A NATIONAL PERSPECTIVE ON A REGIONAL PROBLEM – MATERNAL MORTALITY IN 2017

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www.birthbythenumbers.org

New England Regional Summit on Maternal Mortality
September 28, 2017
Two key background themes in this talk
Timing of Maternal Deaths

(1) Implication of this distribution is that any attempt to resolve the problem of maternal death that doesn’t encompass both clinical and public health approaches is destined to miss a significant portion of women at risk.
“One searches where there is light”

Goethe 1749–1832

Women surveyed in May & June, 2002 about their childbirth experiences. Included if they gave birth within 2 years prior to survey.

**Postpartum Depression**

- 19% of mothers scored 13+ on the Edinburgh Postnatal Depression Scale, meaning they were probably experiencing some degree of depression in the week preceding the survey.
- Only 43% of this group had consulted a professional about their mental health since giving birth.

What happened when this overall finding was stratified by time since birth?
Proportion of Women Scoring 13 + on Edinburgh Postnatal Depression Scale

- 6 months or less: 23%
- 7-12 months: 17%
- 13-18 months: 17%
- 19-24 months: 20%
How much of what we term postpartum depression is chronic depression we happen to be measuring at that point in time?

**What does this have to do with maternal mortality?**

How much of what we’re measuring as “the unacceptable level of maternal mortality” is actually capturing a general problem in the health of women of reproductive age and we have chosen to shine a light on it for the period of conception to 1 year postpartum?

Number of female deaths, 15-49 in 2014 75,192.
Maternal deaths = ~1% of all those.

Source: NCHS. Deaths, Final Data for 2014
So, as we turn the focus to maternal mortality, keep this larger context in mind: if we are going to improve maternal mortality rates we need to improve all women’s health – not just pregnant women’s health.
Maternal Mortality in the U.S.
Definitions (in the U.S.)

• **Maternal Mortality Ratio** – 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. Typically reported as a ratio per 100,000 births.

• **Pregnancy Related Death** – 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.

• **Pregnancy Associated Death** – The death of a women while pregnant or *within one year* of termination of pregnancy, *irrespective of cause*. (*WHO calls these “pregnancy related”*)
U.S. Maternal Mortality (per 100,000 live births), 1951-2007

Source: NCHS. Deaths: Final Data. Annual Reports.
U.S. Maternal Mortality (per 100,000 live births), 1951-2007

1951-1982
89% decline (75.0 to 7.9)

Source: NCHS. Deaths: Final Data. Annual Reports.
U.S. Maternal Mortality (per 100,000 live births), 1951-2007

1982-1998
Basically no change
7.9 to 7.1

Source: NCHS. Deaths: Final Data. Annual Reports.
U.S. Maternal Mortality (per 100,000 live births), 1951-2007

1997-2007
78% increase (7.1 to 12.7)

Source: NCHS. Deaths: Final Data. Annual Reports.
U.S. Maternal Mortality (per 100,000 live births), 1951-2007

Note: The U.S. NCHS hasn’t reported an official maternal mortality rate since 2007 – led to our work

Source: NCHS. Deaths: Final Data. Annual Reports.
Table 34. Number of maternal deaths and maternal mortality rates for selected causes, by Hispanic origin and race for non-Hispanic population: United States, 2007

<table>
<thead>
<tr>
<th>Cause of death (based on ICD–10, 2004)</th>
<th>Number</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All origins¹</td>
<td>Hispanic</td>
</tr>
<tr>
<td>Maternal causes</td>
<td>548</td>
<td>95</td>
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<tr>
<td>Pregnancy with abortive outcome</td>
<td>31</td>
<td>5</td>
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<tr>
<td>Ectopic pregnancy</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Spontaneous abortion</td>
<td>9</td>
<td>2</td>
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<tr>
<td>Medical abortion</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Other abortion</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Other and unspecified pregnancy with abortive outcome</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Other direct obstetric causes</td>
<td>362</td>
<td>67</td>
</tr>
<tr>
<td>Preeclampsia and pre-eclampsia</td>
<td>64</td>
<td>13</td>
</tr>
<tr>
<td>Hemorrhage of pregnancy and childbirth and placenta previa</td>
<td>41</td>
<td>12</td>
</tr>
<tr>
<td>Complications predominately related to the puerperium</td>
<td>93</td>
<td>15</td>
</tr>
<tr>
<td>Obstetric tetanus</td>
<td>(A34)</td>
<td>9</td>
</tr>
<tr>
<td>Obstetric embolism</td>
<td>(C68)</td>
<td>35</td>
</tr>
<tr>
<td>Other complications predominately related to the puerperium</td>
<td>60</td>
<td>9</td>
</tr>
<tr>
<td>All other direct obstetric causes</td>
<td>164</td>
<td>27</td>
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<tr>
<td>Obstetric death of unspecified cause</td>
<td>20</td>
<td>4</td>
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<tr>
<td>Indirect obstetric causes</td>
<td>135</td>
<td>19</td>
</tr>
<tr>
<td>Maternal causes more than 42 days after delivery or termination of pregnancy</td>
<td>221</td>
<td>39</td>
</tr>
<tr>
<td>Death from any obstetric cause occurring more than 42 days but less than 1 year after delivery</td>
<td>215</td>
<td>38</td>
</tr>
<tr>
<td>Death from sequelae of direct obstetric causes</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

