

Arizona Maternal Mortality Review Program

Program Report
2012 - 2015

ARIZONA DEPARTMENT OF HEALTH SERVICES
OFFICE OF INJURY PREVENTION

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**ARIZONA DEPARTMENT
OF HEALTH SERVICES**

PREVENTION SERVICES

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Executive Summary

The Arizona Maternal Mortality Review (MMR) has conducted reviews of all pregnancy associated deaths within the State since the program's inception in 2012. The review committee classifies maternal deaths into one of the four following categories: pregnancy related death, pregnancy associated death, not pregnancy related or associated, and unable to determine. Once categorized, the MMR team focuses on the cause of death for pregnancy related and pregnancy associated deaths. The comprehensive review examines whether the death was preventable or not and if there were any underlying causes for pregnancy related deaths. If the death was considered preventable, the committee will make recommendations on what could have been done to change the outcome.

While the overall number of maternal deaths in Arizona has largely remained the same on a year for year basis throughout the reporting period, the proportion of preventable maternal deaths is high. The committee reviewed a total of 141 maternal deaths that occurred from January 1, 2012 through December 31, 2015. Of those cases, the committee determined 89 percent of pregnancy related deaths were preventable, while 76 percent of pregnancy associated deaths were preventable. These results were drawn from in-depth reviews which examined all identifiable factors surrounding a maternal death.

The MMR program serves as a resource in understanding the risk factors associated with maternal mortality in Arizona. The reviews assist by promoting a proactive approach to prevention services. The determinations of the reviews contribute to improving the health and welfare of Arizona's future mothers. Each maternal death is a tragedy that can have rippling effects not only within their own family dynamic, but also throughout our society. Although there have been many advances in modern medicine, maternal deaths are on the rise across the nation.¹ Everyone can help prevent maternal deaths and awareness is the foundation of a solid prevention strategy.

Maternal mortality reviews are regularly conducted in Arizona. The program continues to grow with newly developed surveillance methods and utilize the data more effectively. Recent developments with the Centers for Disease Control (CDC) have afforded the program a new comprehensive data tracking software package that will greatly improve the program's ability to evaluate the data derived from the reviews.

This annual report provides recommendations with the intent to lower the maternal mortality rate in Arizona. The State MMR committee recommendations are supported by the findings from the review and analysis of the data derived from meeting determinations. Found in the body of the report are recommendations for individuals, communities, first responders, elected officials and the public.

¹ WHO, UNICEF, UNFPA, World Bank Group, & United Nations Population Division Maternal Mortality Estimation Inter-Agency Group (2015) *Maternal mortality in 1990-2015*. Retrieved from http://www.who.int/gho/maternal_health/countries/usa.pdf?ua=1



INTRODUCTION

The World Health Organization (WHO) estimated that the global maternal mortality rate declined from 385 deaths per 100,000 live births to 216 in 2015. Maternal mortality rates for high-income countries averaged 12 deaths per 100,000 live births. The United States showed a higher rate than other countries in the same income range with a maternal mortality rate of 17 deaths per 100,000 live births.² According to the CDC's Pregnancy Mortality Surveillance System, pregnancy related deaths increased from 7 deaths per 100,000 live births in 1987 to nearly 17 deaths per 100,000 live births in 2013.³ While progress to reduce these deaths has occurred globally, the rate in the United States has increased in the last fifteen years. On average, 1000 American women die of pregnancy related causes each year; many of which are preventable. Based on this report, Arizona has had an average of nine pregnancy related maternal deaths each year of the reporting period. While these deaths are rare, the majority of them are due to causes which are determined to be preventable. This knowledge emphasizes the need for continued efforts in order to increase prevention initiatives and reduce the number of maternal deaths.

BACKGROUND

The MMR program was created by Senate Bill 1121 which was passed in April of 2011. Arizona Revised Statute (ARS) was amended to establish the MMR program as a component to the Child Fatality Review (CFR) Program which is outlined in ARS 36-3501⁴. The amendment authorized the CFR program to create a subcommittee dedicated to the review of maternal deaths occurring within the State. The MMR subcommittee was established in July of 2011 and has been reviewing all identified pregnancy related deaths. This multidisciplinary team reviews cases in order to identify preventative factors with the intent to provide recommendations for systems level changes. The inaugural report was published in February 2013 which encompassed data for part of calendar year 2011 and all of 2012. This report is based on case reviews from January 2012 through December 2015.

² Centers for Disease Control (2017) Retrieved from <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pms.html>

³ WHO, UNICEF, UNFPA, World Bank Group, & United Nations Population Division Maternal Mortality Estimation Inter-Agency Group (2015) *Maternal mortality in 1990-2015*. Retrieved from http://www.who.int/gho/maternal_health/countries/usa.pdf?ua=1

⁴ Arizona Revised Statutes (ARS) (2017) Retrieved from <http://www.azleg.gov/viewdocument/?docName=http://www.azleg.gov/ars/36/03501.htm>



METHODOLOGY

The Arizona MMR program defines a pregnancy associated death as “the death of a woman while pregnant or within one year of pregnancy, and the cause of death was not directly related to the pregnancy.” Reviews include all deaths that meet this definition as well as pregnancy related death, defined as “the death of a woman while pregnant or within one year of termination of pregnancy, from any cause related to or aggravated by her pregnancy or its management, but not from any other cause of death.” Reviewing all pregnancy associated deaths allows the committee a broader view to identify all potential cases including those that might have been unidentified or misclassified.

Case identification overview for 2012 to 2015 MMR

A list of cases was compiled monthly by an epidemiologist from the Arizona Department of Health Services (ADHS) using the Arizona death database from the Office of Vital Records Vital Statistics Information Management System (VSIMS). All cases included in the list must have one of the following criteria: pregnant at the time of death; not currently pregnant, but pregnant within 42 days of death; not currently pregnant, but pregnant within 43 days to one year of death; or had an underlying cause of death related to pregnancy. These causes of death include ICD-10 codes A34, O00-O95, O96-O97, O98-O99, and ICD-9 codes 630-638, 640-648, 650-676. The list is narrowed by reproductive age, which are women aged 15 to 49. The MMR program manager reviews this list, and submits requests for relevant medical, legal, and social service records from various agencies. These agencies include, but are not limited to, medical facilities, behavioral health agencies, law enforcement, and obstetrical offices. ARS 36-3503 requires facilities to provide this information to the committee for review.⁵ By statute, the committee reviews of individual cases are kept confidential.

