maternal Mortality Review Panel (MMRP). Convened through Senate Bill 6534 (RCW 70.54.450), the MMRP conducts comprehensive reviews of all maternal deaths in Washington to identify factors surrounding those deaths and make recommendations to reduce preventable deaths and improve women's healthcare in the state. DOH nominated and appointed a 60-member panel comprised of a diverse group of women's health professionals from across Washington State. Through a multi-level review process developed in collaboration with a number of stakeholders and advisors, the MMRP identified 69 maternal deaths in 2014 and 2015; 53 of these deaths were considered to be pregnancy-associated and 16 were considered to be pregnancy-related. After reviewing all maternal deaths from 2014 and 2015, identifying which of the pregnancy-related deaths were preventable, and outlining specific preventative actions, the MMRP made recommendations to reduce the number of maternal deaths in the state and to improve care for all women. The MMRP also identified key issues and contributing factors relating to the maternal deaths, many of which have been identified in other state maternal mortality reviews. This report outlines the development of the Washington MMRP, the multi-level process of maternal mortality review, the findings of the review itself, and the healthcare and systems-level recommendations for prevention made by the panel.

Over the course of the next year, the Department of Health will work with internal and external stakeholders to continue to analyze the maternal mortality data, move from recommendations to action, and to begin work on the next maternal mortality review. The next steps include:

1. Evaluate the Washington Maternal Mortality Review process and develop a quality improvement plan for future reviews.
2. Explore ways to expand focus to social determinants that lead to maternal death and morbidity in the next review.

⁸⁵ World Health Organization. (2016). *Substance Use in Pregnancy*. Management of Substance Use. Retrieved http://www.who.int/substance_abuse/activities/pregnancy_substance_use/en/

3. Provide education for healthcare providers to increase awareness and understanding of the factors that contribute to maternal deaths in our state, and the clinical interventions that may prevent these deaths.
4. Work with panel members, as well as other stakeholders, such as the Washington State Perinatal Collaborative and the Washington State Hospital Association Safe Deliveries Roadmap efforts, to review and implement recommended changes and improvements to the maternal mortality review process.
5. Begin data linkages and maternal deaths identifications for the review of 2016 maternal deaths.
6. Review evidence base and cost benefit of recommendations strategies to prioritize efforts and resources.
7. Reviewing cases with a mental health component is challenging due to the nature of mental illness and its intersection with socioeconomic and health determinants. These types of cases also require specific expertise in order to conduct an adequate review. Because of limited time and resources, DOH was not able to focus sufficiently on mental health-related deaths for this first review, and plans to enhance reviews on this topic in the future.

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Appendices

Appendix A: Acronyms and Important Definitions

ACA: Affordable Care Act

BMI: Body Mass Index; ratio of weight to height. High body mass index can indicate weight-related risks

CDC: Centers for Disease Control

CHARS: Comprehensive Hospital Abstract Reporting System

CHS: Center for Health Statistics

DOH: Department of Health

HCA: Health Care Authority

HIPPA: Healthcare Information Portability and Protection Act

MMR: Maternal Mortality Review

MMRDS: Maternal Mortality Review Data System

MMRP: Maternal Mortality Review Panel

MVA: Motor Vehicle Accident

PAC: Perinatal Advisory Committee (Washington State)

RCW: Revised Code of Washington

RUCA: Rural Urban Coding Area

Key terms and Definitions

Maternal death or **maternal mortality**, used interchangeably in this report and review, is defined in RCW 70.54.450 as the death of a woman while pregnant or within one year of delivering or following the end of pregnancy, whether or not the woman's death is related to or aggravated by the pregnancy. Only those maternal deaths which occurred to Washington State residents within Washington State were reviewed.

Maternal deaths are divided into three categories as part of the review process: **pregnancy-related death**, **pregnancy-associated death – not related**, and **pregnancy-associated death – unable to determine if pregnancy-related**. The first two of these key terms are defined by the CDC to align the Washington review with other maternal mortality review efforts in the United States:

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 (CDC Case Discussion and Decision Guide, 2016). Specific diagnoses, and timelines of death and diagnoses, are based on Cause of Death Decision Guidelines.

Pregnancy-associated death – not related: The death of a woman from any cause during pregnancy or within one year of the end of pregnancy that is not pregnancy-related (see most recent CDC Case Discussion and Decision Guide, 2016).This includes MVA, cancer, homicide, suicide, overdose, other accidents, some seizure.

