

# **The Contemporary Challenge of Maternal Mortality in the U.S.**

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**[www.birthbythenumbers.org](http://www.birthbythenumbers.org)**

# Outline of the Presentation

1. Clarifying Definitions
2. Historical Context
3. The Strange Case of the Pregnancy Checkbox
4. The Pregnancy Mortality Surveillance System
5. Comparing the U.S. to the Rest of the World
6. The Persistence of Racial Disparities
7. Update on 2021-22 Data Release
7. Timing and Maternal Mortality a Public Health Problem
8. The Issue is Broader than Maternal Mortality
9. The Way Forward

# **1. Definitions – the multiple measures of maternal death**

**First a quick side trip into the terms rate and ratio. If you don't find that discussion enthralling, you:**

**(a) are a normal human being; and**

**(b) can skip to slide 11 and wonder what you missed.**

# Is Maternal Mortality a Ratio or a Rate?

- *WHO reports maternal mortality as a ratio, while the U.S. National Vital Statistics System reports maternal mortality as a rate. What's the difference?*

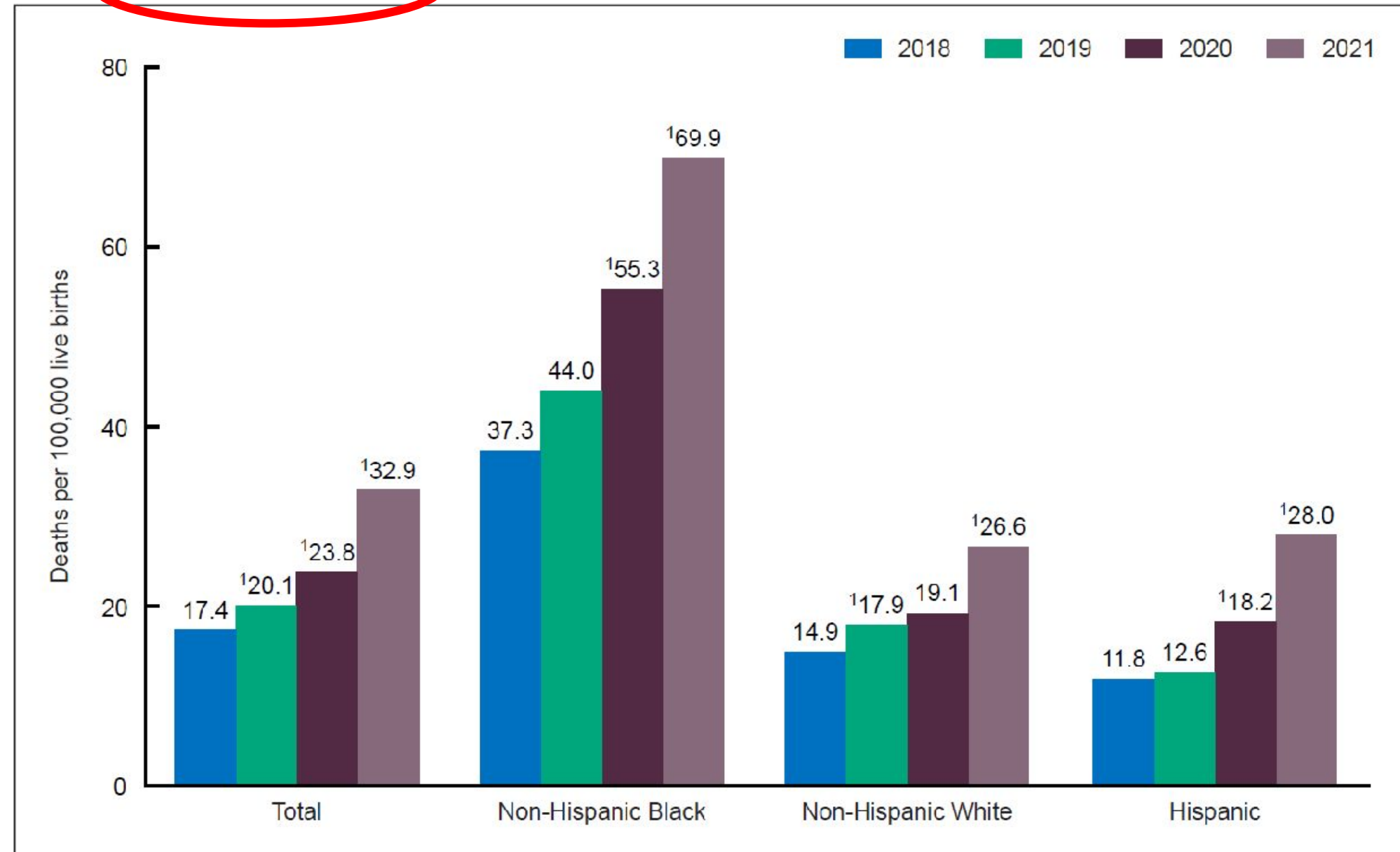
- **Maternal Mortality Ratio:**

Deaths during pregnancy up to 42 days ppm

Live Births

It is a ratio because all the cases in the numerator (e.g. death during early pregnancy) are not necessarily included in the denominator.

Figure 1. Maternal mortality rates, by race and Hispanic origin: United States, 2018–2021

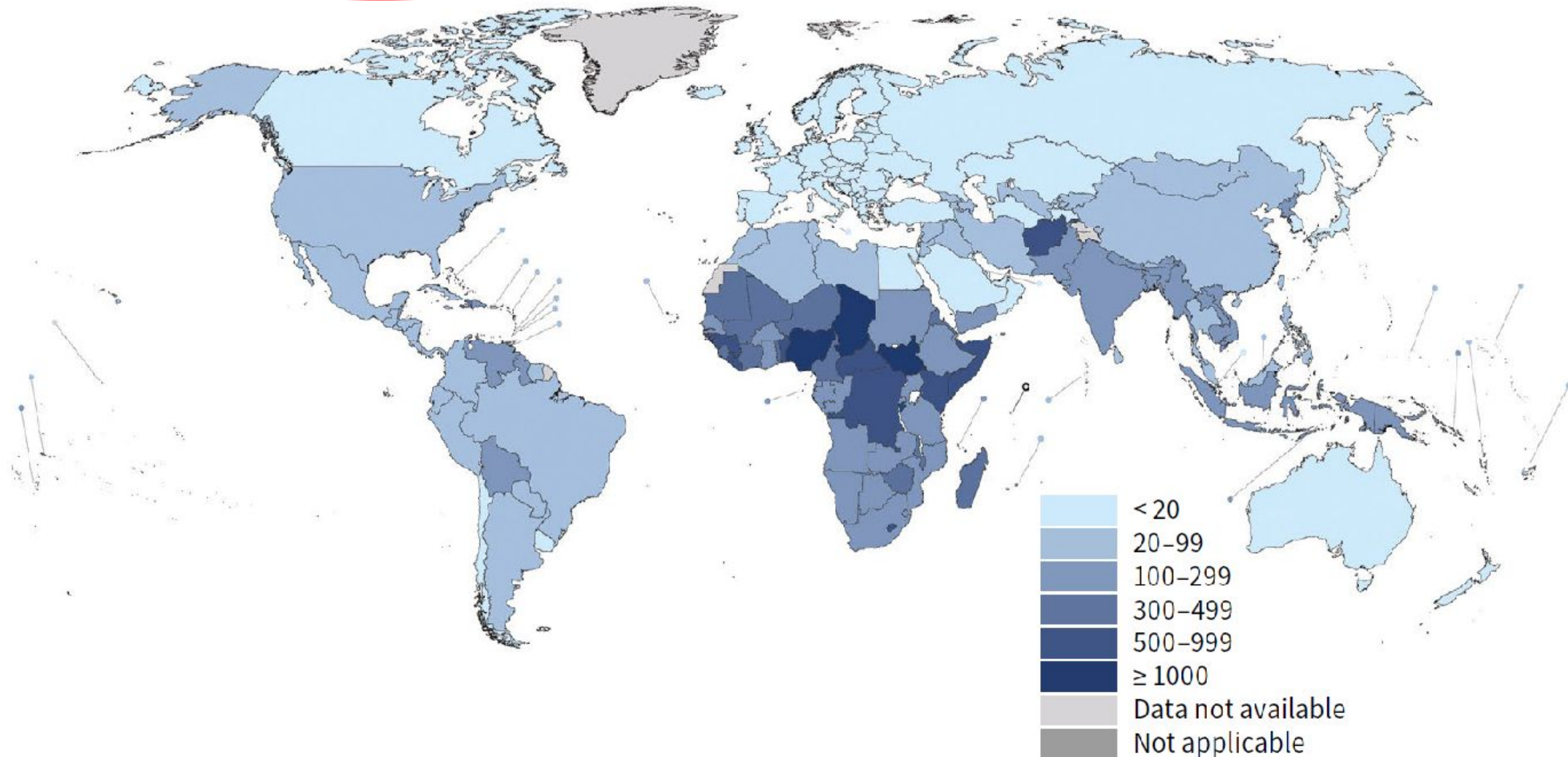


Source: Hoyert DL. Maternal mortality rates in the United States, 2021. NCHS Health E-Stats. 2023.

DOI: <https://dx.doi.org/10.15620/cdc:124678>

[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

Fig. 4.1 **Maternal mortality ratio (MMR)** estimates, by country, 2020



Source: WHO (2023). *Trends in maternal mortality 2000 to 2020*.