Review process for 2012 to 2015 MMR

Upon receipt of the records, the program manager reviews the information to determine whether the case is ready for review or if more information needs to be collected. Specific information may be necessary depending on the circumstances surrounding the death event, e.g. a suicide may be related to post-partum depression, which would mean the team needs information regarding the woman’s family and social history. The MMR committee is then provided an abstract of the information transcribed from the records. The records are also made available for further review at the time of the meeting. The MMR committee reviews all available information to make a determination regarding the woman’s primary cause, as well as any underlying causes of death; whether it was pregnancy related, pregnancy associated or unrelated to the pregnancy. These review meetings are held bi-monthly and, once the review is complete, the findings are entered into a secure database. The data is then analyzed and compiled into a report for Arizona’s health care community, other relevant agencies and the public.

⁵ Arizona Revised Statutes (ARS) (2017) Retrieved from <http://www.azleg.gov/viewdocument/?docName=http://www.azleg.gov/ars/36/03503.htm>



Retrospective case verification

The data presented in this report are maternal mortality cases which were previously identified and reviewed between 2012 and 2015. The specific methods used for case identifications and the MMR review process applied to this data are described earlier. Prior to data analysis, an epidemiologist from ADHS compiled a separate list of cases using the same inclusion criteria applied to identify cases between 2012 and 2015. This information was utilized to verify the existing 2012 to 2015 data.

FINDINGS

There were a total of 141 maternal deaths identified between 2012 and 2015. Out of the 141 maternal deaths identified, 124 were verified to satisfy the inclusion criteria (see page 4). Five additional cases from 2012 to 2015 were identified at a later date, but were not included in the analysis. Additionally, 38 of the verified cases were not eligible for review either because there was no evidence of pregnancy at the time of death, or there was no evidence that the woman was pregnant within one year of death. The information used to disprove pregnancy was found in documents obtained from medical facilities, behavioral agencies, law enforcement agencies and obstetrical offices. The final number of maternal deaths included in the analysis was 86.

Figure 1 illustrates the number of maternal deaths in Arizona from 2012 to 2015. Out of the 86 maternal deaths reviewed, 37 percent (n=32) occurred in 2012, 19 percent (n=16) occurred in 2013, 21 percent (n=18) occurred in 2014, and 23 percent (n=20) occurred in 2015. Figure 2 demonstrates the number of maternal deaths by age group. The case with the youngest maternal death reviewed by the committee was 17 years of age and the case with the oldest maternal death reviewed was 43. The average age of maternal death was 30 years of age. There were 30 percent (n=26) deaths below the age of 30, 49 percent (n=42) deaths were between 30-39 years of age, and 30 percent (n=18) deaths were between 40-49 years.

Figure 3 shows that the Hispanic or Latino population accounted for 35 percent (n=30) of maternal deaths; 31 percent (n=27) of maternal deaths were White, Non-Hispanic; and American Indian or Alaska Native accounted for 17 percent (n=15). Due to a very small sample size, Black or African American, Asian, and Pacific Islander were combined into one group. This group accounted for 16 percent (n=14) of deaths.



FIGURE 1. MATERNAL DEATHS BY YEAR, ARIZONA, 2012-2015 (N=86)

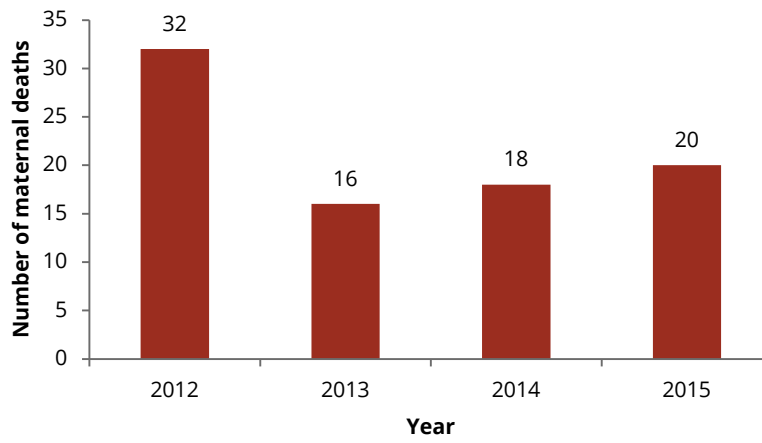


FIGURE 2. MATERNAL DEATHS BY AGE GROUP, ARIZONA, 2012-2015 (N=86)

