Maternal Mortality in the USA

Amos Grunebaum1, Frank Chervenak2

ABSTRACT

Maternal mortality is a major global concern. The time period of maternal death in the USA after delivery is extended for up to 1 year after pregnancy, while according to the World Health Organization (WHO) that period is only within 42 days after pregnancy termination, these two different definitions of maternal deaths, in the USA and by the WHO, make it impossible to precisely compare maternal death ratios between the USA and the remainder of the world. With this in mind, the USA is the only high-income country where maternal mortality rates seem to have increased over the last decades. The cause of the differences between the USA and other countries could be the reporting mechanism and the differences in maternal mortality definitions between the Centers for Disease Control and Prevention (CDC) and the WHO definition. The causes of the increase in maternal mortality in USA are unknown but could include the higher age of women having their first child, and the increase in the obesity and opioid epidemic. In the USA, about one third of maternal deaths happen during pregnancy, about one third happen at delivery or in the week after, and about one third happen 1 week to 1 year postpartum, and about 60% of maternal deaths are potentially preventable.

Keywords: Hemorrhage, Maternal deaths, Maternal mortality, Preeclampsia, Thromboembolism, United states.

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INTRODUCTION

Maternal mortality is a major global concern. A pregnancy-related death is defined differently in the USA vs the remainder of the world (Table 1).

About one third of deaths (31%) happened during pregnancy, about one third (36%) happened at delivery or in the week after, and about one third (33%) happened 1 week to 1 year postpartum.1 The time period of maternal death in the USA after delivery is extended for up to 1 year after pregnancy, while according to the World Health Organization (WHO) that period is only within 42 days after pregnancy termination, and these two different definitions of maternal deaths, in the USA and by the WHO, make it impossible to precisely compare maternal death ratios between the USA and the remainder of the world because automatically more maternal deaths will be reported in the USA compared to the remainder of the world (Fig. 1).

The 1 in 3 maternal deaths that occurs in the USA between more than a week and up to 1 year after delivery is unlikely to be included in other countries’ maternal deaths because the WHO defines a maternal death only up to 6 weeks (42 days) after delivery.

In 2015, maternal mortality in the USA was 25 per 100,000 live births. In the United Kingdom, the number was less than 9. In Canada, it was less than 7. The maternal mortality as defined by the Centers for Disease Control and Prevention (CDC), therefore, places the USA far behind other industrialized nations that use the WHO definition of maternal deaths.2

Table 1: Definition of pregnancy-related death by the Centers for Disease Control and Prevention vs World Health Organization (WHO)

<table>
<thead>
<tr>
<th>CDC1,4</th>
<th>WHO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>“… the death of a woman while pregnant or within 1 year of the end of a pregnancy—regardless of the outcome, duration, or site of pregnancy—from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.”</td>
<td>“… the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental causes.”</td>
</tr>
</tbody>
</table>

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The pregnancy-related mortality ratio is an estimate of the number of pregnancy-related deaths for every 100,000 live births. The pregnancy-related mortality ratio fell significantly in the USA during the 20th century. Although a notable decline in maternal mortality in the USA occurred during the mid-20th century, this progress stalled during the late 20th century. Furthermore, maternal mortality rates have increased during the early 21st century. Since 1987 the number of reported pregnancy-related deaths in the USA steadily increased from 7.2 deaths per 100,000 live births in 1987 to 16.9 deaths per 100,000 live births in 2016. The estimated maternal mortality rate (per 100,000 live births) for 48 states and Washington DC (excluding California and Texas, which were analyzed separately) increased by 26.6% from 18.8 in 2000 to 23.8 in 2014. California showed a declining trend, while Texas had a sudden increase in 2011 to 2012.6

Around the year 2000, the maternal mortality rate began to rise and has since nearly doubled. Given that at least half of maternal deaths in the USA are preventable, the rise in maternal deaths in the USA is historic and worrisome.7

In 2017, pregnancy-related maternal mortality was ranked the 10th most frequent cause of death in all races and origins in the USA among 25–34 years old, and the 6th leading cause of death for women 20–34 years of age right after heart disease but before diabetes.8

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African-Americans died at significantly higher rates during antepartum, intrapartum, and postpartum periods compared to hospitalizations for whites or Hispanics during the same time period.  

### What are the Causes of the Increased Maternal Mortality in the USA?

The exact reasons for the overall increase in pregnancy-related mortality in the USA are unclear. One reason could be the improved reporting of maternal deaths. Identification of pregnancy-related deaths has improved over time due to the use of computerized data linkages by the states, changes in the way causes of death are coded, and the addition of a pregnancy checkbox to the death certificate. In addition, errors in reported pregnancy status on death certificates have been described, potentially leading to overestimation of the number of pregnancy-related deaths. Whether the actual risk of a woman dying from pregnancy-related causes in the USA has truly increased is unclear, and in recent years the pregnancy-related mortality ratios have been relatively stable.

In the USA, data are collected based on racial/ethnic groups, and considerable disparities in pregnancy-related mortality exist between the groups (Table 2).