Pregnancy-associated death – unable to determine if pregnancy-related: The death of a woman from any cause during pregnancy or within one year of the end of pregnancy, but whether the death is directly related to the pregnancy cannot be determined. This definition was developed by the MMRP and breaks away from the CDC framework. As part of the review process, the MMRP identified two deaths which did not fit into any of the above categories (based on 2016 forms). As such, the members of the MMRP felt the addition of a third category and definition was warranted.

Maternal mortality ratio is the number of deaths per 100,000 live births during a specified time period and is used to describe maternal deaths in aggregate and to compare to national and other state rates of maternal deaths, as well as to look at differences across risk groups.

Preventability: A maternal death is considered preventable if the MMRP determines that there was at least some chance of a death being averted by one or more measurable changes to the patient, family, community, provider, facility, and/or systems factors. For the purposes of this maternal mortality review, the time frame of preventability is in relation to changes which could be made during pregnancy or within the first year after the end of the pregnancy.

Appendix B: Washington State Legislature (RCW 70.54.450)

Maternal mortality review panel – Membership – Duties – Confidentiality, testimonial privilege, and liability – Identification of maternal deaths – Reports. (Expires June 30, 2020.)

- (1) For the purposes of this section, "maternal mortality" or "maternal death" means a death of a woman while pregnant or within one year of delivering or following the end of a pregnancy, whether or not the woman's death is related to or aggravated by the pregnancy.
- (2) A maternal mortality review panel is established to conduct comprehensive, multidisciplinary reviews of maternal deaths in Washington to identify factors associated with the deaths and make recommendations for system changes to improve health care services for women in this state. The members of the panel must be appointed by the secretary of the department of health (DOH), must serve without compensation, and may include:
 - (a) An obstetrician;
 - (b) A physician specializing in maternal fetal medicine;
 - (c) A neonatologist;
 - (d) A midwife with licensure in the state of Washington;
 - (e) A representative from DOH who works in the field of maternal and child health;
 - (f) A department of health epidemiologist with experience analyzing perinatal data;
 - (g) A pathologist; and
 - (h) A representative of the community mental health centers.
- (3) The maternal mortality review panel must conduct comprehensive, multidisciplinary reviews of maternal mortality in Washington. The panel may not call witnesses or take testimony from any individual involved in the investigation of a maternal death or enforce any public health standard or criminal law or otherwise participate in any legal proceeding relating to a maternal death.

- (4) (a) Information, documents, proceedings, records, and opinions created, collected, or maintained by the maternal mortality review panel or DOH in support of the maternal mortality review panel are confidential and are not subject to public inspection or copying under chapter 42.56 RCW and are not subject to discovery or introduction into evidence in any civil or criminal action.
 - (b) Any person who was in attendance at a meeting of the maternal mortality review panel or who participated in the creation, collection, or maintenance of the panel's information, documents, proceedings, records, or opinions may not be permitted or required to testify in any civil or criminal action as to the content of such proceedings, or the panel's information, documents, records, or opinions. This subsection does not prevent a member of the panel from testifying in a civil or criminal action concerning facts which form the basis for the panel's proceedings of which the panel member had personal knowledge acquired independently of the panel or which is public information.
 - (c) Any person who, in substantial good faith, participates as a member of the maternal mortality review panel or provides information to further the purposes of the maternal mortality review panel may not be subject to an action for civil damages or other relief as a result of the activity or its consequences.
 - (d) All meetings, proceedings, and deliberations of the maternal mortality review panel may, at the discretion of the maternal mortality review panel, be confidential and may be conducted in executive session.
 - (e) The maternal mortality review panel and the secretary of DOH may retain identifiable information regarding facilities where maternal deaths, or from which the patient was transferred, occur and geographic information on each case solely for the purposes of trending and analysis over time. All individually identifiable information must be removed before any case review by the panel.
- (5) DOH shall review department available data to identify maternal deaths. To aid in determining whether a maternal death was related to or aggravated by the pregnancy, and whether it was preventable, DOH has the authority to:
 - (a) Request and receive data for specific maternal deaths including, but not limited to, all medical records, autopsy reports, medical examiner reports, coroner reports, and social service records; and
 - (b) Request and receive data as described in (a) of this subsection from health care providers, health care facilities, clinics, laboratories, medical examiners, coroners, professions and facilities licensed by DOH, local health jurisdictions, the health care authority and its licensees and providers, and department of social and health services and its licensees and providers.
 - (6) Upon request by DOH, health care providers, health care facilities, clinics, laboratories, medical examiners, coroners, professions and facilities licensed by DOH, local health jurisdictions, the health care authority and its licensees and providers, and department of social and health services and its licensees and providers must provide all medical records, autopsy reports, medical examiner reports, coroner reports, social services records, information and records related to sexually transmitted diseases, and other data requested for specific maternal deaths as provided for in subsection (5) of this section to DOH.
 - (7) By July 1, 2017, and biennially thereafter, the maternal mortality review panel must submit a report to the secretary of DOH and the health care committees of the senate and house of representatives. The report must protect the confidentiality of all decedents and