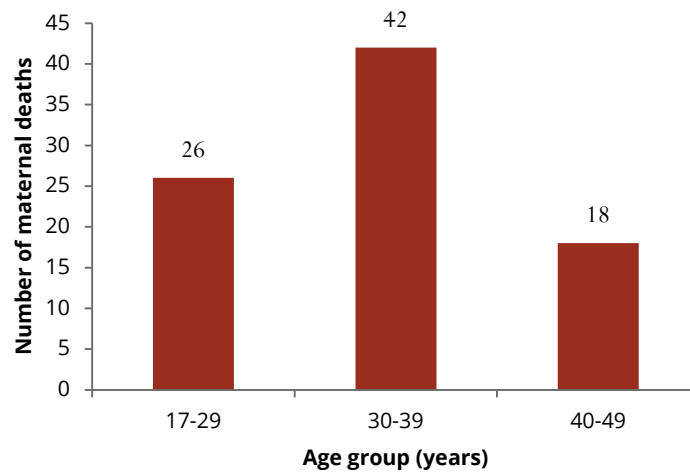
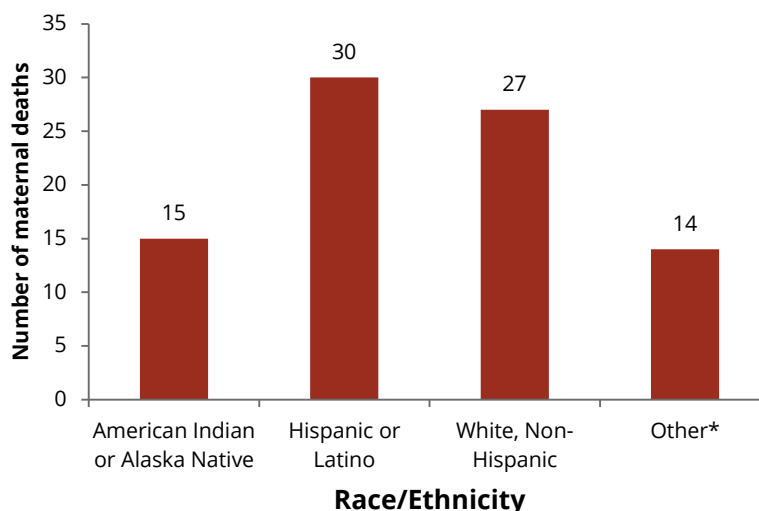


FIGURE 3. MATERNAL DEATHS BY RACE/ETHNICITY, ARIZONA, 2012-2015 (N=86)



*Other includes Black or African American, Asian, and Pacific Islander

Maternal Mortality Rate

The maternal mortality rate was calculated per 10,000 live births in Arizona. Figure 4 illustrates the maternal mortality rates per year from 2012 to 2015. Briefly, the maternal mortality rate in 2012 was 3.7 deaths per 10,000 live births. The maternal mortality rates of the latter years were lower. In 2013, the maternal mortality rate in Arizona was 1.8 deaths per 10,000 live births. In 2014 the rate was 2.1 deaths per 10,000 live births, and in 2015 the maternal mortality rate was 2.4 deaths per 10,000 live births. In Arizona, the overall maternal mortality (2012-2015) rate for American Indian or Alaska Native was 28.4 deaths per 10,000 live births, which is the highest compared to other race and ethnicity groups (Figure 5). Black or African American, Asian, and Pacific Islander were combined in one group due to small sample size. This group had an overall maternal mortality rate of 17.6 deaths per 10,000 live births. Hispanic or Latino had an overall maternal mortality rate of 9.0 deaths per 10,000 live births. White, Non-Hispanic had the lowest overall maternal mortality rate, which was 7.0 deaths per 10,000 live births.



FIGURE 4. MATERNAL MORTALITY RATES PER 10,000 LIVE BIRTHS BY YEAR, ARIZONA, 2012-2015 (N=86)

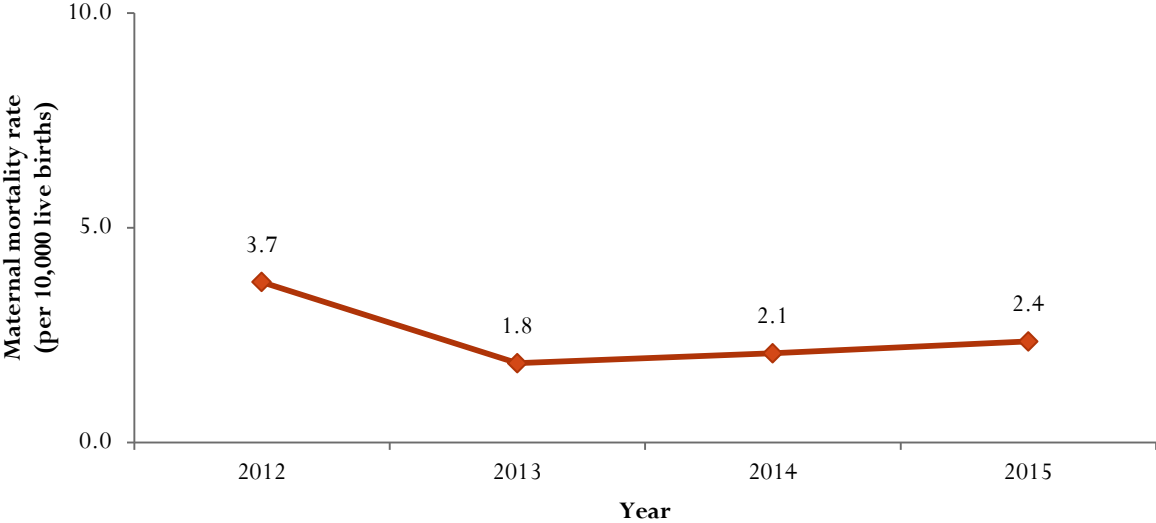
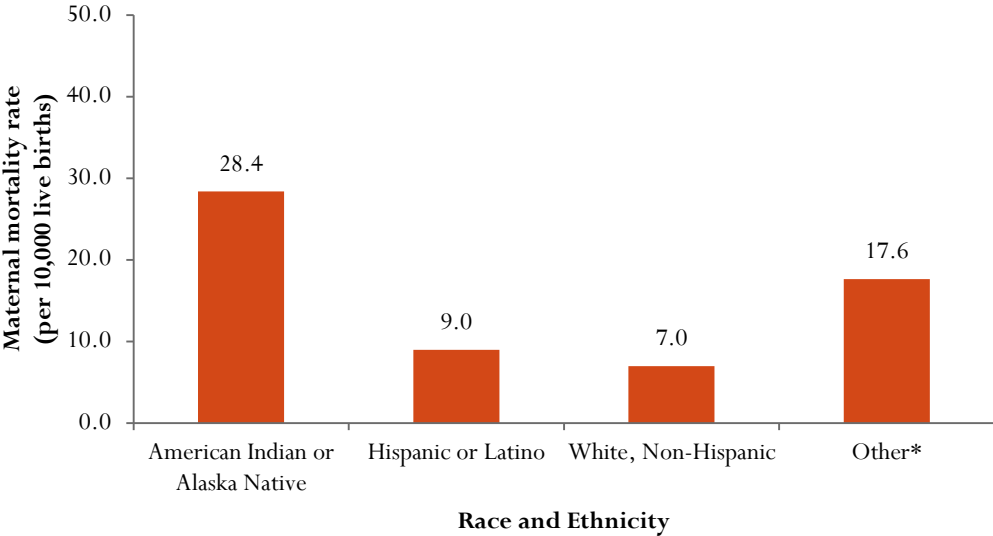