¹All causes of death and maternal mortality rates not otherwise specified for race or Hispanic origin are based on data from non-Hispanic white live births. The term “white” is used to mean “non-Hispanic white.”
²Non-Hispanic includes persons of Hispanic origin.
³Non-Hispanic white includes only those persons of non-Hispanic origin and race.
⁴Non-Hispanic black includes only those persons of non-Hispanic origin and race and is defined as being black non-Hispanic or black Hispanic.

Last reporting (2007) of a maternal mortality rate by NCHS
**Impetus for our Study**

*Maternal Mortality Ratios (per 100K births), 2000-2014, U.S. & Comparable Countries*

- **Deaths per 100,000 live births**
- **OECD 25% Decrease**

*Countries with 300,000+ births (2012): Australia, Canada, France, Germany, Italy, Japan, S. Korea, Spain, United Kingdom*

So has there been any way to monitor maternal death since 2007?
So has there been any way to monitor maternal death since 2007?

CDC and Pregnancy Related Mortality
Pregnancy Mortality Surveillance System

When did CDC start conducting national surveillance of pregnancy-related deaths?

CDC initiated national surveillance of pregnancy-related deaths in 1986 because more clinical information was needed to fill data gaps about causes of maternal death.

How does CDC define pregnancy-related deaths?

For reporting purposes, a pregnancy-related death is defined as the death of a woman while pregnant or within 1 year of pregnancy termination—regardless of the duration or site of the pregnancy—from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

How are the data collected and coded?

Each year, CDC requests the 52 reporting areas (50 states, New York City, and Washington, D.C.) to voluntarily send copies of death certificates for all women who died during pregnancy or within 1 year of pregnancy, and copies of the matching birth or fetal death certificates, if they have the ability to perform such record links. All of the information obtained is summarized and medically trained epidemiologists determine the cause and time of death related to the pregnancy. Causes of death are coded by using a system established in 1986 by the American College of Obstetricians and Gynecologists and the Centers for Disease Control and Prevention Maternal Mortality Study Group.

How are the data used?

Data are analyzed by CDC scientists. Information about causes of pregnancy-related deaths and risk factors associated with these deaths is released periodically through peer-reviewed literature, CDC's *Morbidity and Mortality Weekly Report*, and the CDC Web site. This information helps clinicians and public health professionals to better understand circumstances surrounding pregnancy-related deaths and to take appropriate actions to prevent them.
Data for CDCs Pregnancy Related Mortality System

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Racial Disparities
Rates for 2011-13:

- 12.7 white women
- 43.5 black women
- 11.0 Hispanic
- 14.4 other races

Relying solely on “Pregnancy Related Mortality” does not allow for international comparisons – more impetus for our study.
Two questions arise from the extension to 2013

NOTE: 2008-2013 US rates unofficial based on estimates by the CA MQCC

* Countries with 300,000+ births (2012): Australia, Canada, France, Germany, Italy, Japan, S. Korea, Spain, United Kingdom

Impetus for our Study
Maternal Mortality Ratios (per 100K births), 2000-2013, U.S. & Comparable Countries*

Was the U.S. Increase the Result of Improved Case Ascertainment?

How did CMQCC estimate the rates after 2007?

