

Maternal mortality in the United States: A brief history, overview, and update



Rachel Weigel, MD Candidate, University of Minnesota Medical School

Editor's Choice
March 29, 2019

Abstract

Maternal mortality is both a crucial measure in global public health initiatives and a standard by which many nations compare their quality of care. Researchers, journalists, and physicians are investigating the United States' maternal health crisis and searching for solutions to combat this growing epidemic. This paper discusses the history of maternal mortality surveillance and summarizes classifications, key research findings, current policy efforts, and strategies for further improvement.

Background

Maternal mortality is both a crucial measure in global public health initiatives and a standard by which many nations compare their quality of care. In the United States alone, approximately 700 women die from pregnancy-related issues each year [1]. These include conditions such as post-partum hemorrhage, hypertension, and infection. Researchers, journalists, and physicians are actively investigating the United States maternal health crisis and searching for solutions to combat this growing epidemic. Despite this increased awareness of maternal health and a 44% decrease in pregnancy-related mortality ratios worldwide, the United States' reported maternal mortality ratios are increasing at an alarming rate [2]. In fact, over the past three decades, maternal mortality ratios more than doubled [3].

This paper discusses the history of maternal mortality surveillance and summarizes classifications, key research findings, current policy efforts, and strategies for further improvement.

A Brief History and Summary of Maternal Mortality Surveillance and Measurement

In 1915, the National Center for Health Statistics (NCHS) began to monitor maternal death via death certificates submitted by each state, reporting statistics as maternal mortality rates (maternal deaths per 100,000 live births). Over the next 45 years, the majority of states formed their

own review committees, called Maternal Mortality Review Committees (MMRCs), which reported state or local-level pregnancy-related mortality ratios. However, due to a decrease in maternal deaths and fear of litigation by other physician committee members, nearly half of all MMRCs disbanded in the late 1980s. In 1986, the Pregnancy Mortality Surveillance System (PMSS) was founded in response to both the deteriorating number of MMRCs and the limited accuracy of death certificate data reported through the NCHS. Using pregnancy checkbox data from death certificates, medical epidemiologists worked toward a more clinically relevant representation of maternal deaths by linking these deaths to birth certificates, fetal death certificates, and/or causes of death. [4]

It is important to note that the pregnancy checkbox on U.S. death certificates was only recently updated in 2003 to include the timing of death in relation to pregnancy. Furthermore, only 4 states updated their checkbox in 2003 and as of 2017 only 46 states and the District of Columbia implemented this added field. [4, 5]

The PMSS is limited in that it can only compile data from certificates from states who voluntarily send them to the Centers for Disease Control and Prevention (CDC) [6]. Nonetheless, the CDC's PMSS pregnancy-related mortality ratios (pregnancy-related deaths per 100,000 live births) is currently the most utilized surveillance tool in the U.S. for maternal mortality analysis. [1, 4].

Classification of Pregnancy-Related Deaths

The classification of a woman's death as pregnancy-related varies slightly among different maternal mortality surveillance systems in the United States. The most commonly used definitions are the CDC's NCHS and PMSS. The NCHS defines the term 'maternal death' as death during or within 42 days of termination of pregnancy. The PMSS, which shares their definition with local MMRCs, exercises the terms 'pregnancy-related, pregnancy-associated, or associated but not pregnancy-related death' [1]:

- **Pregnancy-associated deaths:** all deaths during pregnancy or within one year of pregnancy, regardless of cause
- **Pregnancy-related deaths:** deaths of women during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy
- **Pregnancy-associated but not related deaths:** deaths of women during pregnancy or within one year of the end of pregnancy from a cause not related to pregnancy

The origin of the NCHS and PMSS terms originate from ICD-10 codes and a team of medical epidemiologists utilizing PMSS codes, respectively [1, 4].

Most Common Preventable Causes of Maternal Mortality

The top six causes of pregnancy-related fatalities in the U.S., in descending order, are: cardiovascular disease, other medical non-cardiovascular disease, infection/sepsis, hemorrhage, cardiomyopathy, and thrombotic pulmonary embolisms [3]. The National Partnership for Maternal Safety was founded on the need to decrease maternal mortality rates through the collaboration of several organizations including, but not limited to, the American College of Obstetrics and Gynecologists (ACOG) and the American College of Nurse-Midwives (ACNM). It began its initiatives by identifying 3 of the most common and preventable causes of maternal mortality, namely, obstetric hemorrhage, venous thromboembolism (VTE), and severe hypertension. An estimated 93% of all maternal deaths related to hemorrhage were considered preventable in recent reviews [7]. Further-

more, VTE was deemed the single cause of mortality most amenable to reduction by systematic change in practice [7]. An estimated 60% of deaths from hypertension were considered preventable in recent reviews; the degree of systolic hypertension has been noted as the most important predictor of hemorrhagic stroke and cerebral infarction in mothers [7]. Over the past 4 years, the National Partnership for Maternal Safety ultimately converted this data into published, evidence-based sets of care guidelines proven to improve patient outcomes, termed consensus bundles, for hemorrhage, VTE, and severe hypertension to be implemented immediately in hospitals across the nation [7].