FIGURE 5. OVERALL MATERNAL MORTALITY RATES PER 10,000 LIVE BIRTHS BY RACE/ETHNICITY, ARIZONA, 2012-2015 (N=86)



*Other includes Black or African American, Asian, and Pacific Islander



Pregnancy related and Pregnancy associated Deaths

In figure 6, 57 percent (n=49) out of 89 cases were determined to be pregnancy associated deaths and 43 percent (n=37) of deaths were pregnancy related. The average age for pregnancy associated deaths was 28 years old while the average age for pregnancy related deaths was 32 years of age. Figure 7 shows the White, Non-Hispanic population had the largest proportion 39 percent (n=19) of pregnancy associated maternal deaths followed by Hispanic or Latino 35 percent (n=17). In the pregnancy related deaths Hispanic or Latino had the highest proportion of maternal death 35 percent (n=13).

FIGURE 6. PREGNANCY RELATED VS. PREGNANCY ASSOCIATED MATERNAL DEATHS, ARIZONA, 2012-2015 (N=86)

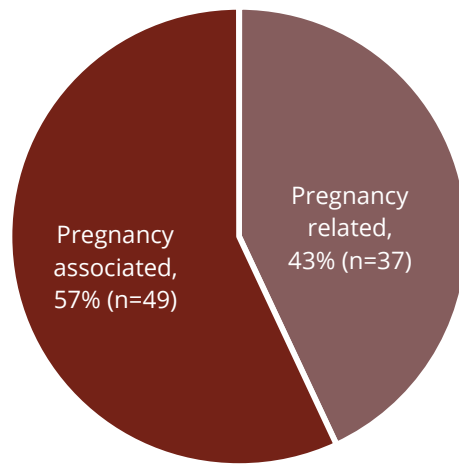
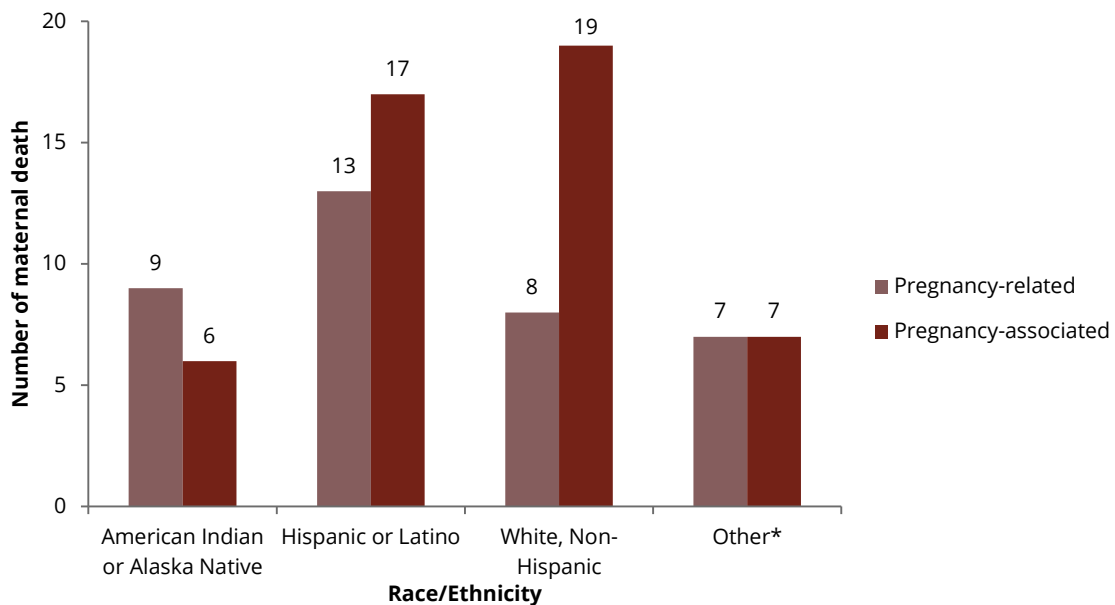


FIGURE 7. PREGNANCY RELATED VS. PREGNANCY ASSOCIATED MATERNAL DEATHS BY RACE/ETHNICITY, ARIZONA, 2012-2015 (N=86)



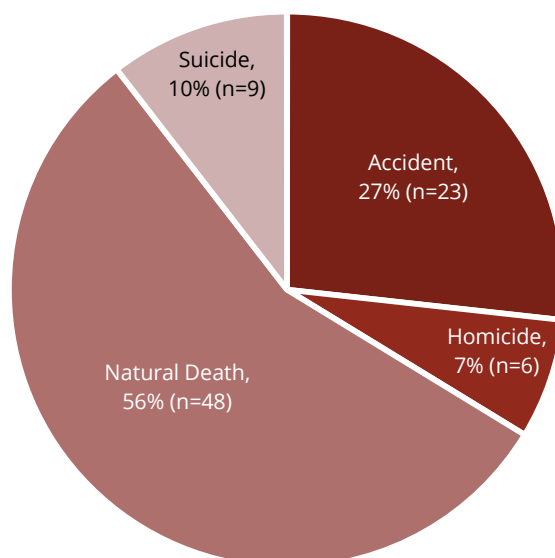
*Other includes Black or African American, Asian, and Pacific Islander



Manner and Cause of Death

Manner of death was extracted from the death certificate. There are five possible categories for manner of death: natural, accident, homicide, suicide, or undetermined. A natural death includes deaths from a natural disease process or medical complications, such as cancer or hypertensive disease. The majority of pregnancy associated and pregnancy related deaths are deemed natural deaths. A death is categorized as accidental when the death occurred due to unintentional causes, such as a motor vehicle crash. A death caused by another individual intending to cause injury or death is considered as homicide. Self-inflicted injury is considered a suicide. Deaths in the undetermined category are deaths where a complete review of the circumstances and examination of the body that yields no determinable cause of injury or natural disease process resulting in the death. Figure 8 includes all maternal deaths grouped by the manner of death as determined by the MMR committee. Natural deaths accounted for 56 percent (n=48) of the deaths, accidents for 27 percent (n=23), suicides for 10 percent (n=9), and homicides for 7 percent (n=6).

