Maternal Deaths in Michigan, 2011-2015

Michigan Maternal Mortality Surveillance Program

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Overview

Key Findings

- All identified deaths that occur during pregnancy or within one year of pregnancy are reviewed
- Deaths are categorized as either **pregnancy-related** (Page 3) or **pregnancy-associated, not related** (Page 5)
- A total of **411 deaths** were reported in Michigan during 2011-2015, of which **66 deaths** were verified as not being pregnant and the pregnancy-relatedness was unable to be determined for an additional **6 deaths**
- During 2011-2015, **66 deaths** were identified as pregnancy-related
- The most common causes of pregnancy-related death were **cardiomyopathy** and **infection/sepsis**
- During 2011-2015, **273 deaths** were identified as pregnancy-associated, not related
- The most common cause of pregnancy-associated, not related death was **accidental drug overdose**
- Disparities exist by race, age, and education level
- Among the reviewed pregnancy-related deaths, 44% were determined to be preventable; among the reviewed pregnancy-associated injury cases, 39% were determined to be preventable

History

Michigan Maternal Mortality Surveillance (MMMS) began in 1950 in Michigan as collaboration between the Michigan Department of Health (now Michigan Department of Health and Human Services [MDHHS]), the Committee on Maternal and Perinatal Health of the Michigan State Medical Society (MSMS) and the Chairs of the Departments of Obstetrics and Gynecology of the medical schools in Michigan.

Now based at MDHHS, the MMMS program is comprised of two multidisciplinary committees that review cases of maternal death that occur during pregnancy or within one year of pregnancy. The medical committee focuses on reviewing natural causes of death and the injury committee focuses on reviewing non-natural causes of death, including accidents, homicides, and suicides. Cases of maternal death are identified through mandatory reports from hospitals/medical examiners, pregnancy check-box on the death certificate, 'O' codes under cause of death on the death certificate, and through probabilistic linkage by Vital Records. These cases are entered into a central database and medical records, police reports, and autopsy reports are collected for case abstraction. After case abstraction is complete, a case narrative is composed for review by the appropriate committees. The committees classify deaths into one of two categories to define the woman's death relative to pregnancy: pregnancy-related or pregnancy-associated, not related. The committees also make policy recommendations based on the cases reviewed that could help prevent similar deaths in the future.

An interdisciplinary committee, comprised of members from the medical and injury committees, meet twice each year to discuss the prioritization of the recommendations from each multidisciplinary committee and to focus on strategies for implementation of those recommendations.

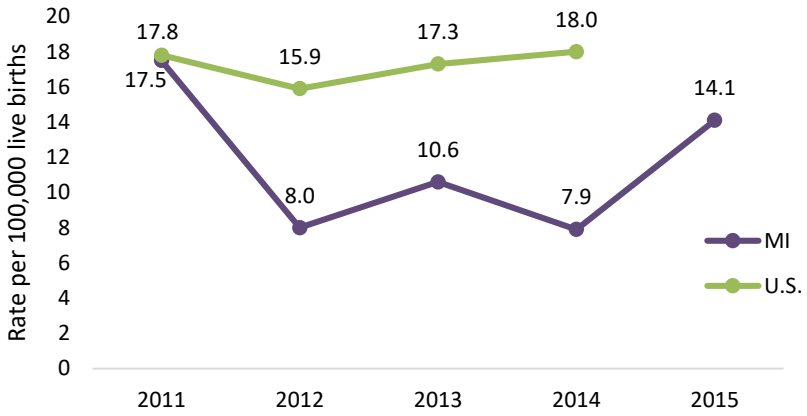
Pregnancy-Related Mortality

Pregnancy-related mortality is the death of a woman while pregnant or within one year of the end of a pregnancy from any cause **related to or aggravated by** the pregnancy or its management. This does not include accidental or incidental causes.