[www.birthingbythenumbers.org](http://www.birthingbythenumbers.org)

# Is Maternal Mortality a Ratio or a Rate?

- **Rate**: # of events / total persons at risk in the population (usually % or number per 1,000/100,000)
- **Ratio**: # of events (or persons) / some *comparable* cohort of people or events



# Is Maternal Mortality a Ratio or a Rate?

- **RATE**: The frequency of an event in a population. All the cases in the numerator are included in the denominator

## Example:

Births to women 15-19

*Teen Birth Rate*

All women 15-19

- **RATIO**: simply divides one number by another – all the cases in the numerator are not included in the denominator

## Example:

Maternal Deaths

*Maternal Mortality Ratio*

Live Births

# So, why do we use maternal mortality ratios internationally?

*Because most countries don't have clear measurement of the total number of pregnancies, but do have some record of total births.*

# **The three widely used definitions of maternal mortality:**

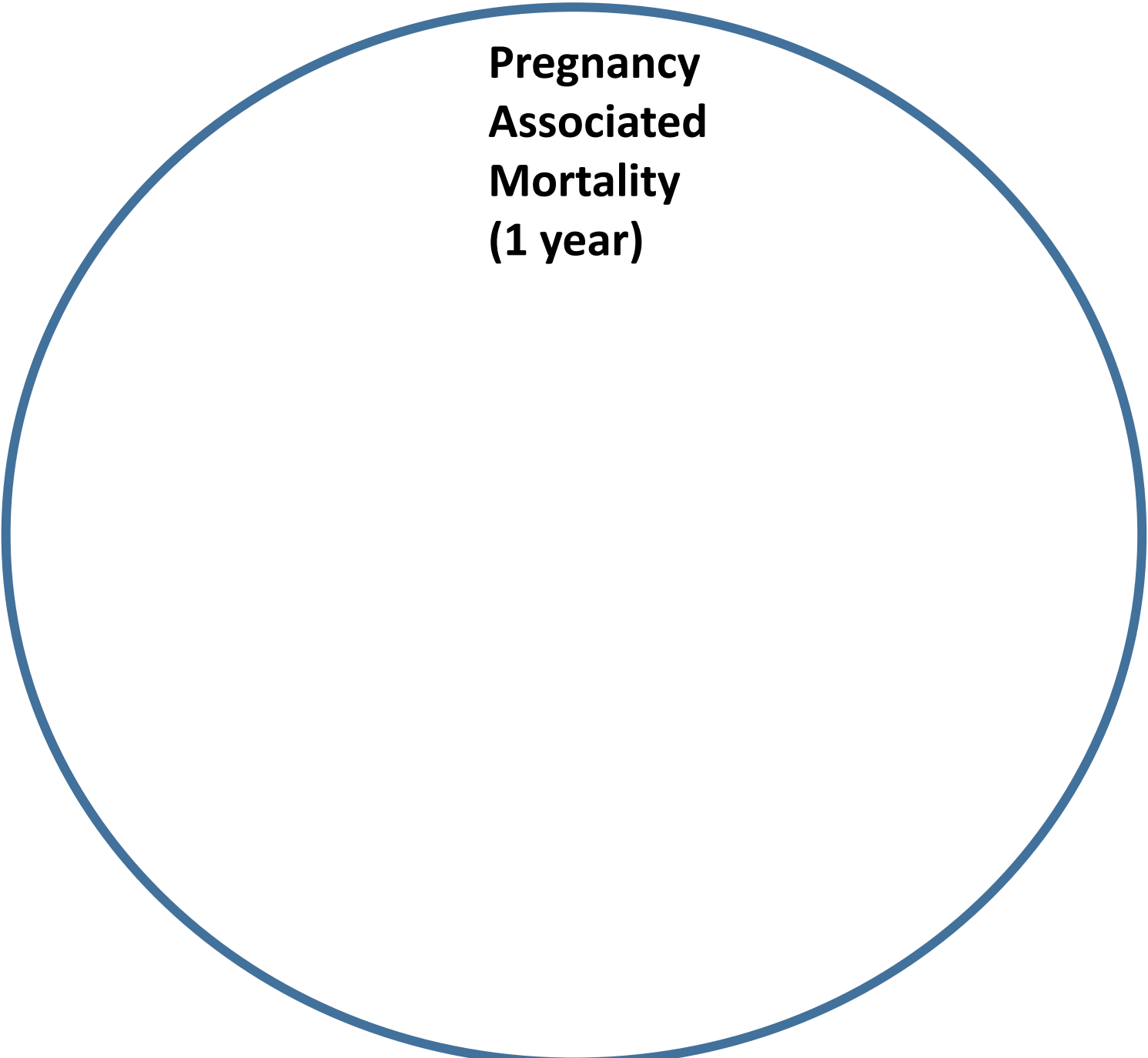
**1. Pregnancy associated death**

**2. Pregnancy related death**

**3 Maternal mortality**

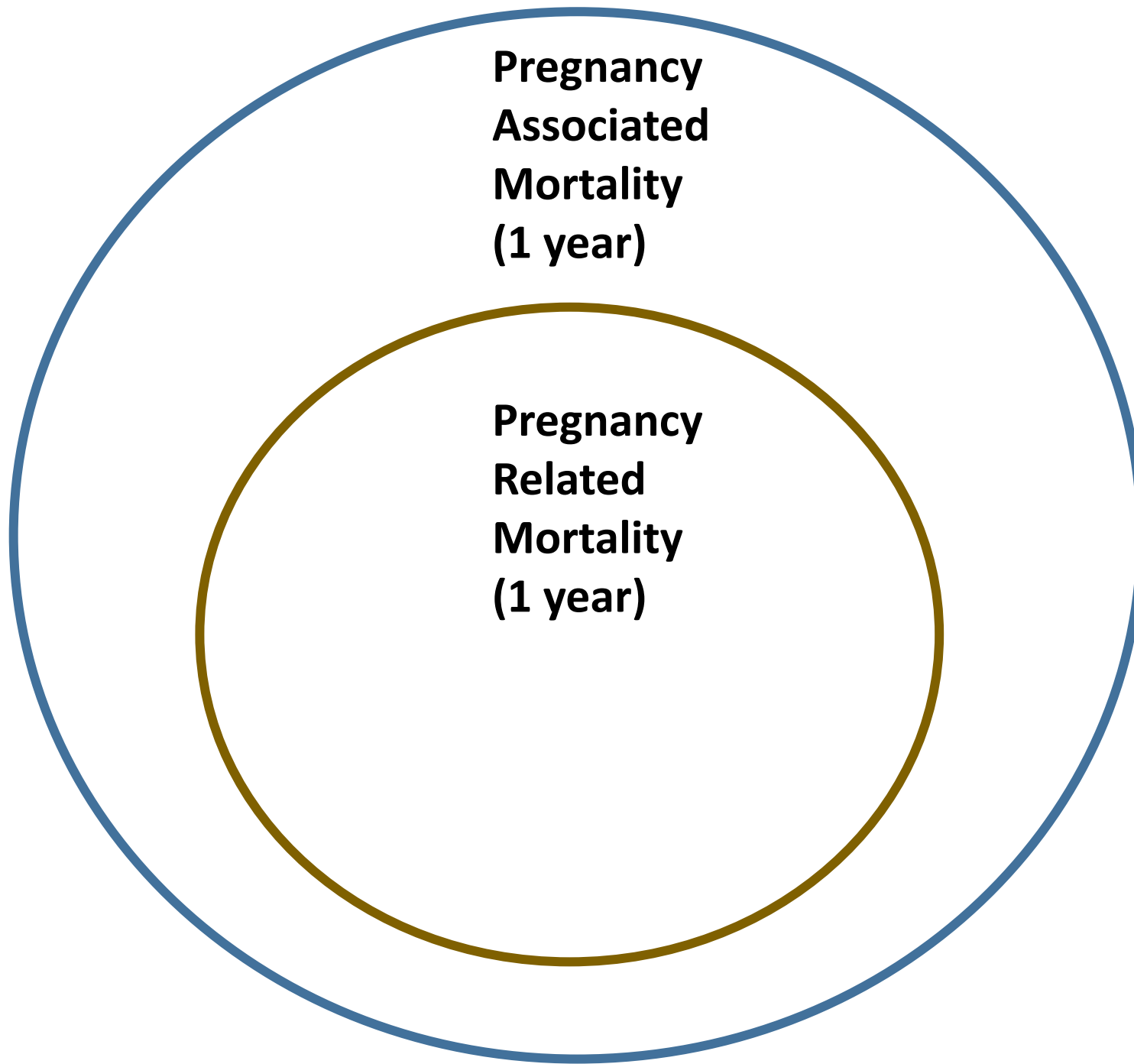
# Three Definitions (in the U.S.)

- **Pregnancy Associated Death** – The death of a woman while pregnant or *within one year* of termination of pregnancy, *irrespective of cause*. (*WHO calls these “pregnancy related”*). *Starting point for analyses.*
- **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. *Used by CDC for U.S. trends.*
- **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. *Used in international comparisons.*