FIGURE 8. MATERNAL MORTALITY MANNER OF DEATH, ARIZONA, 2012-2015 (N=86)



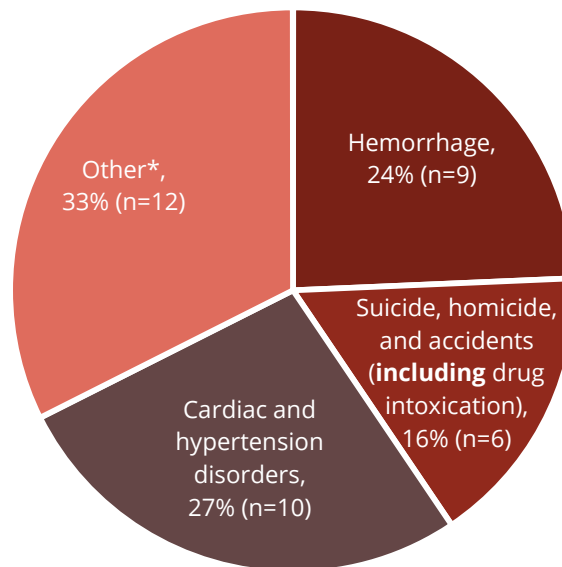
Details on the specific cause of death were found on the death certificate, and were collapsed into groups due to the small sample size. Causes of death in the category “Other” includes all deaths that did not fit in any of the other groups. Deaths due to suicide, homicide, or accidents were combined into one category to increase sample size. Deaths due to suicide included gunshot wounds and hangings. Deaths due to homicide included blunt force trauma and gunshot wounds. Accidental deaths included deaths due to substance use and blunt force injuries. Drug intoxication was analyzed separately in pregnancy-related deaths while, in pregnancy associated deaths, drug intoxication was grouped with suicide, homicide, and accidents due to insufficient sample size.



In pregnancy related deaths, 27 percent (n=10) of the deaths were due to cardiac and hypertension disorder, 16 percent (n=6) were due to suicide, homicide or accident, and 24 percent (n=9) were due to hemorrhage (Figure 9). Other causes of death accounted for 33 percent (n=12) of pregnancy related deaths. Deaths due to hemorrhage included, cerebral hematomas/hemorrhage, hemorrhagic shock, intracerebral hemorrhage, intracranial hemorrhage, massive intra-abdominal hemorrhage, and post-partum hemorrhage.

Figure 10 shows the causes of death in pregnancy associated deaths. 51 percent (n=25) out of 49 deaths in this group were due to suicide, homicide, or accident. Drug intoxication accounted for 14 percent (n=7) of deaths and 12 percent (n=6) of deaths were a result of cardiac and hypertension disorder. 22 percent (n=11) of pregnancy associated deaths were due to other causes.

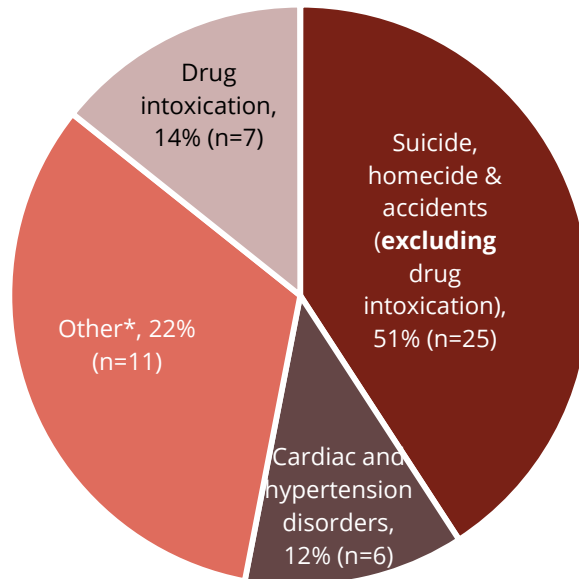
FIGURE 9. PREGNANCY RELATED CAUSE OF DEATH, ARIZONA, 2012-2015 (N=37)



*All deaths that do not fit in other groups



FIGURE 10. PREGNANCY ASSOCIATED CAUSE OF DEATH, ARIZONA, 2012-2015 (N=49)



*All deaths that do not fit in other groups

Postpartum Hemorrhage Cases

The MMR program conducted further analysis of postpartum hemorrhage cases in Arizona, because postpartum hemorrhage remains a leading cause of pregnancy related death globally and in the United States.⁶ Around eight percent of pregnancy-related deaths in the United States are attributed to postpartum hemorrhage.⁷ In Arizona, around two percent of pregnancy-related cases are due to post-partum hemorrhage.⁸ A review of maternal mortality cases from 2012-2015 that were due to a post-partum hemorrhage was conducted. Out of those cases, nine met the criteria; however one case was excluded due to a lack of information. An analysis was conducted with the available information from the death certificates, autopsies, and hospital records. The number of post-partum hemorrhages is too small to draw meaningful conclusions, but the following tables provide some insight into these deaths.

⁶ Smith, J.R. (2016). Post-partum Hemorrhage. *Medscape*. Retrieved from <http://emedicine.medscape.com/article/275038-overview>

⁷ Smith, 2016.

⁸ Eight cases out of 42 pregnancy related deaths.