other participants involved in any incident. The report must be distributed to relevant stakeholder groups for performance improvement. Interim results may be shared at the Washington State Hospital Association coordinated quality improvement review. The report must include the following:

- (a) A description of the maternal deaths reviewed by the panel during the preceding twenty-four months, including statistics and causes of maternal deaths presented in the aggregate, but the report must not disclose any identifying information of patients, decedents, providers, and organizations involved; and
- (b) Evidence-based system changes and possible legislature to improve maternal outcomes and reduce preventable maternal deaths in Washington. [2016 c 238 § 1.]

NOTES: Expiration date—2016 c 238: "This act expires June 30, 2020." [2016 c 238 § 4.

Appendix C: Rural/Urban Classification Coding

A trajectory of recorded zip code changes among maternal deaths in 2014–2015 was determined using the rural/urban classification coding using the following process. Zip codes of maternal residence were obtained from mother's death and infant birth or fetal death certificates, and hospitalizations from the last 5 years of the mother's life.

- A Rural-Urban classification scheme, RUCA 3.10 Scheme 1, was implemented on all zip codes, as per the Washington State Department of Health.
- Guidelines for Using Rural-Urban Classification Systems for Community Health Assessment, to further describe the women's residences in terms of distance away from necessary resources and services is provided below here:
 - The coding scheme chosen was selected to take into account the concept of potential access to resources and services in its broadest sense. It emphasizes populations, population density, and daily commuting pattern.
 - **Urban Core:** Contiguous built-up areas of 50,000 persons or more that correspond to US Census Bureau's Urbanized Areas
 - **Sub-Urban:** Areas, often in metropolitan counties, with high commuting flows to Urban Cores and areas where 30–49% of the population commutes to Urban Cores for work
 - **Large Rural Town:** Towns with populations between 10,000–49,999 and surrounding rural areas with 10% or more primary commuting flows to these towns, and towns with secondary commuting flows of 10% or more to Urban Cores
 - **Small Town/Isolated Rural Town:** Towns with populations below 10,000 and surrounding commuter areas with more than a 1 hour driving distance to the closest city

Appendix D: Washington State MMRP Cause of Death Decision Guidelines

Maternal Mortality Review Underlying Causes of Death Decision Guidelines

The Washington State Maternal Mortality Subpanel made the following decisions to guide the future classification of deaths to women within one year of pregnancy. This decision guide was updated from the version created in 2001.

Pregnancy-related deaths

Cause of Death Group 1	Cause of Death Group 2	Cause of Death Group 3
Hemorrhage	Uterine laceration/rupture	
	Abruptio placentae	
	Placenta previa	
	Placenta accreta/percreta or increta	
	Ruptured ectopic	
	Other site	
	Unknown	
Embolism (NOT CEREBRAL)	Thrombotic (includes pulmonary embolism, NOS)	Deep vein thrombosis (if death occurs < 42 days post pregnancy)
	Amniotic fluid, with autopsy finding	
	Amniotic fluid, no autopsy finding	
	Cardiac embolism	
	Air	
	Other (includes septic embolism)	
	Unknown/NOS pulmonary embolism	
Hypertension	Pre-eclampsia associated with/--	1 = Cerebrovascular hemorrhage
	Eclampsia associated with/--	2 = Cerebral edema
	Other/NOS hypertension in pregnancy	3 = Cerebral embolism
	Pre-existing hypertension with superimposed pre-eclampsia or eclampsia	4 = Metabolic complications (renal failure)
		5 = Metabolic complications (hepatic failure)
		6 = HELLP syndrome
		7 = DIC-Disseminated Intravascular Coagulopathy
		8 = Other (includes encephalopathy) (Note - CDC now includes cerebral vascular accident, cerebral infarct, thrombosis)
		9 = Unknown/NOS

Pregnancy-related deaths (continued)