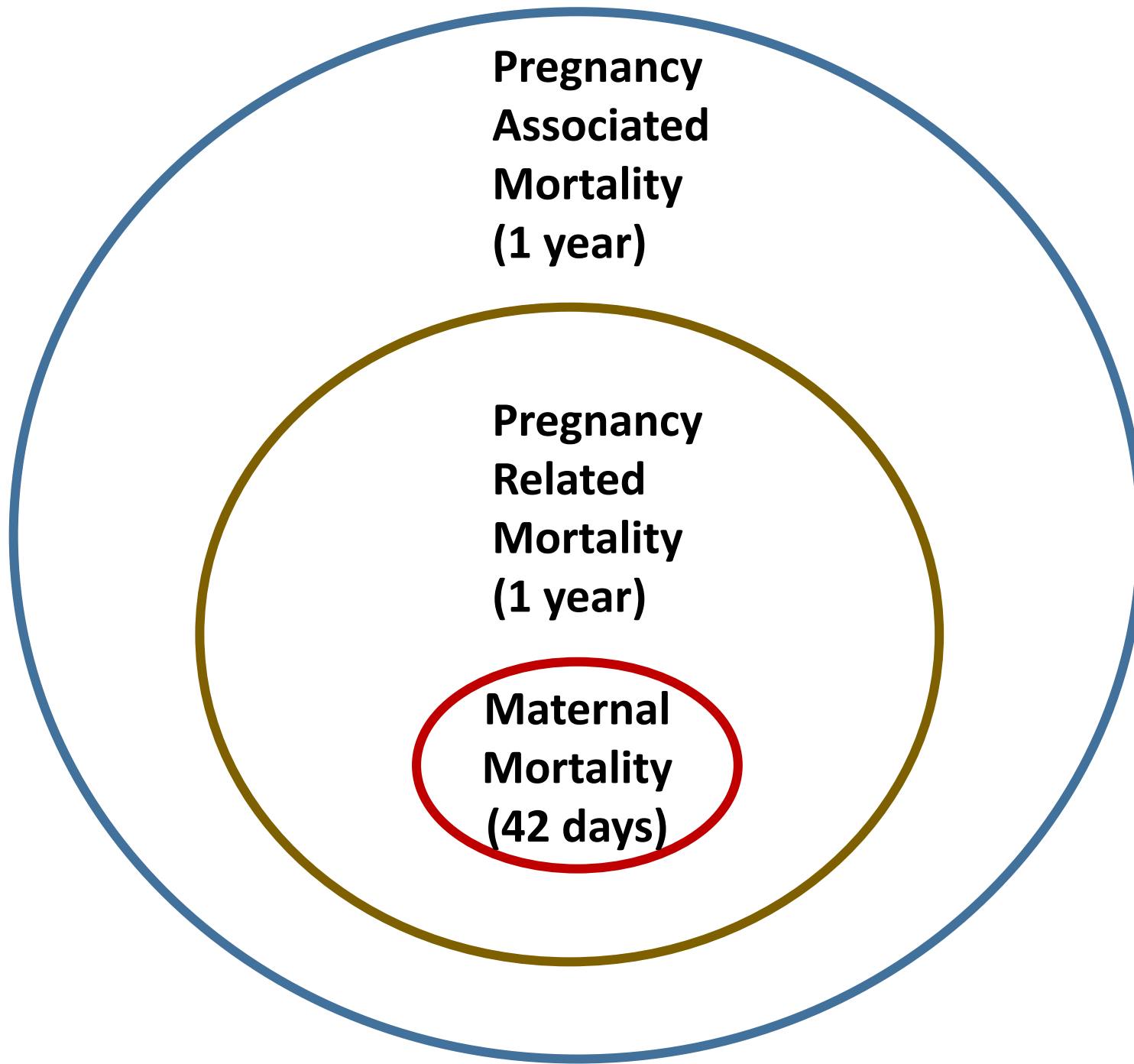


**Pregnancy  
Associated  
Mortality  
(1 year)**

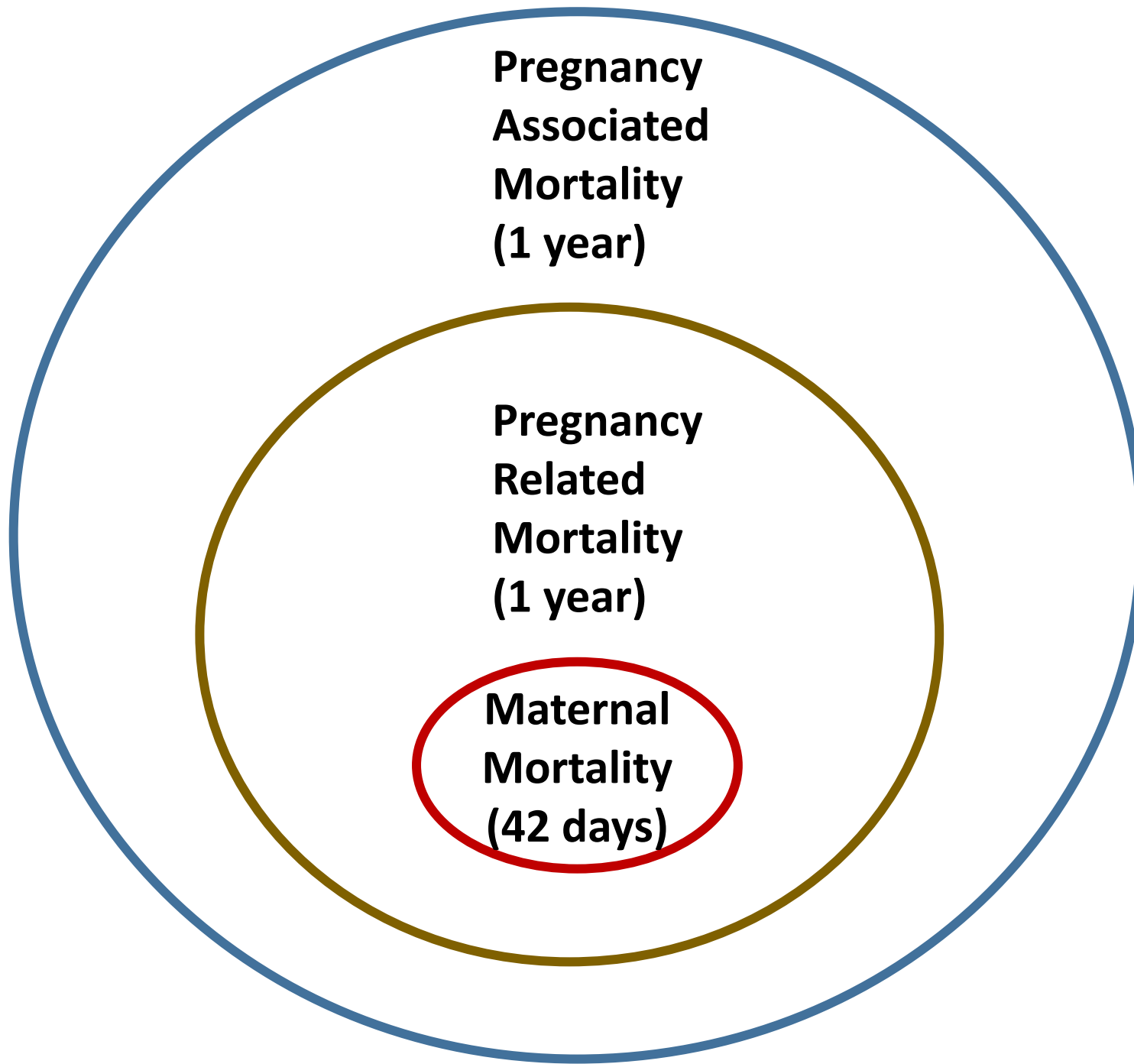
**Pregnancy  
Associated  
Mortality:**  
**All Deaths women  
of reprod. age  
pregnancy to 1  
year ppm**



**Pregnancy  
Related  
Mortality:**  
All Deaths  
women of  
reprod. age  
pregnancy to  
**1 year ppm**  
Related to the  
pregnancy



**Maternal Mortality:**  
All Deaths women  
of reprod. age  
pregnancy to **42**  
**days ppm Related**  
**to the pregnancy**



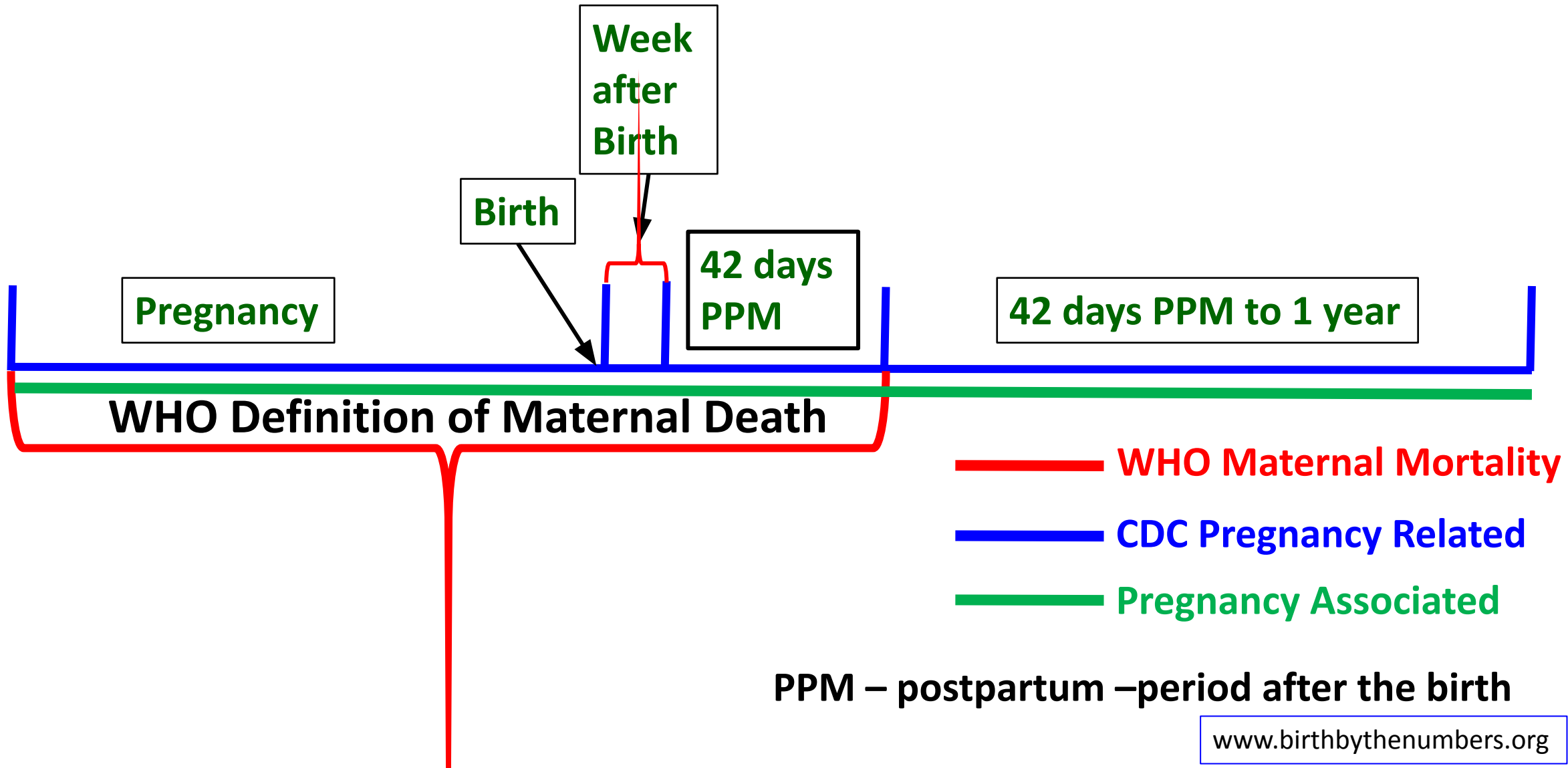
**Pregnancy Associated Mortality:** Deaths during pregnancy and up to **1 year postpartum**