FIGURE 11. POST-PARTUM HEMORRHAGES BY RACE/ETHNICITY, ARIZONA, 2012-2015 (N=8)

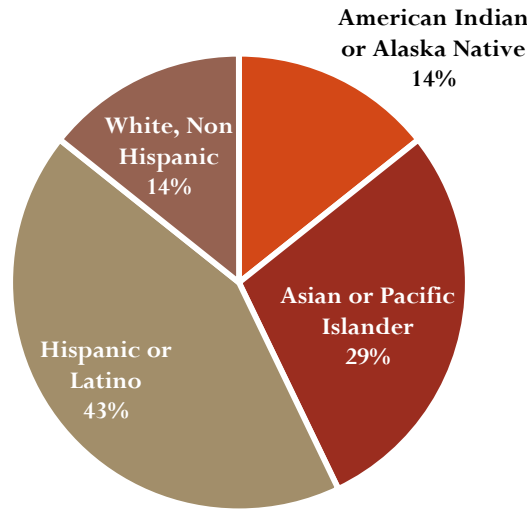


Figure 11 shows that the majority of women with post-partum hemorrhage were Hispanic or Latino.

FIGURE 12. POST-PARTUM HEMORRHAGES BY AGE GROUP, ARIZONA, 2012-2015 (N=8)

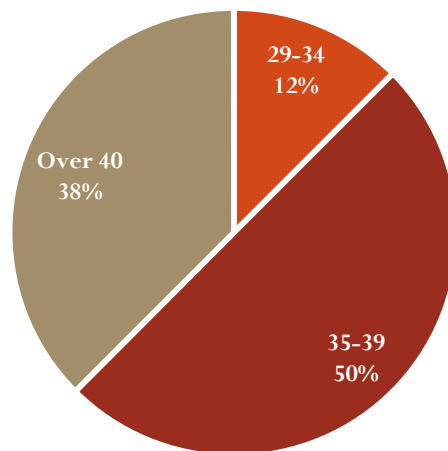


Figure 12 shows that more than three quarters of women with post-partum hemorrhage were over 35 years of age.



FIGURE 13. POST-PARTUM HEMORRHAGES GESTATIONAL AGE COMPLETED WEEKS, ARIZONA, 2012-2015 (N=8)

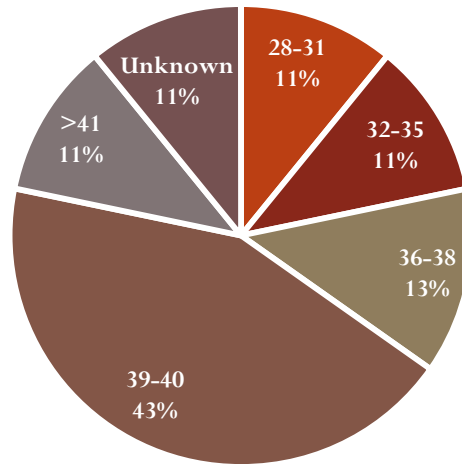


Figure 13 shows nearly half of the deliveries occurred between 39 to 40 weeks gestational age at delivery.

FIGURE 14. POST-PARTUM HEMORRHAGES DELIVERY MODE, ARIZONA, 2012-2015 (N=8)

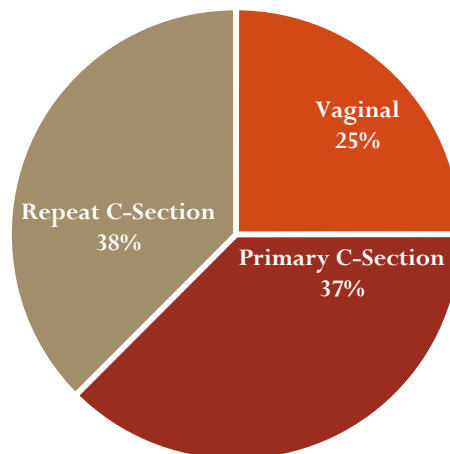


Figure 14 shows that the 75 percent of the deliveries were by cesarean section and nearly half of those procedures were noted to have been done in an emergency situation.



FIGURE 15. POST-PARTUM HEMORRHAGES ESTIMATED BLOOD LOSS (EBL), ARIZONA, 2012-2015 (N=8)