Cause of Death Group 1	Cause of Death Group 2	Cause of Death Group 3
Infection	1 = Chorioamnionitis/antepartal infection	
	2 = Postpartum pelvic infection	
	3 = Generalized septicemia/septic shock/septic abcess	
	4 = Peritonitis	
	5 = Other pelvic tract infection	
	6 = Non-pelvic infection (e.g., pneumonia)	
	7 = Urinary tract infection (e.g., pyelonephritis, cystitis, urinary tract infection)	
	8 = Other	
	9 = Unknown	
Cardiac	1 = cardiomyopathy	
	2 = cardiomegaly	
	3 = cardiac defect (e.g., Eisenmenger syndrome)	
	4 = cardiac defect (maternal congenital cardiac defects)	
	5 = cardiac defect (acquired valvular disease, including SBE/ ABE and rheumatic disease)	
	4 = acute myocardial infarction	
	5 = coronary artery dissection	
	6 = atherosclerosis	
8 = other		
Anesthesia		
Gastrointestinal	Acute fatty liver of pregnancy	
Other	1 = Cerebral hemorrhage	
	2 = Ruptured other aneurysm	
	3 = Thrombotic thrombocytopenic purpura (TTP)	
	4 = Neurologic/neurovascular (including Cerebral aneurysm?), cerebral vascular accident	
	5 = Pulmonary	
	8 = Other	
	9 = Don't know	
10 = Choriocarcinoma		

Pregnancy-associated deaths, not pregnancy-related

Cause of Death Group 1	Cause of Death Group 2	Cause of Death Group 3
Injury	Mechanism	Intent
	Motor vehicle accident	Unintended
	Fall	Suicide
	Firearm	Homicide
	Overdose	
	Cut/pierce	
	Strangulation/suffocation	
	Other	
	Unknown	
Infection/sepsis (if death occurs ≥ 42 days post pregnancy)		
Cancer		
Cardiovascular		
Respiratory		
Epilepsy (if death occurs ≥ 42 days post pregnancy)		
Deep vein thrombosis (if death occurs ≥ 42 days post pregnancy)		
Intracerebral hemorrhage (if death occurs ≥ 30 days post pregnancy)		
Diseases of the circulatory system	1 = Myocardial infarction, ischaemic heart disease	
	2 = Cerebral hemorrhage or infarction	
	3 = Pulmonary heart disease, pulmonary circulatory disorder	
	4 = Other forms of heart diseases, (including Cardiomyopathy)	
	8 = Other	

The following may be pregnancy-related cases and need to be carefully reviewed with additional clinical information wherever possible, specifically:

- Cardiovascular deaths (if death occurs < 90 days post pregnancy)
- Myocardial infarction (if death occurs < 42 days post pregnancy)
- Epilepsy (if death occurs < 42 days post pregnancy)
- Infection (if death occurs < 42 days post pregnancy)

The MMR subpanel also determined that in order to be considered a maternal death, the death must clearly be directly related to pregnancy or exacerbated by pregnancy with a known cause. By definition all indefinite/vague causes of death will be grouped as not-pregnancy-related.

MATERNAL MORTALITY REVIEW CASE COMMITTEE DECISIONS

Review Date: ____/____/____ Record ID #: _____

Select One

- 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 DEATH, NOT RELATED** The death of a woman during pregnancy or within one year of the end of pregnancy from a cause that is not related to pregnancy.
- NOT PREGNANCY RELATED OR ASSOCIATED** (i.e. woman was not pregnant within one year of her death) **UNABLE TO DETERMINE IF PREGNANCY RELATED OR ASSOCIATED**

Estimate the degree of relevant information (records) available for this case:

- Complete:** All Records necessary for adequate review of the case were available **Somewhat Complete:** Major gaps (i.e. information that would have been crucial to the review of the case) essential to the review of the case)
- Mostly Complete:** Minor gaps (i.e. information that would have been beneficial but was not essential to the review of the case) **Not Complete:** Minimal records available for review (i.e. death certificate and no additional records)
- N/A**

Does team agree with cause of death listed on death certificate? Yes No

COMMITTEE DETERMINATION OF CAUSE(S) OF DEATH

Type Cause (descriptive)

Immediate _____

Contributing _____

Underlying _____

Other significant _____

If pregnancy related, committee determination of underlying cause of death*

PMSS-MM NOTE: If more than one is selected, please list them in order of importance beginning with the most compelling (1-2; no more than 2 may be selected in the system).