From 2011-2015, 66 women died of pregnancy-related causes in Michigan, which is a rate of 11.6 deaths per 100,000 live births. Because of the relatively small numbers of cases, a small increase in deaths can lead to large changes in the rates of mortality. In 2014, 9 women died from pregnancy-related causes. In 2015, this number increased to 16, resulting in the rate nearly doubling from 7.9 to 14.1 deaths per 100,000 live births (Figure 1).

The national pregnancy-related mortality rate was comparable to Michigan's rate in 2011 (17.8 and 17.5 per 100,000, respectively). Pregnancy-related mortality in the U.S. remained stable in subsequent years, while Michigan's rate decreased. National data was not yet available for 2015.

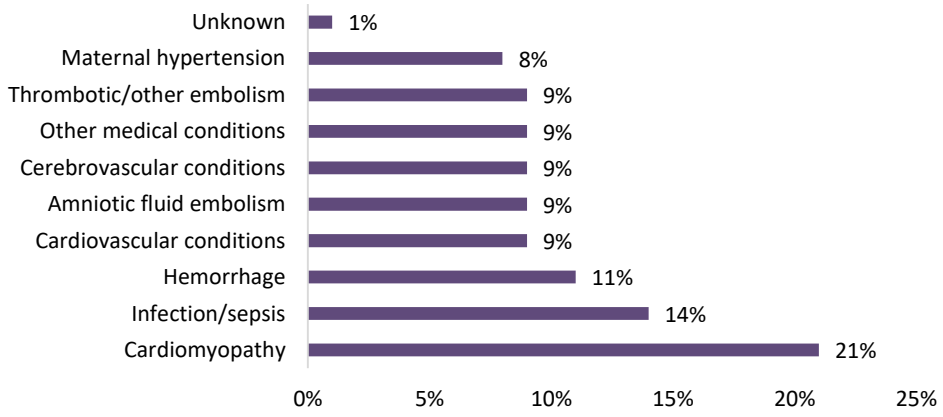
Figure 1. Pregnancy-Related Mortality in MI, 2011-2015



Causes of Pregnancy-Related Deaths

The most common cause of pregnancy-related deaths in Michigan is cardiomyopathy (21%), followed by infection/sepsis (14%) (Figure 2). Less common but significant causes of death include cardiovascular conditions, amniotic fluid embolism, cerebrovascular conditions, embolism, hypertension, and other medical conditions (mostly due to chronic diseases such as cancer, epilepsy, and diabetes).

Figure 2. Causes of Pregnancy-Related Deaths in Michigan, 2011-2015



Pregnancy-Related Mortality

Disparities

Nationwide, black women die from pregnancy-related causes at a much higher rate compared to white women. From 2011-2015, black women were **three times** more likely to die from pregnancy-related causes in Michigan (27.7 and 8.1 per 100,000, respectively). However, this is an improvement from 2007-2010, when black women died five times more often than white women from pregnancy complications. This may be due to a larger decrease in the *average* number of pregnancy-related deaths in black women during this time compared to white women.

Maternal education among pregnancy-related deaths differs from the general Michigan birth cohort. The majority of women that died from pregnancy-related causes had a high school diploma or GED (36%), yet the majority of women who gave birth in Michigan had at least some college education (33%). While 28% of women who give birth in Michigan had four or more years of college, only 17% of women who died from pregnancy-related causes had the same level of education (Figure 4).

Maternal age among pregnancy-related deaths was compared to mothers that gave birth during the same time frame. While age groups appear somewhat similar (Figure 5), a higher percentage of mothers who die from pregnancy-related causes are 35-39 years old and 40 years or older (18% vs. 11% and 6% vs. 2%).