An increasing number of pregnant women in the USA is reported to have chronic health conditions such as obesity, hypertension, diabetes, obesity, and chronic heart disease, or to being addicted to drugs such as opioids. These conditions may put a pregnant woman at higher risk of pregnancy complications. While the contribution of hemorrhage, hypertensive disorders of pregnancy (i.e., preeclampsia, eclampsia), and anemia complications to pregnancy-related deaths has declined, the contribution of cardiovascular, cerebrovascular accidents, and other medical conditions has increased. When combined, cardiovascular conditions (i.e., cardiomyopathy, other cardiovascular conditions, cerebrovascular accidents) were responsible for greater than one third of the pregnancy-related deaths in 2011 to 2016 (Table 3). In addition, obesity has further increased maternal morbidity and mortality.

The USA is the only high-income country without universal healthcare and this could be partially responsible for the increased maternal mortality rates. One study reported that the rural residents in the USA had a 9% greater probability of severe maternal morbidity and mortality, compared with the urban residents. Challenges in rural areas include both clinical factors (workforce shortages, low patient volume, and the opioid epidemic) and social determinants of health (transportation, housing, poverty, food security, racism, violence, and trauma).

About 700 maternal deaths are reported each year in the USA. According to several reports, about 1 in 3 of these occurs between 1 week and 1 year after delivery, and about 60% of these are preventable.

### Efforts in the USA to Prevent Maternal Mortality

One study covering two decades for New York State indicated that “Current hospital-based interventions have not reduced maternal mortality in New York.”

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**Table 2: Maternal mortality rate per 100,000 live births by ethnicity in the USA**

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Mortality Rate per 100,000 Live Births</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black non-Hispanic women</td>
<td>42.4</td>
</tr>
<tr>
<td>American Indian/Alaskan native non-Hispanic women</td>
<td>30.4</td>
</tr>
<tr>
<td>Asian/Pacific Islander non-Hispanic women</td>
<td>14.1</td>
</tr>
<tr>
<td>White non-Hispanic women</td>
<td>14.1</td>
</tr>
<tr>
<td>Hispanic women</td>
<td>13.0</td>
</tr>
</tbody>
</table>

**Table 3: Percentages of pregnancy-related deaths in the USA (2011–2016)**

<table>
<thead>
<tr>
<th>Death Category</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>11.0</td>
</tr>
<tr>
<td>Infection or sepsis</td>
<td>12.5</td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>5.6</td>
</tr>
<tr>
<td>Thrombotic pulmonary or other embolism</td>
<td>9.0</td>
</tr>
<tr>
<td>Hypertensive disorders of pregnancy</td>
<td>6.9</td>
</tr>
<tr>
<td>Anesthesia complications</td>
<td>0.3</td>
</tr>
<tr>
<td>Cerebrovascular accidents</td>
<td>7.7</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>11.0</td>
</tr>
<tr>
<td>Other cardiovascular conditions</td>
<td>15.7</td>
</tr>
<tr>
<td>Other noncardiovascular medical conditions</td>
<td>13.9</td>
</tr>
<tr>
<td>The cause of death for 6.4% of all 2011–2016 pregnancy-related deaths</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

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**Fig. 1:** Trends in pregnancy-related mortality in the United States: 1987–2016. From: https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm
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Table 4: Safety bundles created by AIM

- Maternal mental health: depression and anxiety
- Maternal venous thromboembolism (+AIM)
- Obstetric care for women with opioid use disorder (+AIM)
- Obstetric hemorrhage (+AIM) Postpartum care basics for maternal safety
- From birth to the comprehensive postpartum visit (+AIM)
- Transition from maternity to well-woman care (+AIM)
- Prevention of retained vaginal sponges after birth
- Reduction of peripartum racial/ethnic disparities (+AIM)
- Safe reduction of primary cesarean birth (+AIM)
- Severe hypertension in pregnancy (+AIM)

From: https://safehealthcareforeverywoman.org/patient-safety-bundles/

With the support of the American College of Obstetricians and Gynecologists, the “Alliance for Innovation on Maternal Health (AIM)” was created as a maternal safety and quality improvement initiative to improving maternal safety and outcomes in the USA. The goal of AIM is to eliminate preventable maternal mortality and severe morbidity across the USA, but it can also serve as an example for other countries.

The Alliance for Innovation on Maternal Health has developed the so called “safety bundles” (Table 4), which are a structured way of improving the processes of care and patient outcomes by using a small, straightforward set of evidence-based practices—generally three to five—that, when performed collectively and reliably, have been proven to improve patient outcomes. A safety bundle is a collection of 10–13 best practices for improving safety in maternity care that have been vetted by experts in practice (Appendix).

The goal of a bundle is to move established guidelines into practice with a standard approach.

Conclusion

Maternal mortality has increased in the USA over the last decades. The USA has the highest maternal mortality rates among the high-income countries and is the only one country where maternal mortality rates have increased. The cause of the differences between the USA and other countries could be the reporting mechanism and the differences in maternal mortality definitions between the CDC and the WHO definition. The causes of the increase in maternal mortality rates in the USA are unknown but could include the higher age of women at the time of their first child and the increase in the obesity and opioid epidemic. A significant difference in maternal mortality rates was observed in the USA between different ethnic groups. It is important to notice that in the USA about one third of maternal deaths happen during pregnancy, about one third happened at delivery or in the week after, and about one third happened 1 week to 1 year postpartum, and about 60% of maternal deaths are potentially preventable. This information is essential when devising programs such as AIM to prevent maternal mortality.