<input type="checkbox"/> 110 Hemorrhage (excludes aneurysms or CVA)	<input type="checkbox"/> 180.1 Post-partum/peripartum cardiomyopathy	<input type="checkbox"/> 190.8 Vascular malformations outside head and coronary arteries
<input type="checkbox"/> 110.1 Hemorrhage – rupture/laceration/intraabdominal bleeding	<input type="checkbox"/> 180.2 Hypertrophic cardiomyopathy	<input type="checkbox"/> 190.9 Other cardiovascular disease, including CHF, cardiomegaly, cardiac hypertrophy, cardiac fibrosis, non-acute myocarditis/NOS
<input type="checkbox"/> 110.2 Placental abruption	<input type="checkbox"/> 180.9 Other cardiomyopathy/NOS	<input type="checkbox"/> 191 Pulmonary conditions (excludes ARDS-Adult respiratory distress syndrome)
<input type="checkbox"/> 110.3 Placenta previa	<input type="checkbox"/> 182 Hematologic	<input type="checkbox"/> 191.1 Chronic lung disease
<input type="checkbox"/> 110.4 Ruptured ectopic pregnancy	<input type="checkbox"/> 182.1 Sickle cell anemia	<input type="checkbox"/> 191.2 Cystic fibrosis
<input type="checkbox"/> 110.5 Hemorrhage – uterine atony/post-partum hemorrhage	<input type="checkbox"/> 182.9 Other hematologic conditions including thrombophilias/TTP/HUS/NOS	<input type="checkbox"/> 191.3 Asthma
<input type="checkbox"/> 110.6 Placenta accreta/increta/percreta	<input type="checkbox"/> 183 Collagen vascular/auto immune diseases	<input type="checkbox"/> 191.9 Other pulmonary disease/NOS
<input type="checkbox"/> 110.7 Hemorrhage due to retained placenta	<input type="checkbox"/> 183.1 Systemic lupus erythematosus (SLE)	<input type="checkbox"/> 192 Neurologic/neurovascular conditions (excluding CVAs)
<input type="checkbox"/> 110.8 Hemorrhage due to primary DIC	<input type="checkbox"/> 183.9 Other collagen vascular diseases/NOS	<input type="checkbox"/> 192.1 Epilepsy/seizure disorder
<input type="checkbox"/> 110.9 Other hemorrhage/NOS	<input type="checkbox"/> 185 Conditions unique to pregnancy (e.g., gestational diabetes, hyperemesis, liver disease of pregnancy)	<input type="checkbox"/> 192.9 Renal Disease
<input type="checkbox"/> 120 Infection	<input type="checkbox"/> 188 Injury	<input type="checkbox"/> 193.1 Chronic renal failure/End-stage renal disease (ESRD)
<input type="checkbox"/> 120.1 Post-partum genital tract (e.g., of the uterus/pelvis/perineum/neorotizing fasciitis)	<input type="checkbox"/> 188.1 Intentional (homicide)	<input type="checkbox"/> 193.9 Other renal disease/NOS
<input type="checkbox"/> 120.2 Sepsis/septic shock	<input type="checkbox"/> 188.2 Unintentional	<input type="checkbox"/> 195 Cerebrovascular accident (hemorrhage/thrombosis/aneurysm/ malformation) not secondary to hypertensive disease
<input type="checkbox"/> 120.4 Chorioamnionitis/antepartum infection	<input type="checkbox"/> 188.9 Unknown/NOS	<input type="checkbox"/> 196 Metabolic/endocrine
<input type="checkbox"/> 120.5 Non-pelvic infections (e.g., pneumonia, TB, meningitis, HIV)	<input type="checkbox"/> 189 Cancer	<input type="checkbox"/> 196.1 Obesity
<input type="checkbox"/> 120.6 Urinary tract infection	<input type="checkbox"/> 189.1 Gestational trophoblastic disease (GTN)	<input type="checkbox"/> 196.2 Diabetes mellitus
<input type="checkbox"/> 120.9 Other infections/NOS	<input type="checkbox"/> 189.3 Malignant melanoma	<input type="checkbox"/> 196.9 Other metabolic/endocrine disorders
<input type="checkbox"/> 130 Embolism - thrombotic (non-cerebral)	<input type="checkbox"/> 189.9 Other malignancies/NOS	<input type="checkbox"/> 197 Gastrointestinal disorders
<input type="checkbox"/> 130.9 Other embolism/NOS	<input type="checkbox"/> 190 Cardiovascular conditions	<input type="checkbox"/> 197.1 Crohn's disease/ulcerative colitis
<input type="checkbox"/> 140 Pre-eclampsia	<input type="checkbox"/> 190.1 Coronary artery disease/myocardial infarction (MI)/atherosclerotic cardiovascular disease	<input type="checkbox"/> 197.2 Liver disease/failure/transplant
<input type="checkbox"/> 150 Eclampsia	<input type="checkbox"/> 190.2 Pulmonary hypertension	<input type="checkbox"/> 197.9 Other gastrointestinal diseases/NOS
<input type="checkbox"/> 160 Chronic hypertension with superimposed pre-eclampsia	<input type="checkbox"/> 190.3 Valvular heart disease	<input type="checkbox"/> 1100 Mental health conditions
<input type="checkbox"/> 170 Anesthesia complications	<input type="checkbox"/> 190.4 Vascular aneurysm/dissection	<input type="checkbox"/> 1100.1 Depression
<input type="checkbox"/> 180 Cardiomyopathy	<input type="checkbox"/> 190.5 Hypertensive cardiovascular disease	<input type="checkbox"/> 1100.9 Other psychiatric conditions/NOS
	<input type="checkbox"/> 190.6 Marfan's syndrome	<input type="checkbox"/> 1999 Unknown COD
	<input type="checkbox"/> 190.7 Conduction defects/arrhythmias	