Populations at Risk

Given that many of the most common causes of maternal mortality and morbidity are preventable, it is helpful, with a view toward corrective practices, to identify patient populations at greatest risk for such complications. A 2016 population-based case-control study found five factors to be associated with increased likelihood of maternal mortality among women 35 years or older: smoking during pregnancy, older maternal age, pre-existing medical comorbidities, previous pregnancy problems, and inadequate use of antenatal care [8].

Nevertheless, maternal morbidity and mortality is not entirely predictable based solely on the factors listed above. Unforeseen fatal pregnancy complications continue to occur in young patients otherwise considered low-risk upon admission to the hospital. Additionally, patient's sociodemographic factors, as well as implicit biases of health professionals, have been found to contribute significantly to maternal mortality suggesting discrimination is present in obstetric care [9, 10]. Specifically, non-Hispanic black mothers are dying at rates 3-4 times that of non-Hispanic white mothers in the U.S [9]. Moreover, New York City, NY and Milwaukee, WI, despite their reputations for excellent health care, are specifically noted to have even higher maternal mortality ratios in black women compared to the rest of the nation [10].

Etiology of the Temporal Increase: More than ICD-10 Codes and Checkboxes?

The root cause of the rising maternal death rates in the U.S. remains controversial due to the lack of nationally instituted regulations for data collection and state reporting, combined with the everchanging measures, methods, and analysis of maternal mortality surveillance. A 2017 retrospective study using maternal-mortality ratios (with data obtained from birth and death certificates) reported that the maternal mortality ratios from 1993 to 2014 increased from 7.55 to 21.5 per 100,000 live births [11]. However, upon further analysis researchers found that four new ICD-10 codes implemented during that time period fully accounted for the perceived temporal increase [11]:

- O26.8: pregnancy-related deaths
- O96: obstetric deaths >42 days <1 year
- O97: deaths due to sequelae of obstetric causes
- O99: other maternal disease classifiable elsewhere but complicating pregnancy, childbirth, and puerperium

Another observational study comparing maternal mortality rates obtained from NCHS data from 2008-2009 with 2012-2014 found a 23% increase in these rates [2]. Yet, when patients over 40 years of age or those with nonspecific causes of death were excluded, no significant increase was noted. Regardless, known causes of maternal mortality and maternal mortality ratios of those under 40 years old are still significantly higher than other industrialized countries [2].

The inconsistency of states reporting, as noted above, in combination with the lack of quality data over the past two decades illustrates that the increase in maternal mortality may be due to an increase in statewide data reporting and monitoring, rather than a true increase in rate. The primary aim of the PMSS 33 years ago was to improve the quality of maternal mortality data, yet authors today consider the current state of maternal mortality surveillance an ‘international embarrassment’ given that the U.S. has been unable to provide a national maternal mortality rate to international data repositories since 2007 [5]. The mothers of this nation and their children need a unanimously employed maternal surveillance system in order for the U.S. to be a united and sound front against the maternal health crisis.

Nine States Rising to the Challenge

In 2017, the development of the Maternal Mortality Review Data System (MMRDS) and Maternal Mortality Review Information

Application (MMRIA) created a platform for MMRCs to report and reflect upon maternal health data [1]. In February 2018, nine state MMRCs (termed the Nine Committees)—Colorado, Delaware, Georgia, Hawaii, Illinois, North Carolina, Ohio, South Carolina, and Utah—responded to the need for comprehensive review and assessment of maternal mortality and morbidity. Together, they published an innovative and extensive report outlining their recommendations for maternal death prevention. In the report, they discussed the severe maternal morbidity and mortality data collected using the MMRDS and MMRIA. Ultimately, they proposed a tool to better address health inequities in maternal care. Additionally, an estimated level of potential impact, if such recommendations were implemented, was also included. The Nine Committees stated four areas may have the largest potential for population-level impact if implemented: adopting levels of maternal care, improving policies regarding prevention initiatives, enforcing policies and procedures related to obstetric hemorrhage, and improving policies related to patient management.

One major public policy effort to help state MMRCs operate is the Preventing Maternal Deaths Act/ Maternal Health Accountability Act or H.R. 1318/S. 1112, introduced at the 155th Congress in March 2017. The H.R. 1318/S. 1112 bill would allow the Department of Health and Human Services (HHS) to grant funding to state MMRCs and develop procedures for mandatory reporting to their state departments of health regarding maternal deaths. On December 21, 2018, H.R. 1318 became a law, and the S. 1112 bill was sent to the Senate Health Committee for review [12].