Figure 3. Pregnancy-Related Mortality Rates (per 100,000 live births) by Maternal Race, Michigan, 2011-2015

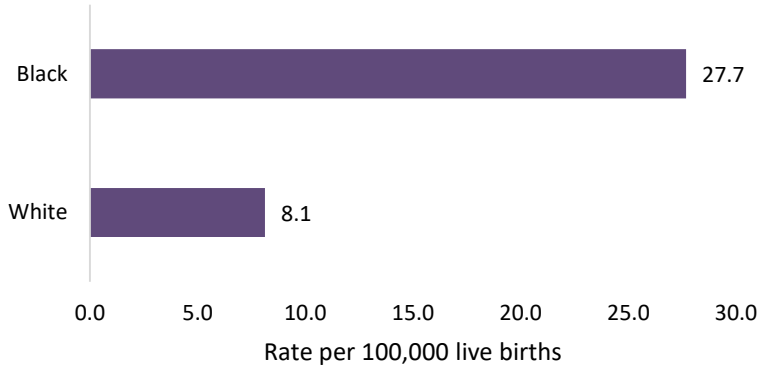


Figure 4. Maternal Education Among Pregnancy-Related Deaths and Michigan Birth Cohort, 2011-2015

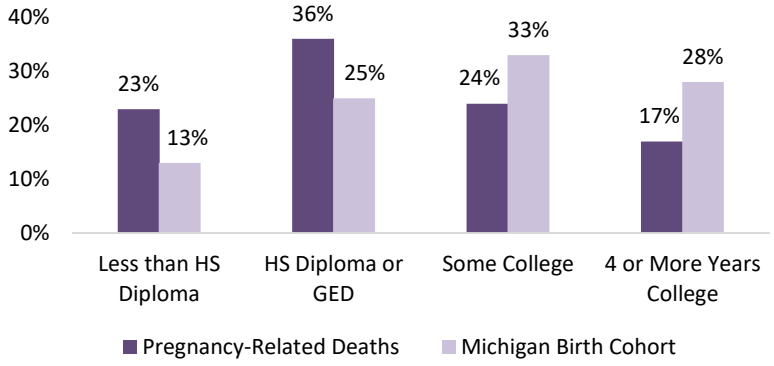
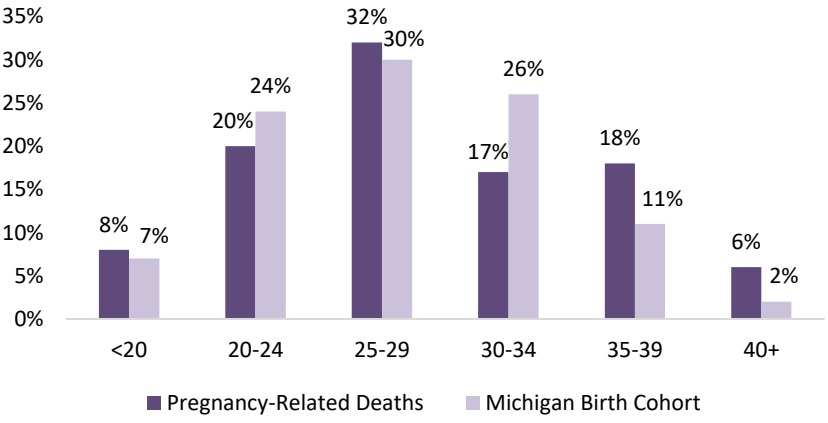


Figure 5. Maternal Age Among Pregnancy-Related Deaths and Michigan Birth Cohort, 2011-2015