**Pregnancy Related Mortality:** Deaths during pregnancy and up to **1 year postpartum** **& related to the pregnancy**

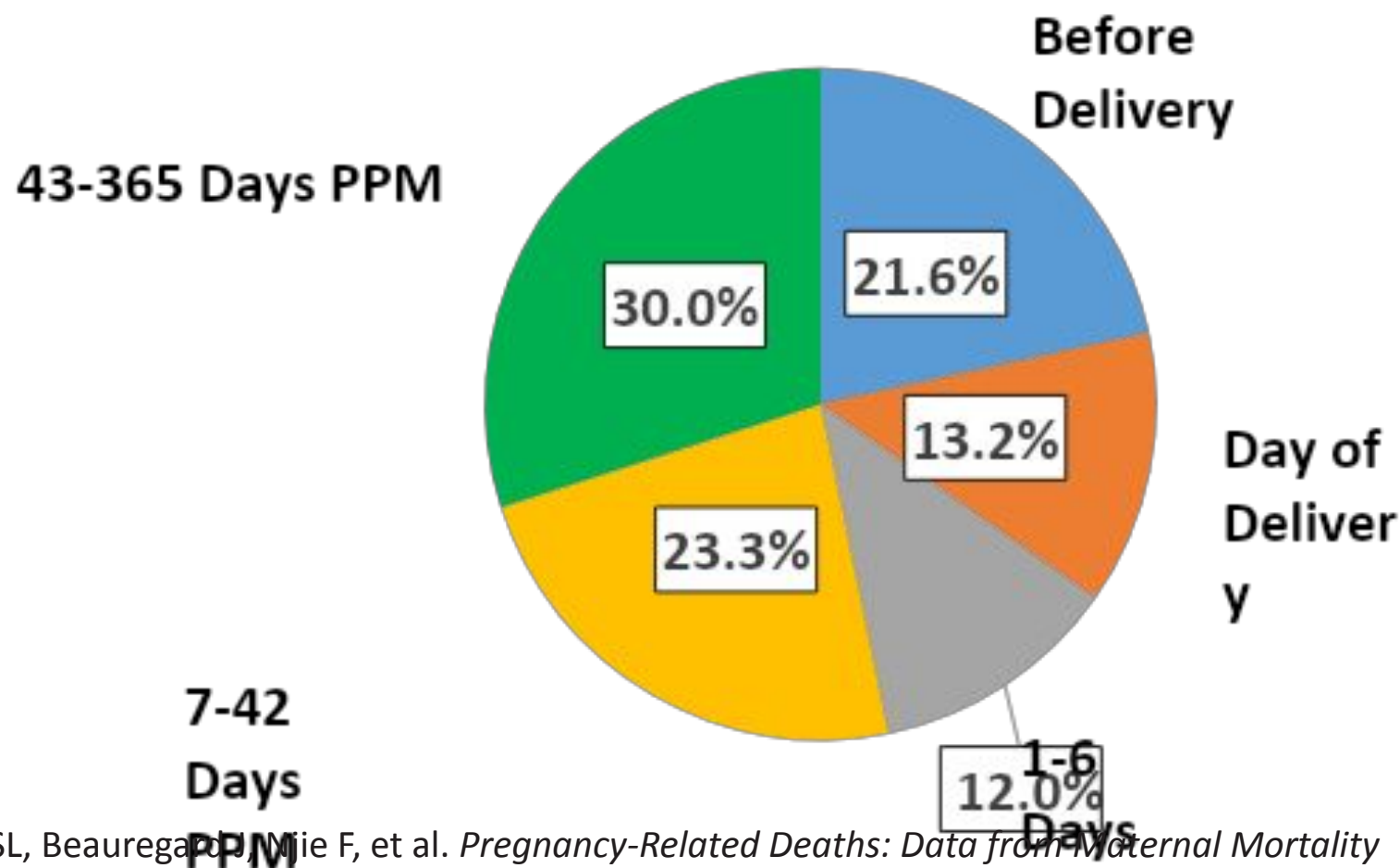
**Maternal Mortality:** Deaths during pregnancy and up to **42 days postpartum** **& related to the pregnancy**



# Timeline of Maternal Mortality Definitions



# Timing of Maternal Deaths (2017-19)



Source: Trost SL, Beauregard J, Mire F, et al. *Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019*. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2022.

# Different Sources & Different Measures

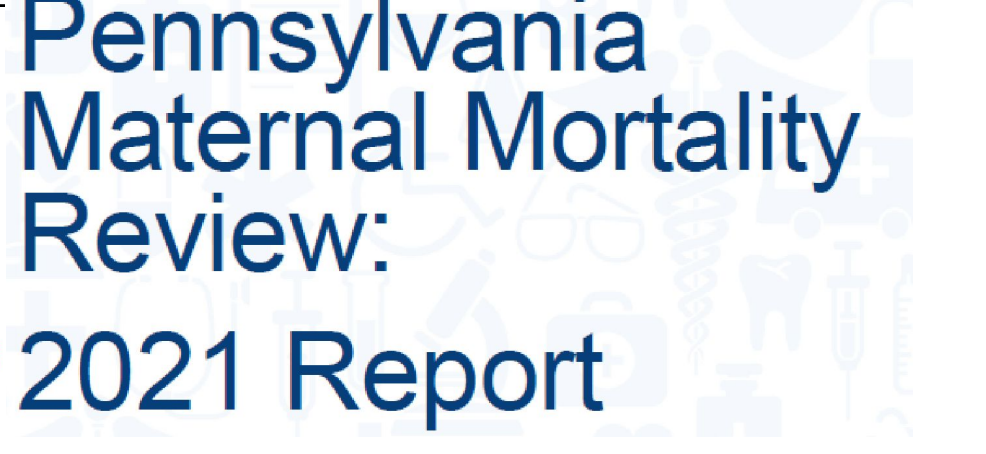
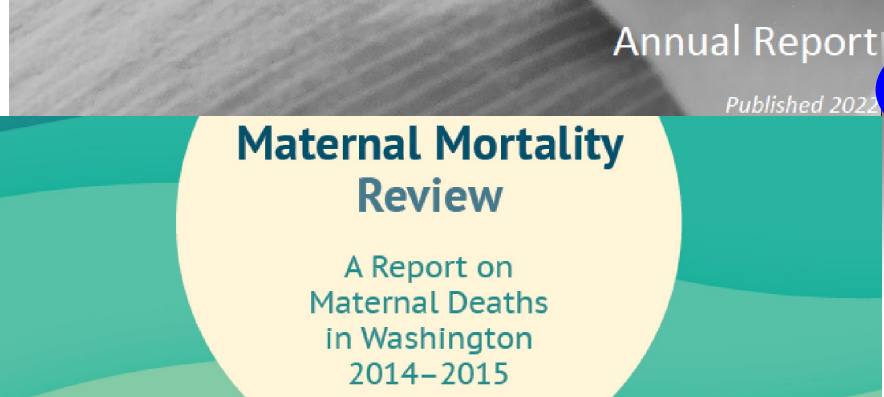
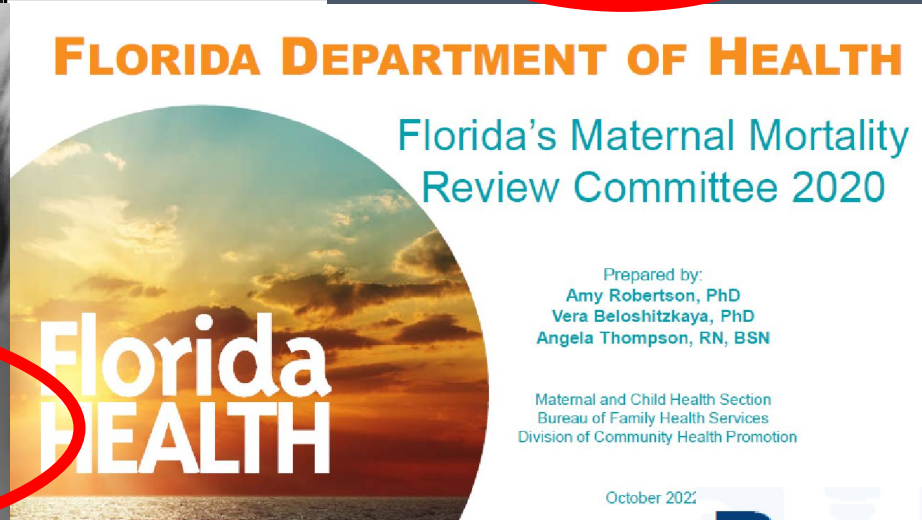
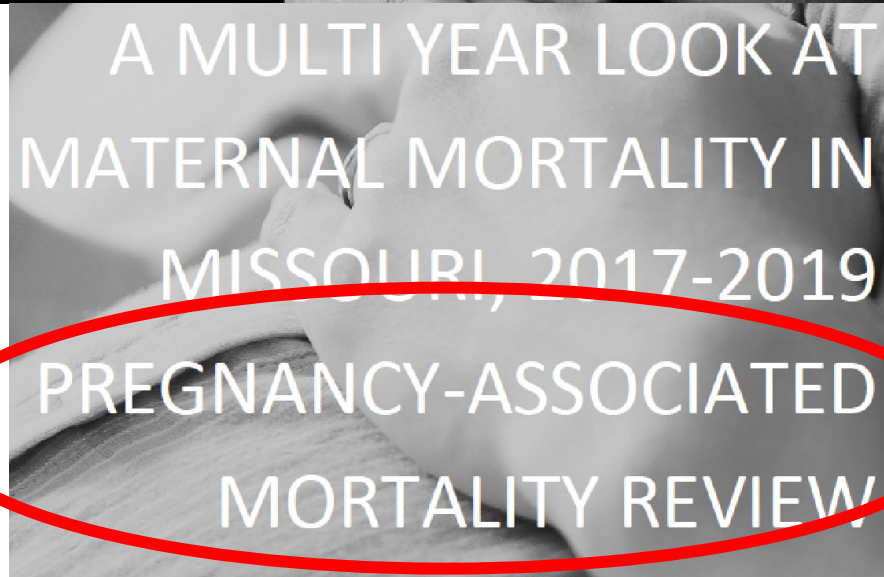
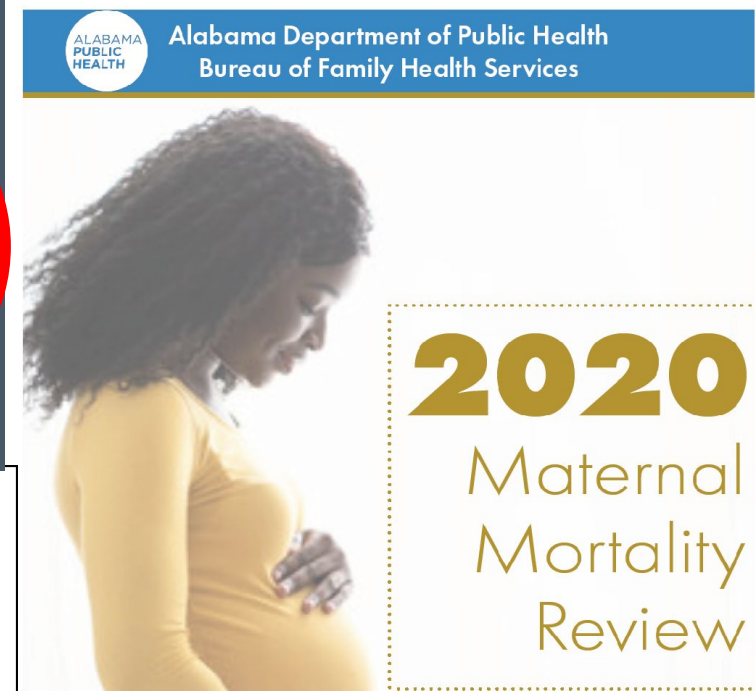
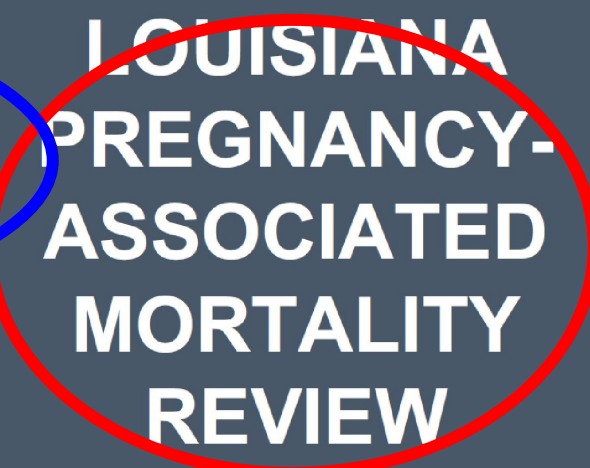
- **U.S. National Vital Stat. System** – Maternal Mortality
- **CDC Pregnancy Related Mortality System** – Pregnancy Related Mortality
- **State Maternal Mortality Review Committees** – Pregnancy Associated, Pregnancy Related & Maternal Mortality depending on states, but primarily Pregnancy Related Mortality

