Maternal Deaths in the United States
Why Is It So Hard to Account for Them?

William M. Callaghan, MD, MPH
Chief, Maternal and Infant Health Branch
Division of Reproductive Health
Centers for Disease Control and Prevention

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MATERNAL DEATHS—ONE IN A THOUSAND

The Journal takes pride in announcing that for the first time in history the maternal mortality rate for a large nation—the United States of America—has been pushed slightly below the apparently irreducible minimum of 1 maternal death per 1,000 live births. When

This is, indeed, a story of human as well as medical progress. The fact that the chances of survival for the mother are better than 999 out of 1,000 should bring comfort and consolation in a troubled era to expectant mothers and their husbands, their children and their parents. Childbearing has been made quite safe.
Maternal Mortality Rate, United States

Deaths per 100,000 live births

JAMA “proclamation”
Achievements in Public Health, 1900–1999

Healthier Mothers and Babies

At the beginning of the 20th century, for every 1000 live births, six to nine women in the United States died of pregnancy-related complications, and approximately 100 infants died before age 1 year (1, 2). From 1915 through 1997, the infant mortality rate declined >90% to 7.2 per 1000 live births, and from 1900 through 1997, the maternal mortality rate declined almost 99% to <0.1 reported death per 1000 live births (7.7 deaths per 100,000 live births in 1997) (3) (Figures 1 and 2). Environmental interventions, improvements in nutrition, advances in clinical medicine, improvements in access to health care, improvements in surveillance and monitoring of disease, increases in education levels, and improvements in standards of living contributed to this remarkable decline (1). Despite these improvements in maternal and infant mortality rates, significant disparities by race and ethnicity persist. This report summarizes trends in reducing infant and maternal mortality in the United States, factors contributing to these trends, challenges in reducing infant and maternal mortality, and provides suggestions for public health action for the 21st century.
If Americans Love Moms, Why Do We Let Them Die?
LOST MOTHERS

How Many American Women Die From Causes Related to Pregnancy or Childbirth? No One Knows.

Data collection on maternal deaths is so flawed and under-funded that the federal government no longer even publishes an official death rate.

by Robin Fields and Joe Sexton, Oct. 23, 8 a.m. EDT
Maternal Mortality Rate, 1999-2014

National Vital Statistics System (NVSS); CDC WONDER
Maternal Mortality: Vital Statistics

Maternal death is 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 the pregnancy or its management but not from accidental or incidental causes.
Vital Statistics: The Basis for Identification

- Based on death certificates sent from the states
- Coded by ICD-10 coding rules
- Information based on COD and checkbox indicating recent or current pregnancy status
  - Checkbox introduced in 2003 with incremental uptake over time
  - Not all maternal deaths have a clinically meaningful code
- Historically, maternal deaths were under-counted
- Pilot studies of checkbox suggest misclassification
  - No recent pregnancy
  - Cause of death not related to pregnancy
- Death certificates may paint an incomplete picture

COD: cause of death
Misclassification of Maternal Deaths -- Washington State

Perspectives in Disease Prevention and Health Promotion Enhanced Maternal Mortality Surveillance -- North Carolina, 1988 and 1989

Maternal deaths in an urban perinatal network, 1992-1998

Andrea Panting-Kemp, MD, MPH, Stacie E. Geller, PhD, Tuan Nguyen, MD,
Louise Simonson, RNC, MS, Bahij Nuwayhid, MD, PhD, and Lony Castro, MD

Chicago, Illinois

An Assessment of the Incidence of Maternal Mortality in the United States

Jack C. Smith, MS, Joyce M. Hughes, Penelope S. Pekow, MPH, and Roger W. Rochat, MD


Monitoring Maternal Mortality Using Vital Records Linkage

Am J Prev Med 1995;11(2)

Stephanie Jocums, BA
Edward F. Mitchel, Jr., MS

Stephen S. Entman, MD
Joyce M. Piper, DrPH
Checkbox is a simple and effective way of identifying maternal deaths
Regular use by all states would enhance surveillance
2003 and beyond: Pregnancy checkbox

2003: 21 states with checkbox; 2 states with prompt
2005: 35 states with checkbox or prompt
2014: 45 states and DC with standard checkbox; 4 states non-standard checkbox
Maternal Mortality Rate, 1999-2014

National Vital Statistics System; CDC WONDER
Pregnancy Checkbox QA Pilot

- Total number of potential pregnancy-related deaths identified*: 221
- Checkbox is only indication of pregnancy: 84 (38%)
  - Pending confirmation: 41
  - Confirmed: 43
    ▪ False positives**: 24 (56%)
    ▪ True positives***: 19

* Identified through linkage and/or checkbox
** No evidence of pregnancy is preceding year
*** Pregnancy in preceding year confirmed
MMR Due to Hemorrhage, Hypertension and Embolisms, 1999-2014

National Vital Statistics System; CDC WONDER
MMR due to other specified pregnancy related conditions (O26.8), 1999-2014
MMR due to other specified diseases and conditions complicating pregnancy, childbirth and the puerperium (O99.8), 1999-2014

National Vital Statistics System; CDC WONDER
Distribution of ICD-10 O chapter codes recorded as underlying cause-of-death, 2000-2014
Pregnancy Mortality Surveillance System (PMSS)

➢ ACOG/CDC Maternal Mortality Study Group (1986)

➢ Pregnancy-associated (temporal relationship)
  ● All deaths during pregnancy and within the year following the end of pregnancy

➢ Pregnancy-related (subset of pregnancy-associated; causal relationship)
  ● Complication of pregnancy
  ● Aggravation of a unrelated condition by the physiology of pregnancy
  ● Chain of events initiated by the pregnancy