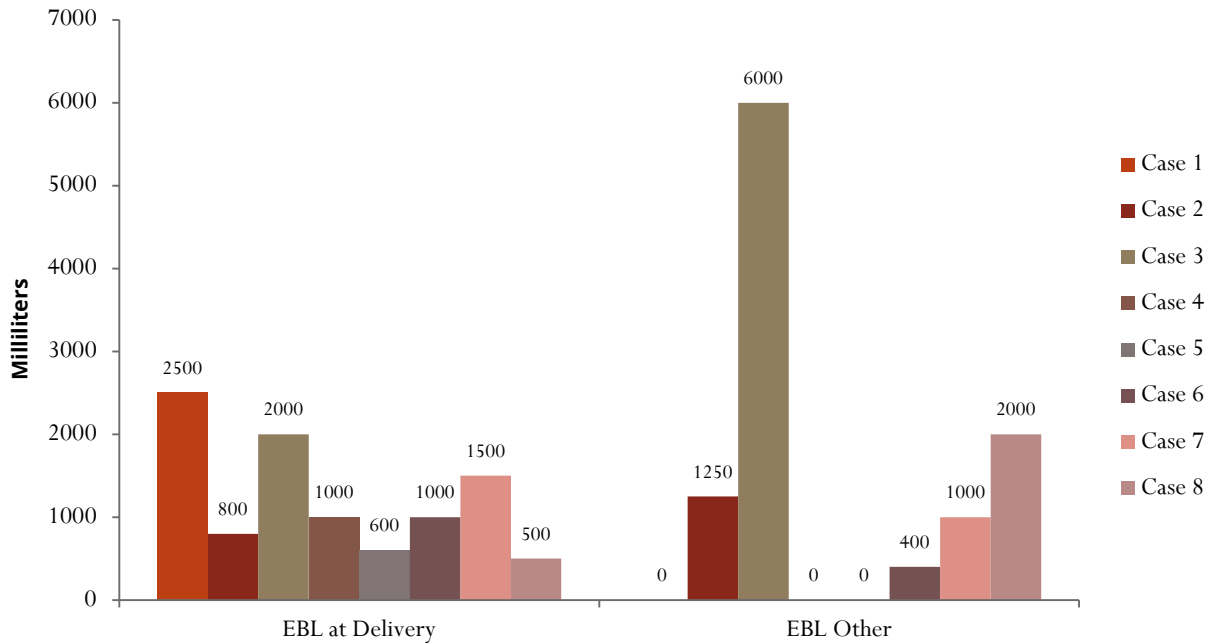


Figure 15 shows that in 63 percent of the cases the Estimated Blood Loss (EBL) was 1000 ml or greater at delivery. Forty percent of these women (who had greater than 1000 ml EBL) continued with large amounts of bleeding with an EBL of 1000 ml or greater at a time other than delivery post-partum.

FIGURE 16. POST-PARTUM HEMORRHAGES ADMISSION HCT AND HGB LEVELS, ARIZONA, 2012-2015 (N=7)

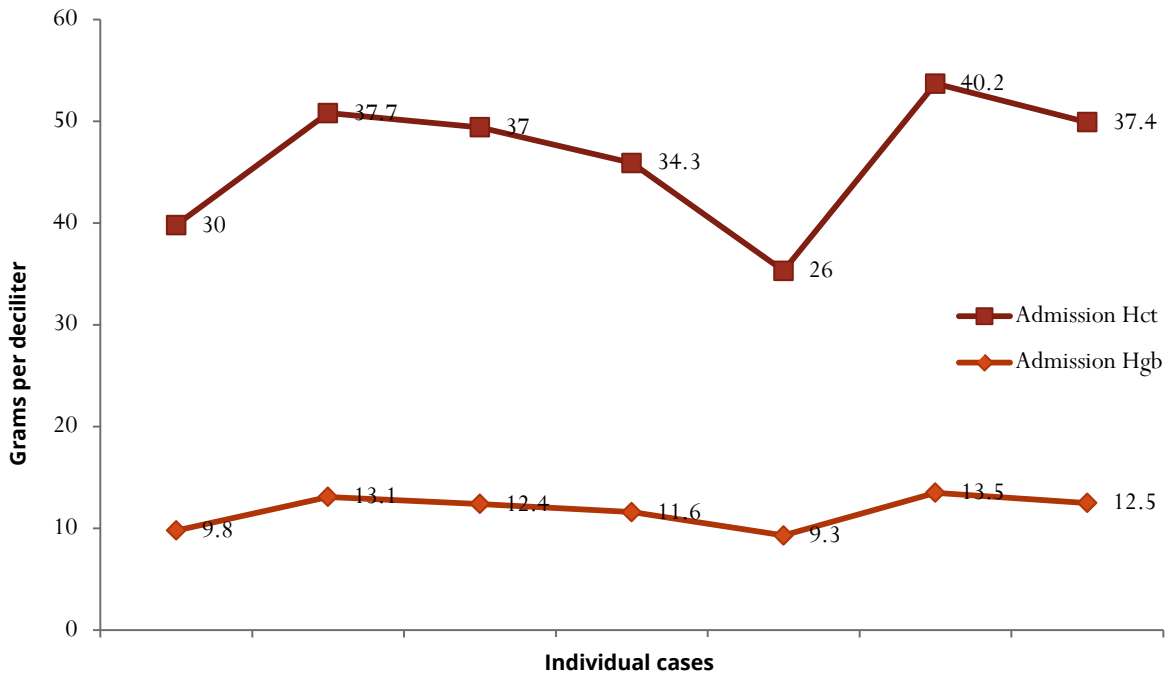


Figure 16 shows that admission hemoglobin ranged from 9.3-13.5 and hematocrit from 26-40.2.

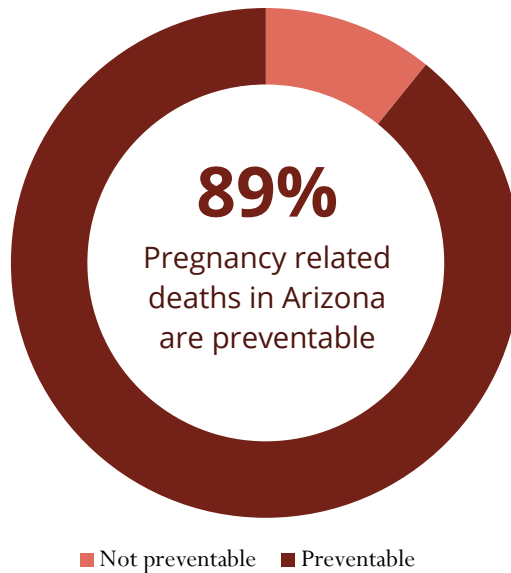


Preventability

The MMR process is based upon a public health focus where the outcomes of the reviews are focused on prevention of maternal deaths. Preventability of a death is determined based upon the idea that under reasonable conditions something could have been done by an individual, or by the community as a whole, to prevent the death. The MMR committee determined preventability of deaths following extensive discussion involving all available materials and information surrounding a maternal death.

For the deaths reviewed from 2012-2015, the MMR committee found 76 percent (n=37) pregnancy associated deaths were preventable and 89 percent (n=33) pregnancy related deaths were preventable. Possible preventable factors discussed during the committee review included no prenatal care, substance abuse, or failure to follow medical advice.

FIGURE 17. PREVENTABLE PREGNANCY RELATED DEATHS IN ARIZONA, 2012-2015 (N=33)



LIMITATIONS

This report has several limitations.