# US Maternal Mortality Surveillance

	CDC – National Vital Statistics System (NVSS)	CDC – Pregnancy Mortality Surveillance System (PMSS)	State and Local Maternal Mortality Review Committees (MMRCs)
Data Source	Death certificates	Death certificates linked to fetal death and birth certificates	Death certificates linked to fetal death and birth certificates, medical records, social service records, autopsy, informant interviews, etc.
Time Frame	During pregnancy – 42 days	During pregnancy – 365 days	During pregnancy – 365 days
Source of Classification	ICD-10 codes	Medical epidemiologists	Multidisciplinary committees
Terms	Maternal death	Pregnancy associated, (Associated and) Pregnancy related, (Associated but) Not pregnancy related	Pregnancy associated, (Associated and) Pregnancy related, (Associated but) Not pregnancy related
Measure	Maternal Mortality Rate - # of Maternal Deaths per 100,000 live births	Pregnancy Related Mortality Ratio - # of Pregnancy Related Deaths per 100,000 live births	Pregnancy Related Mortality Ratio - # of Pregnancy Related Deaths per 100,000 live births
Purpose	Show national trends and provide a basis for international comparison	Analyze clinical factors associated with deaths, publish information that may lead to prevention strategies	Understand medical and non-medical contributors to deaths, prioritize interventions that effectively reduce maternal deaths

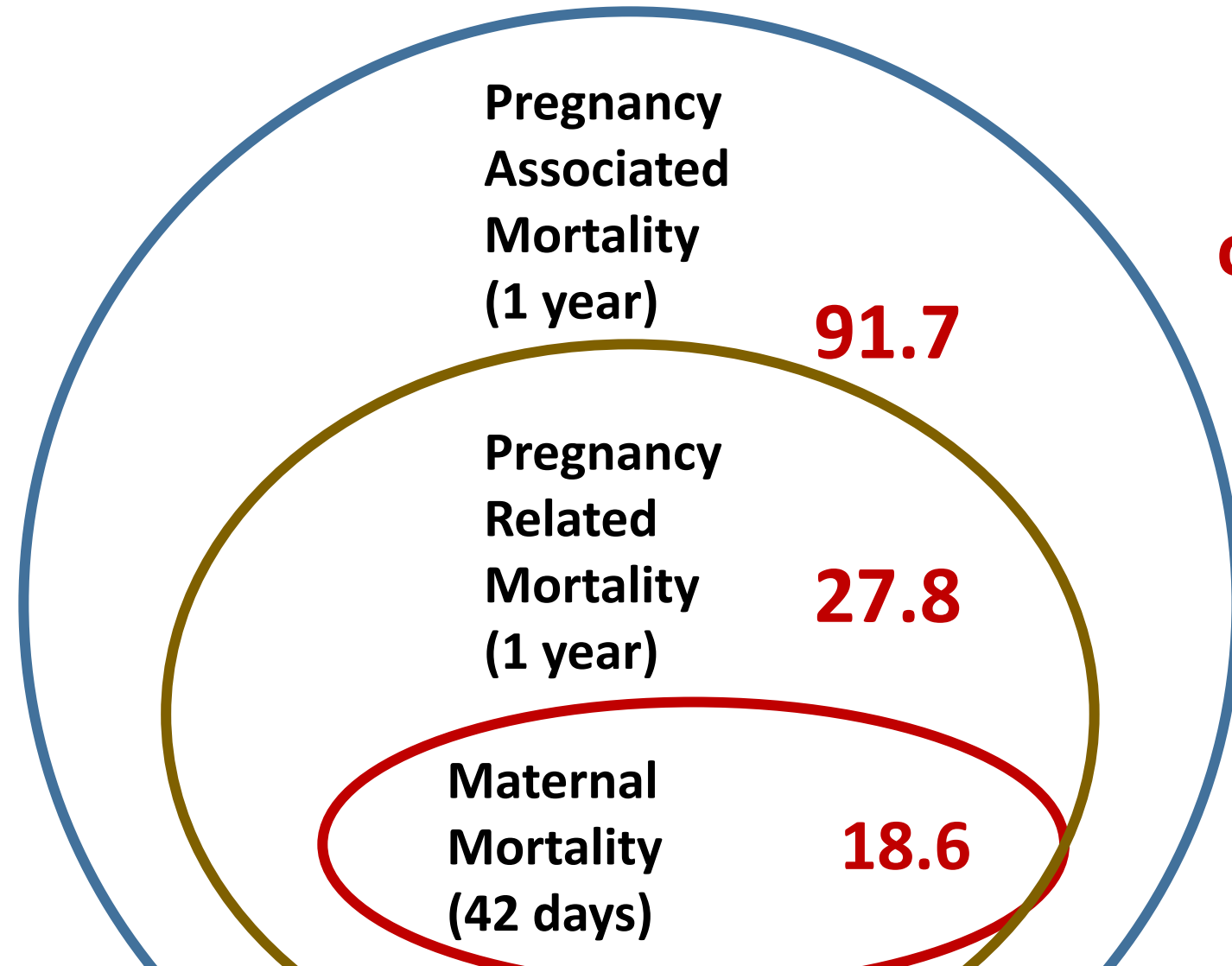
Reviewed in: Callaghan, William M. 2012. Overview of maternal mortality in the United States. *Seminars in perinatology*. 36; 1: 2-6. St. Pierre A, Zaharatos J, Goodman D, Callaghan WM. Challenges and opportunities in identifying, reviewing, and preventing maternal deaths. *Obstet Gynecol*. 2018;131(1):138–142.







# Illustrating the Differences in Measures of Maternal Death: Same State; Same Years; 4 different results.



**NOTE: NVSS Data on Tenn. Maternal Mortality for 2017-2019:**  
75 Deaths; 242,217 births  
Rate – 31.0/100,000

**Tennessee Mortality Rates from the  
Tenn. Maternal Mortality Review  
Committee per 100,000 live births, 2017-19**

## **2. The Historical Trend in U.S. Maternal Mortality**

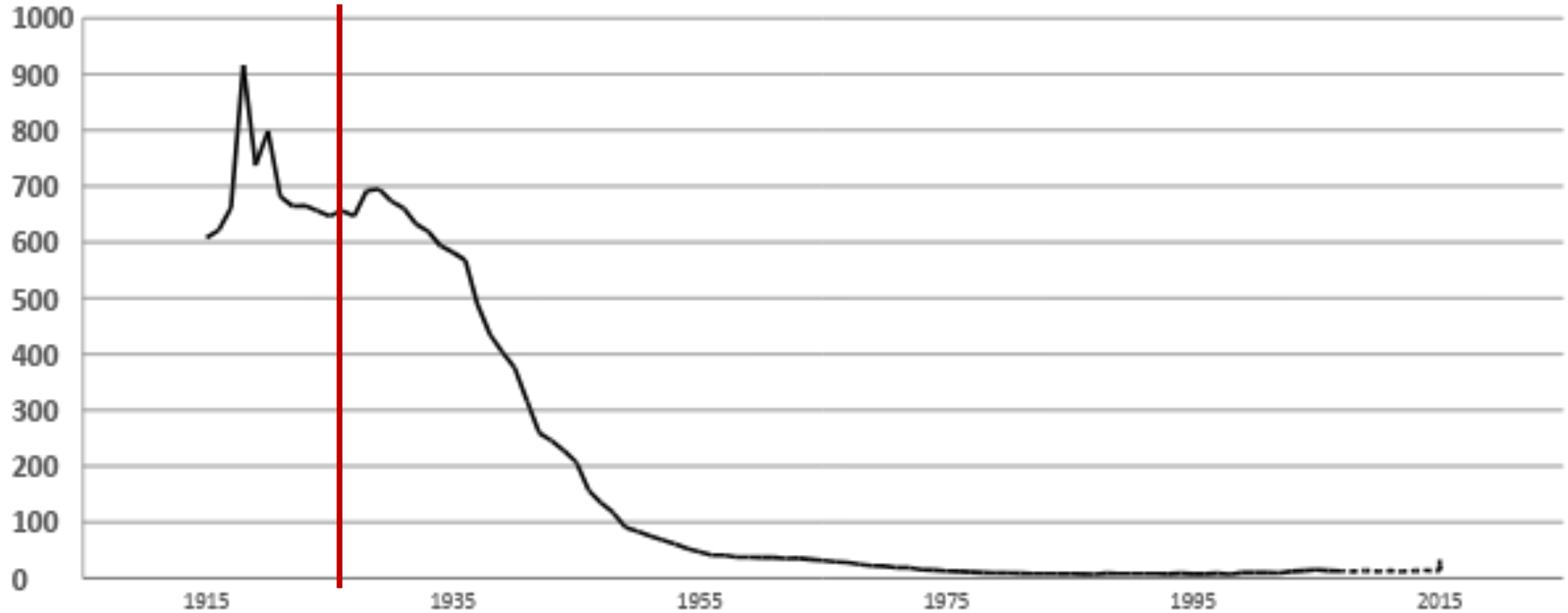
# Declaring Premature Victory

*“An examination of the rates for the different states indicates areas in which further improvement can be expected, but it is clear that maternal mortality is no longer a nationwide problem.....Childbearing has been made quite safe.”*

- Maternal Deaths One in a Thousand. *JAMA*, 1950; 144: 1096-7.
- *At the time the maternal mortality rate was 100 per 100,000*



# U.S. Maternal Mortality (per 100,000 births), 1915-2021



Sources: NCHS. Maternal Mortality and Related Concepts. Vital & Health Statistics. Series 33; #3. & annual data reports. 1915-1960 data from NCHS. *Vital Statistics Rates In The United States 1940-1960*. NOTE: Shifts in measurement (e.g. not all states were part of registration system prior to 1933) accounts for some of the variation over time. 2007-2016 based on 2 year estimates of the pregnancy related mortality rate: Petersen E. *MMWR*.9/6/19; 2017: Rossen. *Impact of Pregnancy Checkbox, U.S. 1999-2017*.NCHS.VitalHlthStat.3(44);2020.; 2018: U.S. Hoyert DL Health E-Stat.Hyattsville, MD: NCHS. 2/2022.