* Countries with 300,000+ births (2012): Australia, Canada, France, Germany, Italy, Japan, S. Korea, Spain, United Kingdom

Where CMQCC got their data – CDC Wonder
Underlying cause of death

Total maternal deaths (during pregnancy or within 42 days after the end of pregnancy) (A34, O00-O95, O98-O99)

Total direct obstetric causes (A34, O00-O92)
- Pregnancy with abortive outcome (O00-O07)
  - Ectopic pregnancy (O00)
- Hypertensive disorders (O10-O16)
  - Pre-existing hypertension (O10)
  - Eclampsia and pre-eclampsia (O11, O13-O16)
- Obstetric Hemorrhage (O20, O43.2, O44-O46, O67, O71.0-O71.1, O71.3-O71.4, O71.7, O72)
- Pregnancy-related infection (O23, O41.1, O75.3, O85, O86, O91)
  - Puerperal sepsis (O85)
- Other obstetric complications (O21-O22, O24-O28, O30-O41.0, O41.8-O43.1, O43.8-O43.9, O47--O66, O68-O70, O71.2, O71.5, O71.6, O71.8, O71.9, O73, O75.0-O75.2, O75.4-O75.9, O87-O90, O92)
  - Diabetes mellitus in pregnancy (O24)
  - Liver disorders in pregnancy (O26.6)
  - Other specified pregnancy-related conditions (O26.8)
    - Obstetric embolism (O88)
    - Cardiomyopathy in the puerperium (O90.3)
- Anesthesia-related complications (O29, O74, O89)

Total indirect causes (O98-O99)
- Mental disorders and diseases of the nervous system (O99.3)
- Diseases of the circulatory system (O99.4)
- Diseases of the respiratory system (O99.5)
- Other specified diseases and conditions (O99.8)

Obstetric death of unspecified cause (O95)

Late maternal causes (43 days-1 year after the end of pregnancy) (O96-O97)

PART II (Other significant conditions)
- Enter all diseases or conditions contributing to death that were not reported in the chain of events in Part I and that did not result in the underlying cause of death. See attached examples.
- If two or more possible sequences resulted in death, or if two conditions seem to have added together, report in Part I the one that, in your opinion, most directly caused death. Report in Part II the other conditions or diseases.

CHANGES TO CAUSE OF DEATH
Should additional medical information or autopsy findings become available that would change the cause of death originally reported, the original death certificate should be amended by the certifying physician by immediately reporting the revised cause of death to the State Vital Records Office.

ITEMS 33-34 - AUTOPSY
- 33 - Enter "Yes" if either a partial or full autopsy was performed. Otherwise enter "No."
- 34 - Enter "Yes" if autopsy findings were available to complete the cause of death; otherwise enter "No." Leave item blank if no autopsy was performed.

ITEM 35 - DID TOBACCO USE CONTRIBUTE TO DEATH?
Check "yes" if, in your opinion, the use of tobacco contributed to death. Tobacco use may contribute to deaths due to a wide variety of diseases; for example, tobacco use contributes to many deaths due to emphysema or lung cancer and some heart disease and cancers of the head and neck. Check "no" if, in your clinical judgment, tobacco use did not contribute to this particular death.

ITEM 36 - IF FEMALE, WAS DECEDENT PREGNANT AT TIME OF DEATH OR WITHIN PAST YEAR?
This information is important in determining pregnancy-related mortality.

ITEM 37 - MANNER OF DEATH
- Always check Manner of Death, which is important: 1) in determining accurate causes of death; 2) in processing insurance claims; and 3) in statistical studies of injuries and death.
- Indicate "Pending Investigation" if the manner of death cannot be determined whether due to an accident, suicide, or homicide within the statutory time limit for filing the death certificate. This should be changed later to one of the other terms.
- Indicate "Could not be Determined" ONLY when it is impossible to determine the manner of death.
To improve case identification:


Checkbox format:

IF FEMALE:

- Not pregnant within past year
- Pregnant at time of death
- Not pregnant, but pregnant within 42 days of death
- Not pregnant, but pregnant 43 days to 1 year before death
- Unknown if pregnant within the past year

Meant to solve 2 problems:

(1) Most states had no such question; and

(2) Different questions used in different states
The Check Box
Determining Pregnancy Status to Improve Maternal Mortality Surveillance

Andrea P. MacKay, MSPH, Roger Rochat, MD, Jack C. Smith, MS, Cynthia J. Berg, MD, MPH

Objective: More than half of pregnancy-related deaths are not identified through routine surveillance methods. The purpose of this study was to evaluate the effectiveness of the pregnancy check box on death certificates in ascertaining pregnancy-related deaths.