In the interim, the Nine Committees have proposed an innovative tool to begin addressing aspects of maternal death currently being overlooked. This tool, termed the ‘Socio-Spatial Dashboard’, strives to better incorporate social determinants of health and the impact of patient, family, provider, facility, health system and community-level factors as part of the larger setting of each death. The Dashboard proposes six key socio-spatial indicators, called ‘environments’, to assess for areas of needed intervention and more vigilant monitoring in patients. The six environments are: general health services,

reproductive health services, behavioral health, transportation, social and economic. [1] This initial report from Nine Committees may be setting the new gold standard of comprehensive maternal mortality review analysis and discussion in the United States. It is imperative that the remaining 41 states also prioritize maternal health, take responsibility for their population's health, and join in this effort.

Take Home Points

- Over the past three decades maternal-mortality ratios in the United States have more than doubled [3].
- Some of this increase can be attributed to improvements in maternal health surveillance with the NCHS, the PMSS, and MMRCs [2].
- However, adjusted maternal death rates are still much higher than those in other industrialized nations, suggesting a need for improved, comprehensive data collection and analysis [2].
- The National Partnership of Maternal Safety developed practice bundles for three of the most common and preventable causes of maternal death: hemorrhage, venous thromboembolism (VTE), and severe hypertension [7].
- Non-Hispanic black mothers are found to be the most vulnerable to implicit bias and sociodemographic factors and die at rates 3-4 times that of non-Hispanic white mothers in the U.S [11].
- The Nine Committees may be setting a new gold standard of comprehensive maternal mortality review analysis and discussion with state MMRCs in the future [1].
- The Preventing Maternal Deaths Act/ Maternal Health Accountability Act would allow (HHS) to fund state MMRCs and develop procedures for mandatory reporting regarding maternal deaths. The Act is currently under review by the Senate Health Committee [12].

Author Contact Information

Rachel Weigel: weig0101@umn.edu

References

- [1] Building U.S. Capacity to Review and Prevent Maternal Deaths. (2018). *Report from nine maternal mortality review committees*. Retrieved from http://reviewtoaction.org/Report_from_Nine_MMRCs
- [2] Macdorman, M. F., Declercq, E., & Thoma, M. E. (2017). Trends in Maternal Mortality by Sociodemographic Characteristics and Cause of Death in 27 States and the District of Columbia. *Obstetrics & Gynecology*, 129(5), 811-818. doi:10.1097/aog.0000000000001968
- [3] Hirshberg, A., & Srinivas, S. K. (2017). Epidemiology of maternal morbidity and mortality. *Seminars in Perinatology*, 41(6), 332-337. doi:10.1053/j.semperi.2017.07.007
- [4] Pierre, A. S., Zaharatos, J., Goodman, D., & Callaghan, W. M. (2017). Challenges and Opportunities in Identifying, Reviewing, and Preventing Maternal Deaths. *Obstetrics & Gynecology*, 1. doi:10.1097/aog.0000000000002417
- [5] MacDorman, M. F., Declercq, E., Cabral, H., & Morton, C. (2016). Recent Increases in the U.S. Maternal Mortality Rate: Disentangling Trends From Measurement Issues. *Obstetrics and gynecology*, 128(3), 447-55.
- [6] Reproductive Health. (2018, August 07). Retrieved from <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-mortality-surveillance-system.htm>
- [7] D'Alton ME, Friedman AM, Smiley RM, et al. (2017). National Partnership for Maternal Safety. *Survey of Anesthesiology*, 61(1):13. doi:10.1097/01.sa.0000513494.93773.d9
- [8] McCall S, Nair M, Knight M. (2016). Factors associated with maternal mortality at advanced maternal age: a population-based case-control study. *BJOG: An International Journal of Obstetrics & Gynaecology*, 124(8):1225-1233. doi:10.1111/1471-0528.14216
- [9] Mann S, Hollier LM, McKay K, Brown H. (2018). What We Can Do about Maternal Mortality — And How to Do It Quickly. *New England Journal of Medicine*, 379(18):1689-1691. doi:10.1056/nejmp1810649
- [10] Nowakowski A, Jensen RH. (2017). Researcher explores how segregation affects maternal mortality rates. *WUWM 897*. <http://www.wuwm.com/post/researcher-explores-how-segregation-affects-maternal-mortality-rates#stream/0>.
- [11] Joseph KS, Lisonkova S, Muraca GM, et al. (2017). Factors Underlying the Temporal Increase in Maternal Mortality in the United States. *Obstet Gynecol*, 129(1):91-100.
- [12] Beutler H. Text - H.R.1318 - 115th Congress (2017-2018): Preventing Maternal Deaths Act of 2017. Congress.gov. <https://www.congress.gov/bill/115th-congress/house-bill/1318/text?format=txt>.