- Did obesity contribute to the death? Yes Probably No Unknown
- Did mental health conditions contribute to the death? Yes Probably No Unknown
- Did substance use disorder contribute to the death? Yes Probably No Unknown
- Was this death a suicide? Yes No
- Was this death a homicide? Yes No
- If homicide, suicide, or accidental death, list the means of fatal injury Firearm Sharp instrument Blunt instrument Poisoning/overdose Hanging/strangulation/suffocation Fall Punching/kicking/beating
- If homicide, suicide, or accidental death, list the means of fatal injury Fire or burns Drowning Explosive Partner Ex-Partner Other Relative Other Acquaintance Other, specify _____ Unknown
- If homicide, suicide, or accidental death, list the means of fatal injury No relationship No relationship Partner Ex-Partner Other Relative Other Acquaintance Other, specify _____ Unknown

EVALUATION CRITERIA

A death is considered preventable if the committee determines that there was at least some chance of a death being averted by one or more reasonable changes to patient, family, community, provider, facility, and/or systems factors.

Was this death preventable? Yes No
 Chance to alter outcome? Good chance Some chance No chance Unable to determine

Critical Factors Worksheet

If there was at least some chance that the death could have been averted, what were the specific and feasible actions, which if implemented or altered, might have changed the course of events?

Critical Factor	Class Category and Description of Issue
Patient/Family	
Community	
Provider	
Facility	
System	

Class Category Key

- | | |
|---|---|
| <input type="checkbox"/> Delay | <input type="checkbox"/> Childhood abuse / trauma |
| <input type="checkbox"/> Adherence | <input type="checkbox"/> Access / financial |
| <input type="checkbox"/> Knowledge | <input type="checkbox"/> Unstable housing |
| <input type="checkbox"/> Cultural / religious | <input type="checkbox"/> Social support / isolation |
| <input type="checkbox"/> Environmental | <input type="checkbox"/> Equipment / technology |
| <input type="checkbox"/> Violence | <input type="checkbox"/> Policies / procedures |
| <input type="checkbox"/> Mental health | <input type="checkbox"/> Communication |
| <input type="checkbox"/> Substance use | <input type="checkbox"/> Continuity of care / care coordination |
| <input type="checkbox"/> Chronic disease | <input type="checkbox"/> Clinical skill / quality of care |

- Outreach
- Enforcement
- Referral
- Assessment
- Legal
- Other: _____

Recommendations of the Committee	Level of Prevention (select from menu below)	Level of Impact (select from menu below)

- Prevention
- Primary - Prevent incidence
 - Secondary - Prevent progression
 - Tertiary - Prevent complications

- Expected Impact Level
- Small - Education/Counseling (Community- / Provider-based health promotion and education activities)
 - Medium - Clinical intervention and Coordination of Care across continuum of well-woman through obstetrics (protocols, prescriptions)
 - Large - Long lasting protective intervention (Improve Readiness, Recognition and Response to Obstetric Emergencies / LARC)
 - Extra Large - Change in context (Promote environments that support healthy living / Ensure available and accessible services)
 - Giant - Address Social Determinants of Health (poverty, inequality, etc.)



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To submit a request, please call 1-800-525-0127 (TDD/TTY 711).