# Year State was Added to the Maternal Death Registry

Year	State	Year	State	Year	State
1880.....	Massachusetts.	1908.....	Washington.	1919.....	Florida.
	New Jersey.		Wisconsin.		Mississippi.
	District of	1909.....	Ohio.	1920.....	Nebraska.
	Columbia. <sup>1</sup>	1910.....	Minnesota.	1922.....	Georgia. <sup>5</sup>
1890.....	Connecticut.		Montana.		Idaho.
	Delaware. <sup>2</sup>		Utah.		Wyoming.
	New Hampshire.	1911.....	Kentucky.	1923.....	Iowa.
	New York.		Missouri.	1924.....	North Dakota.
	Rhode Island.	1913.....	Virginia.	1925.....	Alabama.
	Vermont.	1914.....	Kansas.		West Virginia.
1900.....	Maine.	1916.....	South Carolina.	1926.....	Arizona.
	Michigan.		North Carolina. <sup>4</sup>	1927.....	Arkansas.
	Indiana.	1917.....	Tennessee.	1928.....	Oklahoma.
1906.....	California.	1918.....	Illinois.	1929.....	Nevada.
	Colorado.		Louisiana.		New Mexico.
	Maryland.		Oregon.	1933.....	Texas.
	Pennsylvania.			1959.....	Alaska.
	South Dakota. <sup>3</sup>			1960.....	Hawaii.

<sup>1</sup> Included as a State.

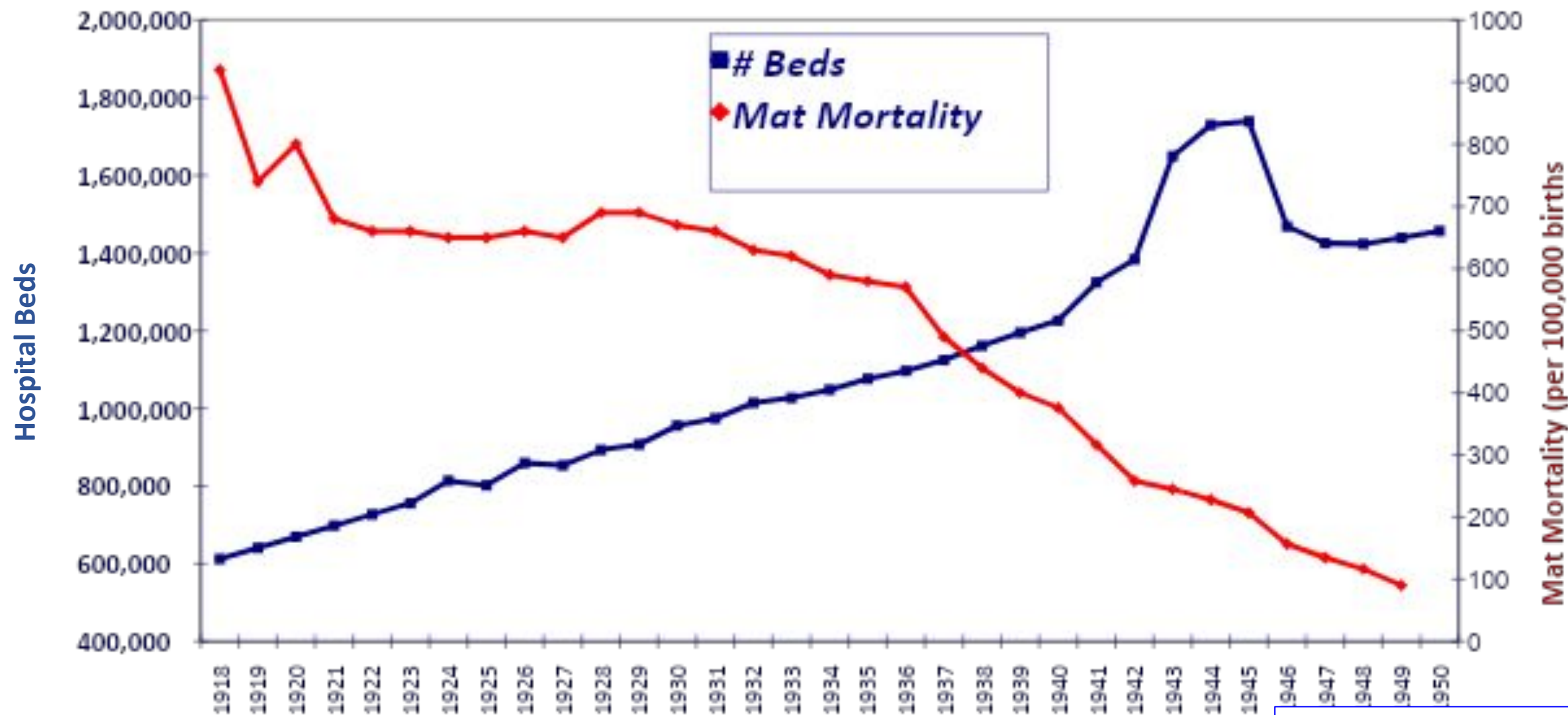
<sup>2</sup> Dropped from the registration system in 1900; readmitted in 1919.

<sup>3</sup> Dropped from the registration system in 1910; readmitted in 1930.

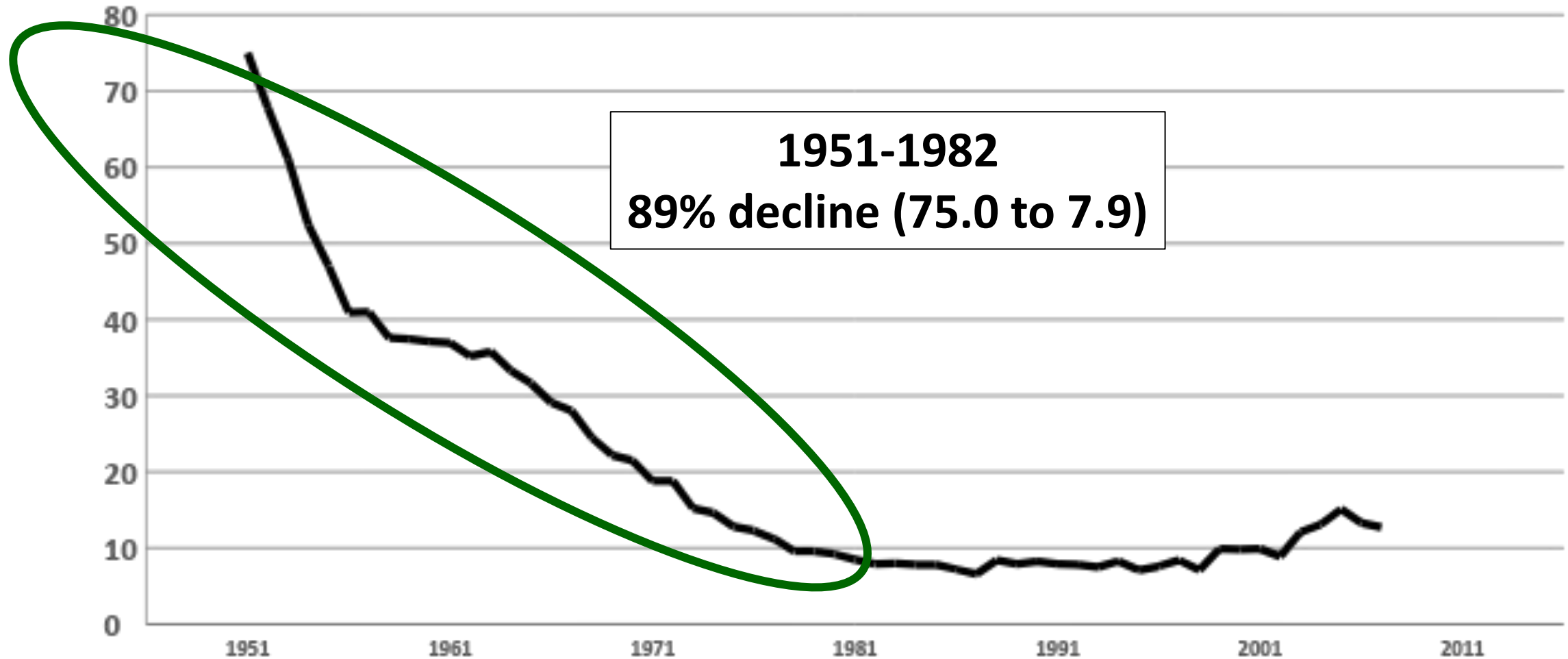
<sup>4</sup> Included only municipalities with populations of 1,000 or more in 1900 (about 16 percent of the total population); the remainder of the State was added to the system in 1916.

<sup>5</sup> Dropped from the registration system in 1925; readmitted in 1928.