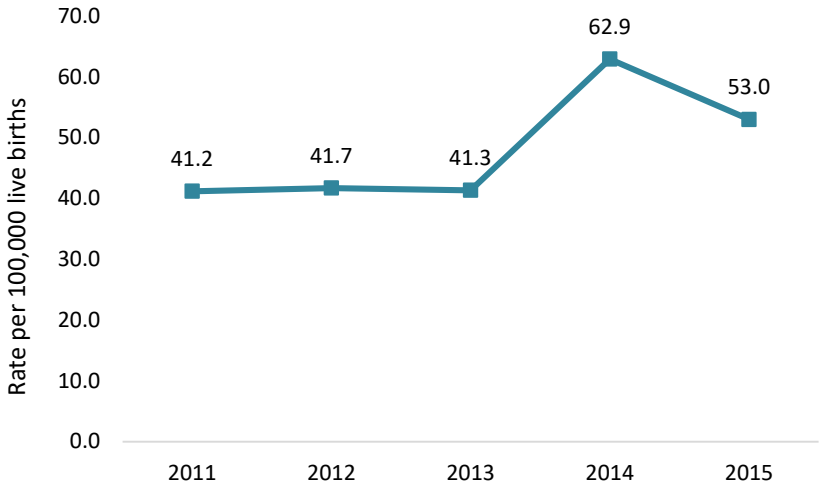
Pregnancy-Associated Mortality

Pregnancy-associated, not related mortality is the death of a woman while pregnant or within one year of the end of a pregnancy due to a cause **unrelated to** pregnancy.

From 2011-2015, 273 women in Michigan died from pregnancy-associated, not related causes, or a rate of 47.9 per 100,000 live births. This includes both accidental and medical causes of death which were determined to be unrelated to pregnancy.

In 2013, 47 women died from pregnancy-associated, not related causes. In 2014, this number rose to 72, resulting in the rate increasing from 41.3 to 62.9 deaths per 100,000 live births (Figure 6). It is unclear why there was such a large increase in 2014, but we suspect it was due to an increase in the number of deaths due to cardiovascular conditions, as well as other medical conditions such as cancer, asthma, epilepsy, and other chronic diseases.

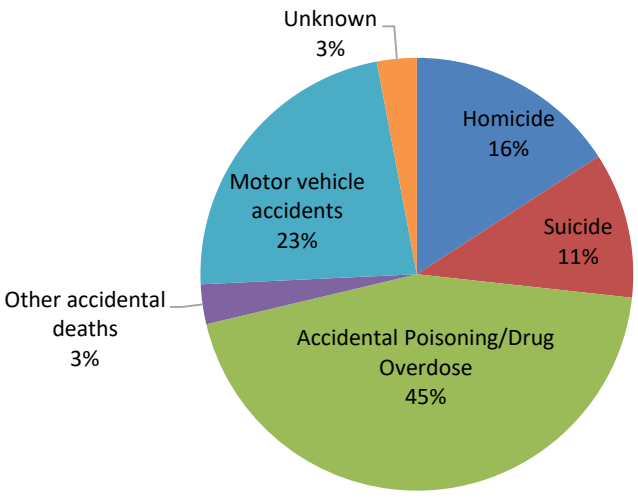
Figure 6. Pregnancy-Associated, Not Related Mortality in MI, 2011-2015



Causes of Pregnancy-Associated, Not Related Injury Deaths

The most common cause of pregnancy-associated injury death is accidental poisoning/drug overdose (45%). Other common causes of death include motor vehicle accidents (23%), homicide (16%), and suicide (11%). Other accidental deaths (3%) include deaths such as electrocution, hypothermia, fire, drowning, and other unintentional deaths.