1. Protocols used for case identification may have varied from year to year due to changes in personnel involved with MMR. This variation of protocols may result to additional cases being identified or failure to identify specific cases in certain years. Recent compilation of maternal mortality cases for 2012 to 2015 from the Vital Statistics Information Management System (VSIMS), applying the same search criteria, found five additional MMR cases that were not previously identified. These cases were not included in the final data analysis.
2. There were cases where the death certificate identified a woman as being pregnant, however further investigation revealed there was no evidence of pregnancy at the time of death or there was no evidence that the woman was pregnant within one year of death. Most of these cases had death certificates and medical examiner reports, but not the associated medical records. The M.E. report often indicates if the woman was pregnant at the time of death, but is unable to identify the women who were not pregnant at the time of death, but had been pregnant within one year of death. Thus, the findings reported here may be an underestimation of the true value.
3. In 2010, SB1304 statutorily required the reporting of abortions, complications of abortions, and the treatment of those complications. The reporting system is web-based, and its design helps to protect patient anonymity by not collecting identifying information while still collecting aggregated data. This means it provides outcome information, but no data is available for the committee's review, making it difficult to determine whether the death was preventable or not.
4. The Office of the Medical Examiner only accepts cases where there are suspicious or unknown circumstances surrounding a death, e.g. suicide, homicide, or unknown medical complications. These circumstances may cause the program to miss women who died of natural causes who were unaware of their pregnancy at the time of death.
5. Arizona is home to 22 federally recognized Native American tribes. These sovereign nations are not required to provide the committee access to records. This may result in only having access to the death certificate and other limited records for a case review.

RECOMMENDATIONS

1. All pregnant women must have access to prenatal care, especially hard to reach populations, such as those living in rural areas, the uninsured, and the underinsured.
2. Promote public awareness of the importance of healthy behaviors and women's overall health prior to pregnancy in order to prevent pregnancy complications and improve the health of women and their future children.
3. Women should always wear proper restraints when riding in a motor vehicle.



4. Encourage maternal care professionals, organizations, and health facilities to update their standards of practice and care to include all recommended guidelines for the prevention of medical complications by instituting regular mandatory training and practice. Facilities should increase funding to provide access to simulation training and build partnerships to facilitate it.
5. Maternal health-care systems require strengthened, prepared, and educated communities to improve deliveries in health facilities, particularly in rural areas.
6. Increase and streamline access to behavioral health services statewide, including training and education for advanced practice nurses in behavioral health services.
7. Support and implement community suicide prevention and awareness programs, such as Mental Health First Aid, that train community members, teachers, families and students how to identify and address perinatal depression and related behaviors that can lead to suicide.
8. The Maternal Mortality Subcommittee recommends that health care providers screen frequently for perinatal depression and domestic violence; starting at the initial prenatal screening, throughout the pregnancy, in the postpartum period, and during well baby visits.
9. Institute and follow recommended California Maternal Quality Care Collaborative (CQMCC) guidelines (www.cmqcc.org) for the timely transfer and transport to a higher-level care facility for any complications using regional transport services.
10. Educate providers on the availability of maternal postpartum resources such as home visiting programs.



GLOSSARY

ARS – Arizona Revised Statutes

CDC – Centers for Disease Control

CFR – Child Fatality Review

Epidemiologist – A public health professional who investigates patterns and causes of diseases and injury in humans

ICD Code – International Classification of Diseases

ME – Medical Examiner

MMRIA – Maternal Mortality Review Information Application

MMR – Maternal Mortality Review

Pregnancy associated – 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

Pregnancy related – 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

UNFPA – United Nations Fund for Population Activities

UNICEF – United Nations International Children’s Emergency Fund

VSIMS – Vital Statistics Information Management System

WHO – World Health Organization

MEMBERSHIP

The Maternal Mortality Review team is comprised of a multidisciplinary team of professionals. These professionals include; OB/GYNs, neonatologists, directors of nursing, maternal-fetal medicine specialists, public health professionals, domestic violence specialists, behavioral health specialists, and representatives from Arizona’s tribal nations.

The following subcommittee members make the maternal mortality reviews in Arizona possible.

- Teresa Anzar, RNC-OB, MS-NL: RN Director, Women and Infant Services, Banner Health
- Deb Christian, Executive Director, Arizona Perinatal Trust
- Dr. Kimberly Couch, DNP, CNM, FNP: Director of Women & Infant Services, Phoenix Indian Medical Center, United States Public Health Services



- Dr. Michael Clement, MD, March of Dimes, Professional Services, Trustee for Arizona Perinatal Trust
- Dr. Dean Coonrod, MD-MPH: Chair, Department of OB and GYN, Maricopa Integrated Health System; Professor of OB and GYN, University of Arizona-College of Medicine, Phoenix
- Dr. Tim Flood, MD, Bureau Medical Director, Arizona Department of Health Services
- Dr. Robert Johnson, MD – Chair, Director of Maternal-Fetal Medicine, Arizona Perinatal Care Centers
- Dr. Michael McQueen, MD – Co Chair, NICU Director, Banner Thunderbird; Medical Director, Women and Infant Services, Banner Estrella; CEO, Goodnight Pediatrics; Medical Director, Women and Infant Services, Banner Del E. Webb
- Kathleen Malkin, RN, MS, Division Manager-Community Health Services, Pima County Health Department
- Brenda Nichols, Program Manager, HRPP/NICP, Arizona Department of Health Services
- Dr. Mary Rimsza, MD, State Team Chair-Arizona State Child Fatality Review Team; American Academy of Pediatrics-Arizona Chapter; University of Arizona College of Medicine
- Vivienne Rubio, MSN, RN, RNC-OB, C-EFM, Chandler Regional Medical Center
- Robin Shepherd, RN, MSN, Chief Nurse Officer, Abrazo Arrowhead Campus
- Karen Stewart, Program Manager, High Risk Perinatal Program/Neonatal Intensive Care Program, AHCCCS
- Tomi St. Mars, MSN,RN, CEN, FAEN, Chief, Office of Injury Prevention, Arizona Department of Health Services
- Lisa Villarroel, MD MPH, Medical Director, Bureau of Epidemiology and Disease Control, Arizona Department of Health Services
- Dr. Ken Welch, MD Life Fellow, American College of Obstetricians and Gynecologists



Appendix

Arizona Maternal Mortality Review Case Identification and Data Flow