# Number of U.S. Hospital Beds and Maternal Mortality, 1918-1950

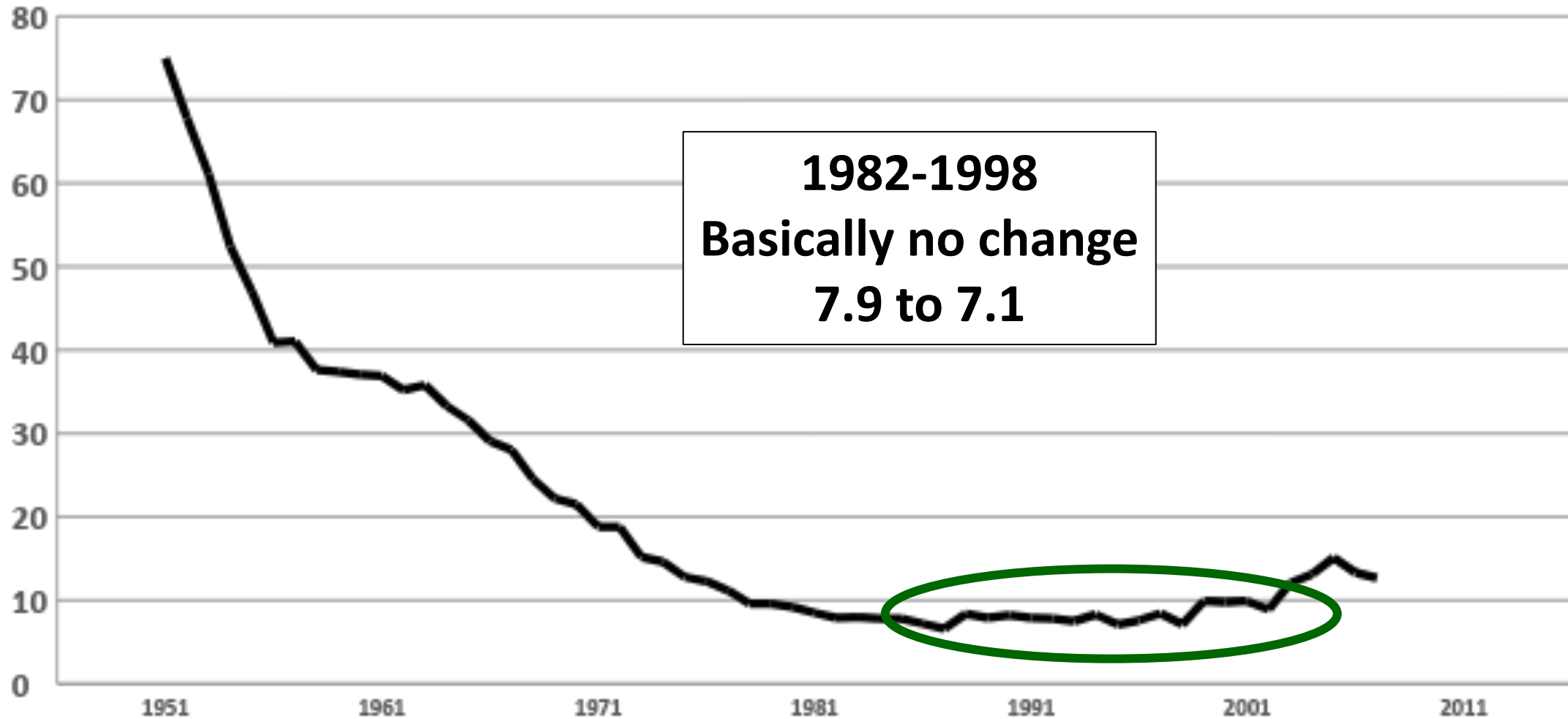


# U.S. Maternal Mortality (per 100,000 live births), 1951-2007



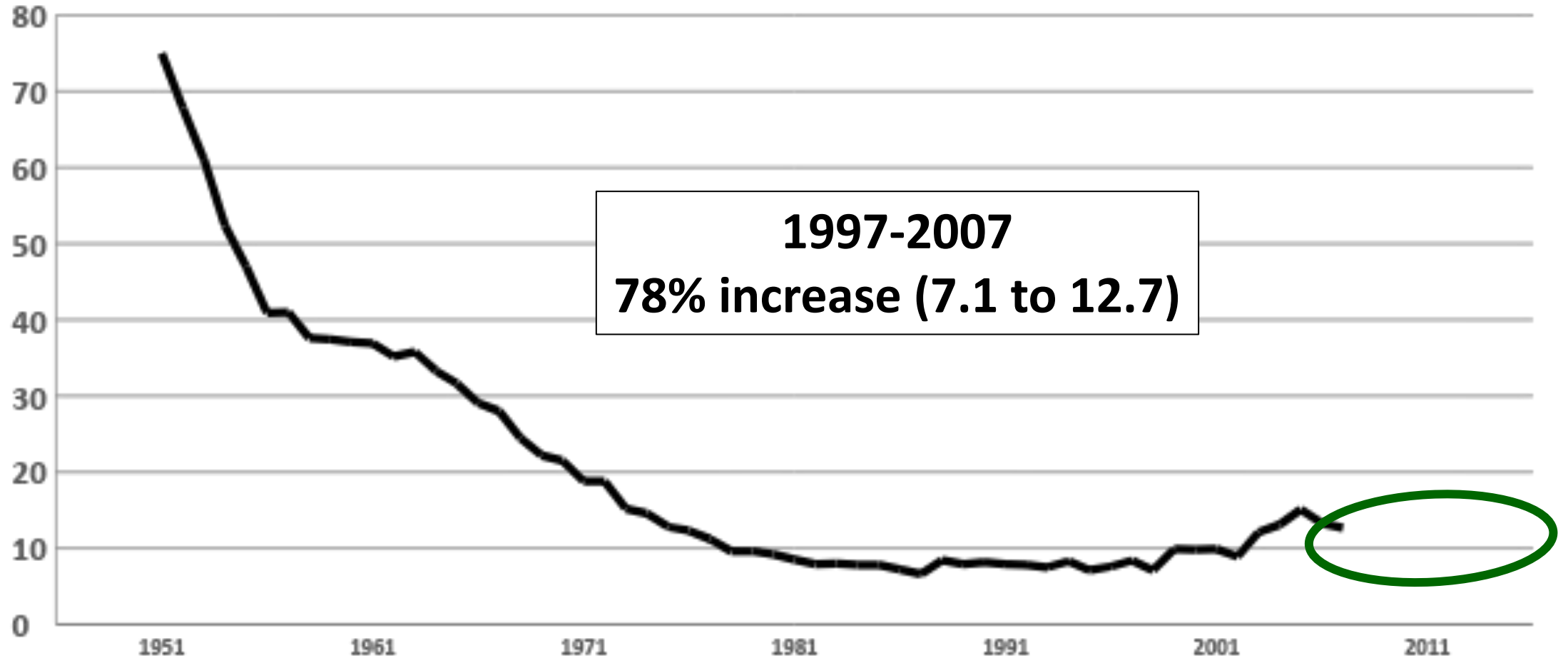
Source: NCHS. Deaths: Final Data. Annual Reports.

# U.S. Maternal Mortality (per 100,000 live births), 1951-2007



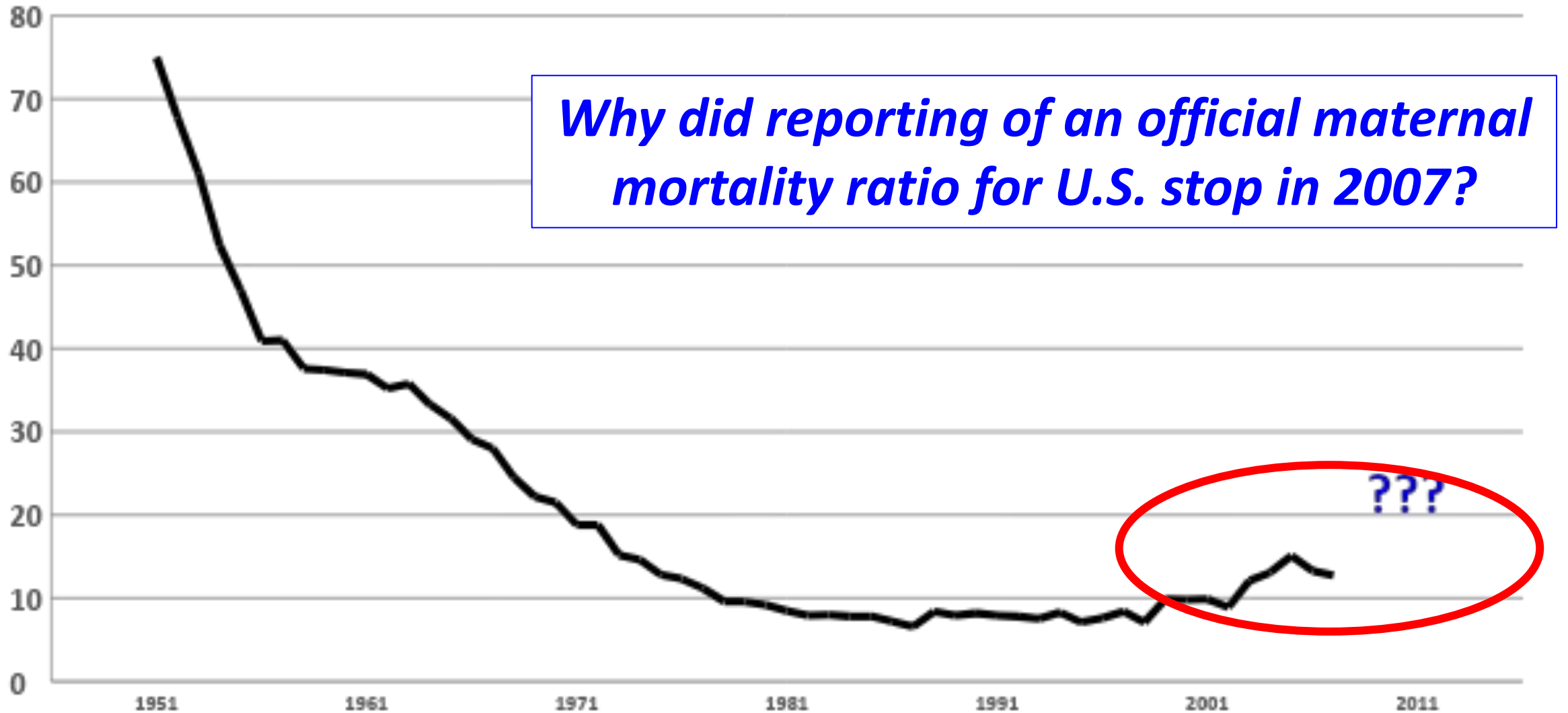
Source: NCHS. Deaths: Final Data. Annual Reports.

# U.S. Maternal Mortality (per 100,000 live births), 1951-2007



Source: NCHS. Deaths: Final Data. Annual Reports.

# U.S. Maternal Mortality Ratio (per 100,000 live births) , 1951-2007



# Last reporting (2007) of a maternal mortality rate by NCHS before 2018





***How did the U.S. get to the point  
where they stopped publishing a  
maternal mortality rate?***

***Efforts to avoid poor case  
ascertainment led to  
over-ascertainment***

### 3. The Case of the Pregnancy Checkbox

*“This difficulty [in measuring maternal mortality] would be solved easily if universal birth and stillbirth registration was practiced and if death certificates required a statement as to the association of the puerperal state.”*

# 3. The Case of the Pregnancy Checkbox

*“This difficulty [in measuring maternal mortality] would be solved easily if universal birth and stillbirth registration was practiced and if death certificates required a statement as to the association of the puerperal state.”*

*Committee on Maternal Welfare. Maternal Mortality in Philadelphia 1931-1933 (1934)*

# Quick note on the federal reporting system of births and deaths.

- There is no centralized “national” reporting system in the U.S.
- Birth and death data is collected at the local level, compiled at the state level, and then selected items are sent to the National Vital Statistics System (NVSS).
- The states and the NVSS periodically negotiate an agreement (seen in the *U.S. Standard Certificate of Death*) on the specific items from state data collection used in the national file. These revisions were last made in 1975, 1989, and 2003.
- The failure to officially report U.S. maternal deaths from 2008-18 was a direct result of the 2003 revisions that attempted to improve reporting.

# The Check Box

## Determining Pregnancy Status to Improve Maternal Mortality Surveillance

*Am J Prev Med* 2000;19(1S):35-39.