Methods: Data derived from the Centers for Disease Control and Prevention’s ongoing Pregnancy Mortality Surveillance System were used to identify states that included a check box on the death certificate in 1991 and 1992. Death certificates from those states were evaluated to determine the number and proportion of pregnancy-related deaths identified by a marked check box. Characteristics of death were also examined.

Results: Sixteen states and New York City included a check box or question specifically asking about pregnancy of the decedent. Of the 425 pregnancy-related deaths identified in the 17 reporting areas, 124 (29%) were determined to be pregnancy-related deaths only because of the pregnancy status information provided in the check box. The proportion of deaths identified only by a marked check box ranged from less than 5% for four states to 40% or more for seven states.

Conclusions: The availability of pregnancy status information on death certificates is a simple and effective aid in ascertaining a pregnancy-related death, when no other indicators of pregnancy appear on the death certificate. Routine use of the pregnancy check box for all states would lead to substantially increased classification of maternal deaths and more accurate classification of the causes of and risk factors for maternal deaths.

Time periods used:
- 42 days
- 6 weeks
- 3 months
- 90 days
- 12 mos
- “last year”
Maternal Mortality Rates (per 100,000) in States with & without a checkbox, 1996-2003

So adopting the checkbox will solve the problem of under ascertainment & we can report a more accurate national rate after 2003?

### Delays in Adoption of the U.S. Standard Pregnancy Question among States

<table>
<thead>
<tr>
<th>Year</th>
<th>New Adopters*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2004</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>2005</td>
<td>7</td>
<td>18</td>
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<td>2006</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>2007</td>
<td>2</td>
<td>24</td>
</tr>
<tr>
<td>2008</td>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>35</td>
</tr>
<tr>
<td>2011</td>
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<td>2012</td>
<td>4</td>
<td>41</td>
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<td>2013</td>
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<td>42</td>
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<tr>
<td>2014</td>
<td>5</td>
<td>47</td>
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<tr>
<td>2015</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>2016</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>2017</td>
<td>1</td>
<td>51</td>
</tr>
</tbody>
</table>

* Note: Some states adopted change in the middle of the calendar year.

### New England

<table>
<thead>
<tr>
<th>State</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>New Hampshire</td>
<td>4/2004</td>
</tr>
<tr>
<td>Connecticut</td>
<td>2005</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>2006</td>
</tr>
<tr>
<td>Vermont</td>
<td>7/2008</td>
</tr>
<tr>
<td>Maine</td>
<td>2010</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>9/2014</td>
</tr>
</tbody>
</table>
Our Analysis

We did an analysis that examined data by state, modeled for whether or not they were using the new item, and came up with national estimates.

Not enough cases to do single state analyses, but could look at some of the larger states.
Recent Increases in the U.S. Maternal Mortality Rate

Disentangling Trends From Measurement Issues

Marian F. MacDorman, PhD, Eugene Declercq, PhD, Howard Cabral, PhD, and Christine Morton, PhD

RESULTS: The estimated maternal mortality rate (per 100,000 live births) for 48 states and Washington, DC (excluding California and Texas, analyzed separately) increased by 26.6%, from 18.8 in 2000 to 23.8 in 2014. California showed a declining trend, whereas Texas had a sudden increase in 2011–2012. Analysis of the measurement change suggests that U.S. rates in the early 2000s were higher than previously reported.
Grouping the States

• Group 1 – 24 states & D.C. that *did not have an unrevised pregnancy question* and adopted the U. S. standard question by January 2013

• Group 2 – 14 states that *had an unrevised pregnancy question with a timeframe longer* than the U.S. standard

• Group 3 – 7 states that *had not revised by late 2013* with either no pregnancy question or a nonstandard pregnancy question on their unrevised death certificate.

• Group 4 – 3 states that *had an unrevised pregnancy question consistent with the U.S. standard.*

*But wait – that only adds up to 48 states & DC*
Grouping the States

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• **Group 4** – 3 states that *had an unrevised pregnancy question consistent with the U.S. standard*.