➢ Pregnancy-related mortality ratio (PRMR; deaths per 100,000 births)

ACOG: American College of Obstetricians and Gynecologists
Based on death and linked birth or fetal death certificates when death occurred following birth or stillbirth

Independent of ICD-10

Information includes COD and checkbox indicating recent or current pregnancy status and all other details concerning pregnancy

- COD descriptions often unclear
- If checkbox only and unclear COD, difficult to include or exclude

Clinical relevance instead of rule-based designation of COD
Comparison: MMR and PRMR

Deaths per 100,000 births

PRMR: Pregnancy-related mortality ratio
MMR: Maternal Mortality rate

Comparison: MMR and PRMR

PRMR: Pregnancy-related mortality ratio  
MMR: Maternal mortality rate
Causes of maternal deaths:

1. Hemorrhage
2. Hypertensive disorder of pregnancy
3. Infection
4. Thrombotic pulmonary embolism
5. Amniotic fluid embolism
6. Anesthesia complication
7. Cardiovascular condition
8. Cardiomyopathy
9. Cerebrovascular accident
10. Other condition

Pregnancy-related Mortality Ratios by State, PMSS, 2006-2013
Pregnancy-related Mortality by Race and Hispanic Ethnicity, 2006-2013

Deaths per 100,000 births

NHW: Non-Hispanic white  NHB: Non-Hispanic black  AI/AN: American Indian/Alaska Native
API: Asian/Pacific Islander  HISP: Hispanic
State PRMR by Percent Non-Hispanic Black Births

R² = 0.5165
PRMR by Race/Ethnicity and Education

![Bar chart showing PRMR (Deaths per 100,000 births) by Race/Ethnicity and Years of Education. The chart displays data for NHW, NHB, and Hispanic populations.](chart.png)
What Are the Real Trends in Maternal Mortality?

➢ The measured maternal mortality rate is increasing
➢ The pregnancy-related mortality rate has increased but is now relatively stable
➢ Disparities are persistent, and some causes of death may be increasing
➢ There are hints that efforts to improve identification have resulted in misclassification
  ● What is the extent of the false positives?
  ● What is the extent of the false negatives?
  ● Why are mistakes being made?
Beyond Better Data

➢ We need to aspire to something greater
  ● Information needed for prevention will not be found on death certificates

➢ There is no acceptable rate of maternal mortality
Where Can We Go?

➢ Surveillance of maternal mortality is driven by information from state- and city-based reviews which

● Goes beyond vital statistics
● Informs and evaluates local quality improvement initiatives
● Provides an accurate national picture for trends and causes of death
➢ NYS received an award from CDC to support their Perinatal Quality Collaborative
New York City Launches Committee to Review Maternal Deaths

Amid intensifying concerns about deaths and near-deaths related to pregnancy and childbirth, New York City will review cases in depth to protect mothers and improve data collection.
Building U.S. Capacity to Review and Prevent Maternal Deaths

- Technical assistance to support jurisdiction-level maternal mortality review
- Promotes opportunities to identify interventions with the greatest potential to end preventable maternal mortality
- Partnership of CDC Division of Reproductive Health, the Association of Maternal and Child Health Programs, and the CDC Foundation (funded through an award agreement with Merck on behalf of its Merck for Mothers program)
Building U.S. Capacity to Review and Prevent Maternal Deaths

➢ Was the death pregnancy-related?
➢ What was the underlying cause of death?
➢ Was the death preventable?
➢ What were the factors that contributed to the death?
➢ What are the recommendations and actions that address those contributing factors?
➢ What is the anticipated impact of those actions if implemented?
Resources: MMRIA

➢ Addresses barrier identified by MMRCs (2012)
➢ Built with expert input
➢ Lessons learned from precursor (2014-2016)
➢ One stop shop
➢ Comprehensive, but standardized
➢ Common language for reviews to work together
➢ 13 jurisdictions using MMRIA, 12 preparing to use (and 2 on the wait list)
Report from Maternal Mortality Review Committees

- Included data from 9 state-based MMRCs
- 35% of pregnancy-associated deaths were pregnancy-related
- Nearly 50% of all pregnancy-related deaths were caused by hemorrhage, cardiovascular and coronary conditions, cardiomyopathy, or infections.
- Over 60% of pregnancy-related deaths estimated to be preventable
Select examples of factors that contributed to the death included: lack of patient knowledge on warning signs, provider misdiagnosis, and lack of coordination between providers.

Recommendations for action were identified and grouped into themes.

Anticipated magnitude of impact of each recommendation if implemented was grouped into categories based on best informed opinions.
Report from Maternal Mortality Review Committees: Suggestions for Action

<table>
<thead>
<tr>
<th>CARDIOVASCULAR AND CORONARY CONDITIONS</th>
<th>HEMORRHAGE</th>
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<tbody>
<tr>
<td>Improve training</td>
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<td>Adopt maternal levels of care/Ensure appropriate level of care determination</td>
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<td>Improve patient/provider communication</td>
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<td>Improve policies regarding prevention initiatives</td>
<td>Enforce policies/procedures</td>
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<td>Mandate autopsies</td>
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Goals:

- Assist states to establish maternal mortality review committees for states which lack one
- Improve processes of existing committees through standardization
- Connect states with committees to share best practices
REVIEW TO ACTION promotes the maternal mortality review process as the best way to understand why maternal mortality in the United States is increasing and prioritize interventions to improve maternal health.
Thank You

wgc0@cdc.gov