Figure 7. Causes of Pregnancy-Associated Injury Deaths in Michigan, 2011-2015

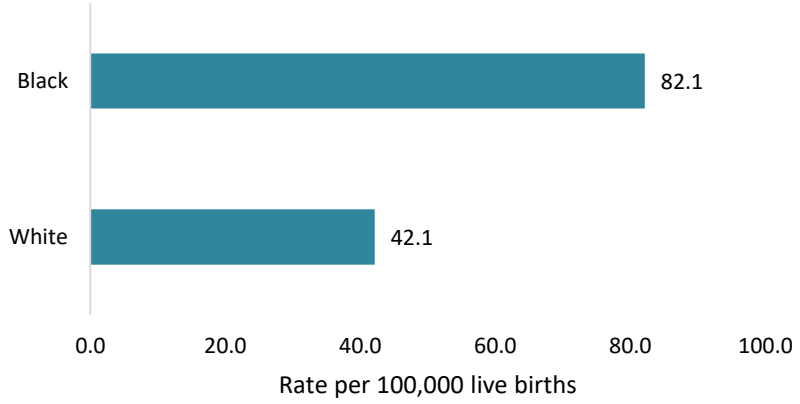


Pregnancy-Associated Mortality

Disparities

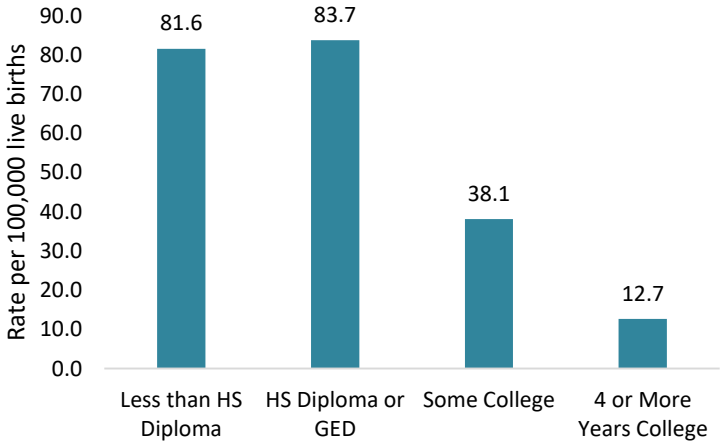
Disparities exist among pregnancy-associated, not related deaths in Michigan. Similar to pregnancy-related deaths, there is also a racial disparity for pregnancy-associated, not related deaths. From 2011-2015, black women were twice as likely to die from pregnancy-associated, not related causes compared to white women (Figure 8).

Figure 8. Pregnancy-Associated, Not Related Mortality Rates (per 100,000 live births) by Maternal Race, Michigan, 2011-2015



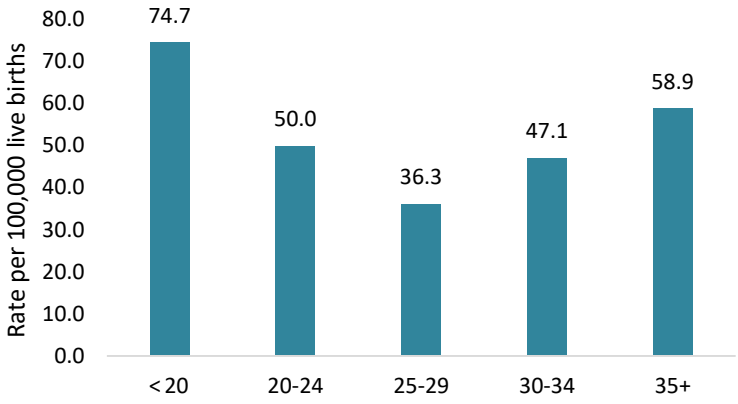
There is also a disparity in maternal education among women who die from pregnancy-associated, not related causes. Women with a high school education or less were more likely to die from pregnancy-associated causes (83.7 and 81.6 per 100,000) compared to those with a higher level of education (38.1 and 12.7 per 100,000). (Figure 9).

Figure 9. Maternal Education Among Pregnancy-Associated, Not Related Deaths, Michigan, 2011-2015



Pregnancy-associated, not related mortality rates also vary greatly among maternal age groups. Women younger than 20 years old have the highest rates of death in Michigan (74.7 per 100,000 live births). Additionally, women who are 35 years or older also experience higher rates compared to women ages 20–34, at 58.9 per 100,000 live births (Figure 10).

Figure 10. Pregnancy-Associated, Not Related Mortality Rates by Maternal Age, MI 2011-2015



Preventability

Preventability

The committees consider whether an intervention at the provider, patient, facility, system, community, or policy domain could have potentially averted the death. For each domain, preventability is considered at three levels:

- **Primary prevention** avoids the development of a disease and/or injury. Most population-based health promotion activities are primary preventive measures.
- **Secondary prevention** activities are aimed at early disease detection, thereby increasing opportunities for interventions to prevent progression of the disease, condition, or problem.
- **Tertiary prevention** reduces the negative impact of an already established disease, condition, or problem by restoring function and reducing disease-related complications.