*California and Texas are unique – each in their own ways*
Correcting for Impact of Adding Pregnancy Box

Correction factor = \[
\frac{\text{Sum of the number of maternal deaths in each state for 2 years following the revision date}}{\text{Sum of the number of maternal deaths in each state for the 2 years preceding the revision date}}
\]

Also did tests involving 1 year and 3 year periods with little change
Estimating a Combined, Adjusted MMR, for 48 states and DC, from 2000-2014

• California excluded because only reports deaths at <1 year. Texas excluded because of divergent trend.

• First, computed the weighted average of the slopes of the regression lines from Analysis Groups 1-4, weighted by the total number of live births in each group from 2000-2014. Weighted slope=0.357.

• Then computed a combined 2014 MMR for the 44 states and DC with standard pregnancy question.

• Used the combined slope to back-estimate MMRs back to 2000.
Estimated MMRs, 48 states* and DC, 2000-2014

Rate per 100,000 live births

27% increase 2000-2014


18.8

23.8

How might the U.S. compare internationally?

*Excludes California and Texas.
Maternal Mortality Ratios, OECD* Countries, 2014

Source: OECD Health Data 2016
* 2013
# 2012
^U.S. from MacDorman et al.

* Organization for Economic and Cooperation and Development
U.S. MMR* Compared to Countries with 300,000+ births, 2014, using WHO Estimates

<table>
<thead>
<tr>
<th>Country</th>
<th>Maternal Mortality</th>
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<tbody>
<tr>
<td>U.S.</td>
<td>14.8</td>
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<tr>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>UK</td>
<td>8</td>
</tr>
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<td>Australia</td>
<td>6</td>
</tr>
<tr>
<td>Germany</td>
<td>6</td>
</tr>
<tr>
<td>Canada</td>
<td>7</td>
</tr>
<tr>
<td>France</td>
<td>8</td>
</tr>
<tr>
<td>Italy</td>
<td>4</td>
</tr>
<tr>
<td>Spain</td>
<td>5</td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Korea</td>
<td>11</td>
</tr>
</tbody>
</table>

* Maternal Mortality per 100,000 births

U.S. MMR* Compared to Countries with 300,000+ births, 2014, using WHO Estimates

<table>
<thead>
<tr>
<th>Country</th>
<th>MMR*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>4</td>
</tr>
<tr>
<td>Spain</td>
<td>5</td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Australia</td>
<td>6</td>
</tr>
<tr>
<td>Germany</td>
<td>6</td>
</tr>
<tr>
<td>Canada</td>
<td>7</td>
</tr>
<tr>
<td>France</td>
<td>8</td>
</tr>
<tr>
<td>U.K.</td>
<td>9</td>
</tr>
<tr>
<td>Korea</td>
<td>11</td>
</tr>
<tr>
<td>U.S. White</td>
<td>11.3</td>
</tr>
<tr>
<td>U.S.</td>
<td>14.8</td>
</tr>
</tbody>
</table>

* Maternal Mortality per 100,000 births


If we limited the US ratio to white mothers (estimated 11.3) only, the U.S. would still rank behind all other countries including South Korea.
But what about me?
How are we doing locally?
Maternal Mortality Ratio (per 100,000 live births) in New England States, 2016 (?)

Source: America's Health Rankings. United Health Foundation. Their cited source – CDC, National Vital Statistics System
Massachusetts Maternal Deaths, (per 100,000), 1992-2015

Source: Mass DPH
What are the causes of maternal deaths?

Figure 6. Distribution of Pregnancy-Related Deaths Caused by Medical Conditions, Massachusetts, 2000-2007

- Complications of Pregnancy, Labor, or Delivery: 29
- Cardiovascular: 11
- Neurological/Cerebrovascular: 4
- Respiratory: 3
- Infectious and Parasitic: 2
- Other Medical Causes: 1
- Medical, Unknown: 1

Total: 51

Figure 8. Distribution of Injury Deaths, Massachusetts, 2000-2007

- MVC: 19
- Drug Poisoning: 16
- Undetermined: 4
- Suicide: 3
- Homicide: 5

Total: 51
Original Research

Trends in Maternal Mortality by Sociodemographic Characteristics and Cause of Death in 27 States and the District of Columbia

Marian F. MacDorman, PhD, Eugene Declercq, PhD, and Marie E. Thoma, PhD

Obstet Gynecol 2017;129:811–8
Over Ascertainment??