References

Appendix: Three Examples of AIM Patient Safety Bundles

Example 1

![Patient Safety Bundle](image)

**READINESS**

Every Unit
- Use a standardized thromboembolism risk assessment tool for VTE during:
  - Outpatient prenatal care
  - Antepartum hospitalization
  - Hospitalization after cesarean or vaginal deliveries
  - Postpartum period (up to 6 weeks after delivery)

**RECOGNITION & PREVENTION**

Every Patient
- Apply standardized tool to all patients to assess VTE risk at time points designated under "Readiness"
- Apply standardized tool to identify appropriate patients for thromboprophylaxis
- Provide patient education
- Provide all healthcare providers education regarding risk assessment tools and recommended thromboprophylaxis

**RESPONSE**

Every Unit
- Use standardized recommendations for mechanical thromboprophylaxis
- Use standardized recommendations for dosing of prophylactic and therapeutic pharmacologic anticoagulation
- Use standardized recommendations for appropriate timing of pharmacologic prophylaxis with neuraxial anesthesia

**REPORTING/SYSTEMS LEARNING**

Every Unit
- Review all thromboembolism events for systems issues and compliance with protocols
- Monitor process metrics and outcomes in a standardized fashion
- Assess for complications of pharmacologic thromboprophylaxis

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Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women’s Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women’s Health Care is a broad consortium of organizations across the spectrum of women’s health for the promotion of safe health care for every woman.

For more information visit the Council’s website at www.safehealthcareforeverywoman.org

October 2015
Example 2

READINESS
Every Unit
- Standards for early warning signs, diagnostic criteria, monitoring and treatment of severe preeclampsia/eclampsia (include order sets and algorithms)
- Unit education on protocols, unit-based drills (with post-drill debriefs)
- Process for timely triage and evaluation of pregnant and postpartum women with hypertension including ED and outpatient areas
- Rapid access to medications used for severe hypertension/eclampsia: Medications should be stocked and immediately available on L&D and in other areas where patients may be treated. Include brief guide for administration and dosage.
- System plan for escalation, obtaining appropriate consultation, and maternal transport, as needed

RECOGNITION & PREVENTION
Every Patient
- Standard protocol for measurement and assessment of BP and urine protein for all pregnant and postpartum women
- Standard response to maternal early warning signs including listening to and investigating patient symptoms and assessment of labs (e.g. CBC with platelets, AST and ALT)
- Facility-wide standards for educating prenatal and postpartum women on signs and symptoms of hypertension and preeclampsia

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RESPONSE

Every case of severe hypertension/preeclampsia

- Facility-wide standard protocols with checklists and escalation policies for management and treatment of:
  - Severe hypertension
  - Eclampsia, seizure prophylaxis, and magnesium over-dosage
  - Postpartum presentation of severe hypertension/preeclampsia
- Minimum requirements for protocol:
  - Notification of physician or primary care provider if systolic BP \( \geq 160 \) or diastolic BP \( \geq 110 \) for two measurements within 15 minutes
  - After the second elevated reading, treatment should be initiated ASAP (preferably within 60 minutes of verification)
  - Includes onset and duration of magnesium sulfate therapy
  - Includes escalation measures for those unresponsive to standard treatment
  - Describes manner and verification of follow-up within 7 to 14 days postpartum
  - Describe postpartum patient education for women with preeclampsia
- Support plan for patients, families, and staff for ICU admissions and serious complications of severe hypertension

REPORTING/SYSTEMS LEARNING

Every unit

- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of all severe hypertension/eclampsia cases admitted to ICU for systems issues
- Monitor outcomes and process metrics

Note: “Facility-wide” indicates all areas where pregnant or postpartum women receive care. (E.g. L&D, postpartum critical care, emergency department, and others depending on the facility.)
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Example 3

COUNCIL ON PATIENT SAFETY IN WOMEN’S HEALTH CARE

safe health care for every woman

READINESS

Every unit

- Hemorrhage cart with supplies, checklist, and instruction cards for intrauterine balloons and compressions stitches
- Immediate access to hemorrhage medications (kit or equivalent)
- Establish a response team - who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
- Establish massive and emergency release transfusion protocols (type-O negative/uncrossmatched)
- Unit education on protocols, unit-based drills (with post-drill debriefs)

RECOGNITION & PREVENTION

Every patient

- Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
- Measurement of cumulative blood loss (formal, as quantitative as possible)
- Active management of the 3rd stage of labor (department-wide protocol)

RESPONSE

Every hemorrhage

- Unit-standard, stage-based, obstetric hemorrhage emergency management plan with checklists
- Support program for patients, families, and staff for all significant hemorrhages

REPORTING/SYSTEMS LEARNING

Every unit

- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of serious hemorrhages for systems issues
- Monitor outcomes and process metrics in perinatal quality improvement (QI) committee

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