A death is considered **preventable** if the committee determines there was at least some chance of the death being averted by one or more reasonable changes in any domain at any level. Preventability is unknown if there is insufficient information available to determine if a death was preventable.

Of the 66 pregnancy-related deaths reviewed from 2011-2015, **44%** were determined to be preventable. Of the 191 pregnancy-associated, not related injury deaths reviewed during that same time period, **39%** were preventable.

Figure 11. Preventability for Pregnancy-Related Deaths, MI 2011-2015

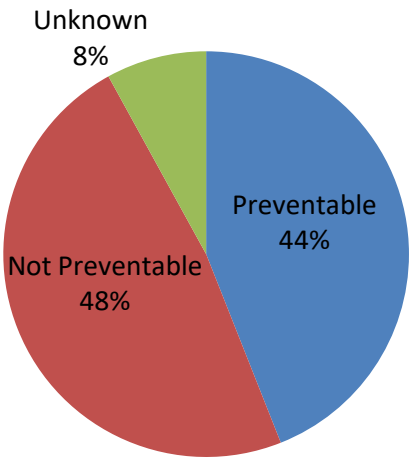
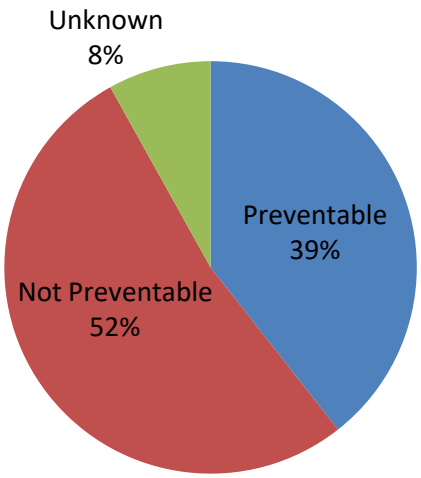


Figure 12. Preventability for Pregnancy-Associated, Not Related Injury Deaths, MI 2011-2015



Successes and Further Recommendations

Successes

- Participated in the CDC Pregnancy Checkbox Quality Assurance Pilot project which aimed to examine the validity of the pregnancy checkbox in four states. MDHHS now has a process in place to certify pregnancy in deaths without linked birth records before additional records are requested for abstraction.
- The mandatory maternal death reporting law, Public Act 479 of 2016, was passed on January 5, 2017 which requires physicians and individuals in charge of health facilities to report maternal deaths.
- Michigan joined the Alliance for Innovation in Maternal Health (AIM) in 2015, a national data-driven maternal safety and quality improvement initiative with the goal of preventing/reducing severe maternal morbidity and maternal mortality. Michigan started implementing hemorrhage and hypertension safety bundles in early 2016 and has started to see improvements in hospitals implementing bundles and reductions in severe maternal morbidity.
- The MMMS program implemented an expedited review process (pre-committee review of certain types of cases) starting in mid-2016 which has helped reduce the backlog of cases. Since then, over 150 cases have received an expedited review.

Priority MMMS Recommendations

The committees recommend:

- Increase the use and implementation of the Alliance for Innovation in Maternal Health (AIM) hemorrhage, hypertension, and opioid bundles.
- Enhance education and coordination with lay midwives around timely referral of women to hospitals as appropriate.
- Develop and implement community education initiatives regarding Narcan availability and use.
- Develop and implement community education initiatives about postpartum depression.
- Promote appropriate evaluation of all women who present to the emergency department with severe pain.
- Promote earlier postpartum follow-up by prenatal care providers for those patients with severe mental health issues.
- Advocate for wellness checks for mothers be conducted by CPS and community mental health following the removal of a child from the home.
- Implement guidelines regarding follow-up for women who score high on postpartum depression screenings.
- Develop and implement an expanded awareness campaign around the Michigan mandatory maternal death reporting law.