• Research into the cause of death category finds much of the increase is coming from *less specific codes*.

• Other specified pregnancy-related conditions (O26.8)
• Other obstetric complications (O21–O22, O24–O41.0, O41.8–O43.1, O43.8–O43.9, O47–O66, O68–O70, O71.2, O71.5–O71.6, O71.8, O71.9, O73–O75.2, O75.4–O75.9, O87–O90, O92)
• Other specified diseases and conditions (O99.8)
• Obstetric death of unspecified cause (O95)
Underlying cause of death

Total maternal deaths (during pregnancy or within 42 days after the end of pregnancy) (A34, O00-O95, O98-O99)

Total direct obstetric causes (A34, O00-O92)
- Pregnancy with abortive outcome (O00-O07)
  - Ectopic pregnancy (O00)
- Hypertensive disorders (O10-O16)
  - Pre-existing hypertension (O10)
  - Eclampsia and pre-eclampsia (O11, O13-O16)
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  - Liver disorders in pregnancy (O26.6)
- Other specified pregnancy-related conditions (O26.8)
  - Obstetric embolism (O88)
  - Cardiomyopathy in the puerperium (O90.3)
- Anesthesia-related complications (O29, O74, O89)

Total indirect causes (O98-O99)
- Mental disorders and diseases of the nervous system (O99.3)
- Diseases of the circulatory system (O99.4)
- Diseases of the respiratory system (O99.5)
- Other specified diseases and conditions (O99.8)
- Obstetric death of unspecified cause (O95)

Late maternal causes (43 days-1 year after the end of pregnancy) (O96-O97)

Maternal Death
ICD-10 Codes
Assessing the impact of ill-defined causes on maternal deaths and mortality rates by cause of death, 27 states and DC, 2008-2009 to 2013-2014

<table>
<thead>
<tr>
<th>Underlying cause of death (ICD-10 category)</th>
<th>2008-9</th>
<th>2013-14</th>
<th>Percent change 2008-9 to 2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total maternal (A34, O00-O05, O98-O99)</td>
<td>780</td>
<td>907</td>
<td>23.3</td>
</tr>
<tr>
<td>Ill-defined causes (O26.8, O95, O99.8)</td>
<td>266</td>
<td>371</td>
<td>47.9</td>
</tr>
<tr>
<td>Total maternal minus ill-defined causes (Remainder)</td>
<td>514</td>
<td>536</td>
<td>10.6</td>
</tr>
<tr>
<td>Total direct obstetric (A34, O00-O92)</td>
<td>527</td>
<td>595</td>
<td>19.7</td>
</tr>
<tr>
<td>Other specified pregnancy-related conditions (O26.8)</td>
<td>130</td>
<td>212</td>
<td>73.0</td>
</tr>
<tr>
<td>Total direct obstetric minus O26.8 (Remainder)</td>
<td>397</td>
<td>383</td>
<td>2.3</td>
</tr>
<tr>
<td>Total indirect causes (O98-O99)</td>
<td>202</td>
<td>294</td>
<td>54.4</td>
</tr>
<tr>
<td>Other specified diseases and conditions (O99.8)</td>
<td>85</td>
<td>141</td>
<td>75.9</td>
</tr>
<tr>
<td>Total indirect causes minus O99.8 (Remainder)</td>
<td>117</td>
<td>153</td>
<td>38.7</td>
</tr>
</tbody>
</table>

- 100% for All ages in 2008–2009
- 81% for All ages in 2013–2014
- -6% decrease in specific cause codes for ≥40 years of age
Sensitivity Analysis of Impact of 1% Random Miscoding

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>No. of Maternal Deaths</th>
<th>No. of Female Deaths From Natural Causes (Excludes Maternal Deaths)</th>
<th>No. of Maternal Deaths With 1% False-Positives Added to Total</th>
<th>% Increase in MMR With 1% False-Positive Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>907</td>
<td>82,572</td>
<td>1,733</td>
<td>91.0</td>
</tr>
<tr>
<td>Younger than 40</td>
<td>618</td>
<td>15,553</td>
<td>774</td>
<td>25.2</td>
</tr>
<tr>
<td>15–19</td>
<td>26</td>
<td>929</td>
<td>35</td>
<td>35.7</td>
</tr>
<tr>
<td>20–24</td>
<td>119</td>
<td>1,619</td>
<td>135</td>
<td>13.6</td>
</tr>
<tr>
<td>25–29</td>
<td>152</td>
<td>2,568</td>
<td>178</td>
<td>16.9</td>
</tr>
<tr>
<td>30–34</td>
<td>177</td>
<td>4,092</td>
<td>218</td>
<td>23.1</td>
</tr>
<tr>
<td>35–39</td>
<td>144</td>
<td>6,345</td>
<td>207</td>
<td>44.1</td>
</tr>
<tr>
<td>40–54</td>
<td>289</td>
<td>67,019</td>
<td>959</td>
<td>231.9</td>
</tr>
</tbody>
</table>
REPORT FROM MATERNAL MORTALITY REVIEW COMMITTEES: A VIEW INTO THEIR CRITICAL ROLE
Impact of the Checkbox – Better and Worse Ascertainment

• The Four Committee data includes a total of 650 potentially pregnancy-related deaths. Among these, 97 were determined to have no evidence of pregnancy within the year prior to the woman’s death (neither pregnancy-related nor –associated; false positive pregnancy-associated deaths), and so were excluded from further analysis. The predominant reason for these 97 false positives were errors on the death certificate from the pregnancy checkbox. While the checkbox contributed to errors, the Four Committee data show that the checkbox also improved identification of pregnancy-related deaths. Without the pregnancy checkbox, approximately 50% of pregnancy-related deaths that occurred during pregnancy and 11% of pregnancy-related deaths that occurred within 42 days of the end of pregnancy, and 8% of pregnancy-related deaths that occurred within 43 days to 1 year of the end of pregnancy would have been missed.
Real potential for over-ascertainment, though unlikely it accounts for the increases which are seen across all settings and even the most conservative measures show the U.S. faring poorly in international comparisons.
How do these findings vary by race/ethnicity?
Maternal mortality rates by race and ethnicity, 27 states* and Washington D.C., 2008-9 and 2013-14

NH = non-Hispanic. n.s. = no significant change.

Black-White ratio 2.8
Interracial Differences

Where would estimated rates leave the U.S. in international comparisons?

Hispanic  10.0 (Lithuania 10/Portugal 10)
<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Rate</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>10.0</td>
<td>Lithuania 10/Portugal 10</td>
</tr>
<tr>
<td>NH White</td>
<td>11.3</td>
<td>Bulgaria 11/S. Korea 11</td>
</tr>
</tbody>
</table>
Interracial Differences

Where would estimated rates leave the U.S. in international comparisons?

Hispanic 10.0 (Lithuania 10/Portugal 10)

NH White 11.3 (Bulgaria 11/S. Korea 11)

NH Black 36.2 (Uzbekistan 36/ Mexico 38)
U.S. Maternal Mortality (per 100,000 live births), 1951-2007 by Race

- All
- White
- Black

Conclusions

• Maternal mortality may be rising at a slower rate than thought, but largely because the earlier rates may have underestimated the actual number of maternal deaths.

• We don’t actually know what the exact national rate is & won’t until we standardize measurement across all states (2018?).

• Maternal deaths in the U.S. by any measure appear to be rising in contrast to most of the rest of the world, resulting in the U.S. ranking declining in international comparisons.
Conclusions

• There are wide disparities by race/ethnicity, HOWEVER, even if we limit comparisons of whites to other countries, the U.S. still fares poorly in international comparisons.

• Deaths for unspecified causes needs more examination, particularly among older mothers

• Texas deserves more attention.
Next Steps

• **Clarify the nature of the problem** – Establish & staff state Maternal Mortality Review Committees to explore in depth the causes of these deaths and if they were preventable (IL study found 32.4% potentially preventable)

• **Improve maternity care systems** – establishment of state or regional *Perinatal Quality Collaboratives* to address clinical care issues

• **Focus on women’s public health** – since maternal deaths involve more than childbirth, focus on women’s health not just because she might someday have a child, but because *women’s health in itself is important*. Can result in women being healthier when they become pregnant and better cared for after they have a baby.
Our Best Estimate

- Active MMR Committees (~27 states/1 city)
- Newly starting up/planning a MMR Committees (~11 states/DC)
- Unknown/No Reviews (~12 states)
- Legislative support this past session (~5 states)

Source: CDC. Div. of Reproductive Health