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

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

**Methods:** Data derived from the Centers for Disease Control and Prevention's Mortality Surveillance System were used to identify states that included a pregnancy status check box on death certificates in 1991 and 1992. Death certificates from those states were reviewed to determine the number and proportion of pregnancy-related deaths identified by the 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.

**16 States already had a pregnancy checkbox on death certificates as far back as 1991-1992, but with different wording**



State	Wording	Wording of “Pregnancy Checkbox” in states prior to 2003	Time periods used: 42 days; 6 weeks; 3 months; 90 days; 12 mos; “last year”
Alabama	Was there a pregnancy in last 42 days? (Specify Yes, No, or dk.)		
California	If female, pregnant in last year? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> UNK		
Florida	If female, was there a pregnancy in the past 3 months?    Yes    No		
Idaho	If female aged  0–54: <input type="checkbox"/> not preg  win past yr <input type="checkbox"/> preg at time of death <input type="checkbox"/> not pregnant, but preg within 42 days of death <input type="checkbox"/> not pregnant but preg 43 days to 1 yr before death <input type="checkbox"/> unknown if preg w/in the past yr		
Illinois	If female, was there a pregnancy in past three months?  Yes <input type="checkbox"/> No <input type="checkbox"/>		
Indiana	Was decedent pregnant or 90 days postpartum? (Yes or no)		
Iowa	If female, was there a pregnancy in the past 12 months? (Specify yes or no)		
Kentucky	If female, was there a pregnancy in the past 12 months? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Louisiana	If deceased was female 10–49, was she pregnant in the last 90 days? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unk		
Maryland	If female: Was decedent pregnant in the past 12 months? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown Separate field  on dates of death and delivery support capability to compute the other categories in the standard.		
Minnesota	Was female pregnant: At death?    yes    no        In last 12 months?    yes    no    unknown		
Mississippi	Had decedent been pregnant within 90 days prior to death? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Missouri	If deceased was female 10–49, was she pregnant in the last 90 days? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Un		
Montana	If female: <input type="checkbox"/> not preg within past year <input type="checkbox"/> not preg but preg within 42 days of death <input type="checkbox"/> not preg but pregnant 43 days to 1 year before death <input type="checkbox"/> pregnant at time of death <input type="checkbox"/> unknown if preg within past year		
New Jersey	If female, was she pregnant at death, or any time 90 days prior to death <input type="checkbox"/> Yes <input type="checkbox"/> No		
New Mexico	Was decedent pregnant within last 6 weeks? <input type="checkbox"/> Yes <input type="checkbox"/> No		
North Dakota	Was deceased pregnant within 18 months of death? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Nebraska	If female, was there a pregnancy in the past 3 months?  Yes <input type="checkbox"/> No <input type="checkbox"/>		
Texas	Was decedent pregnant at time of death <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> UNK within last 12 MO <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> UN		
Virginia	If female, was there a pregnancy in past 3 months?  Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>		
		Source: Hoyert DL, NVSR; vol 69 no 1. Hyattsville, MD: NCHS. 2020.	
		www.birthbythenumbers.org	

# Revised (2003) U.S. Standard Certificate of Death

[illegible]

**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:

## *U.S. Standard Pregnancy Question, 2003 (sort of)*

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 that did ask about pregnancy status.*



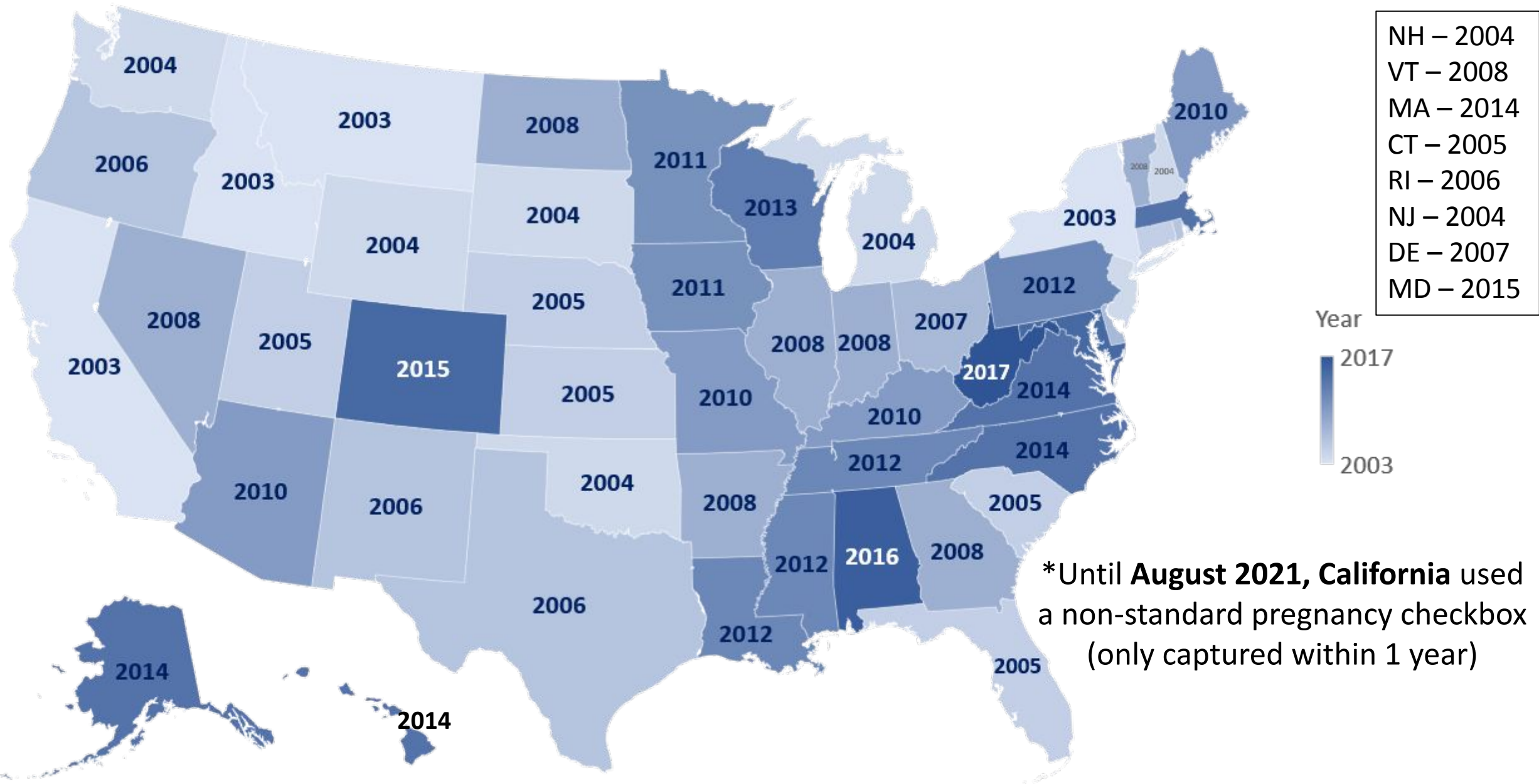
# Delays in Adoption of the U.S. Standard Pregnancy Question among States

State	Year Adopted
CA, ID, MT, NY	2003
New Jersey	2004
Florida	2005
Texas	2006
Ohio	2007
Massachusetts	9/2014
Alabama	2016
<b>W. VA</b>	<b>2017</b>

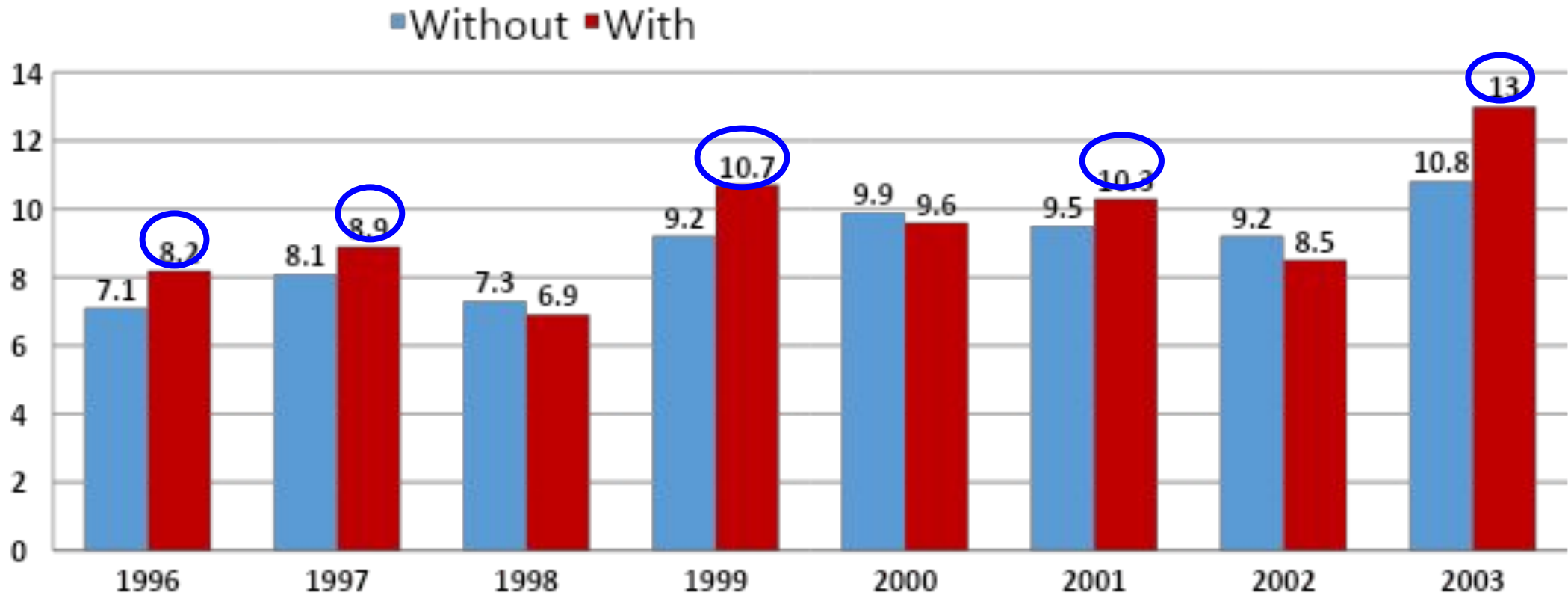
\* Note: Some states adopted change in the middle of the calendar year.

	New Adopters*	Total
2003	4	4
2004	7	11
2005	7	18
2006	4	22
2007	2	24
2008	7	31
2009	0	31
2010	4	35
2011	2	37
2012	4	41
2013	1	42
2014	5	47
2015	2	49
2016	1	50
2017	1	51

# Staggered adoption of 2003 revisions by states (2003-17)



# 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?***

# 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.

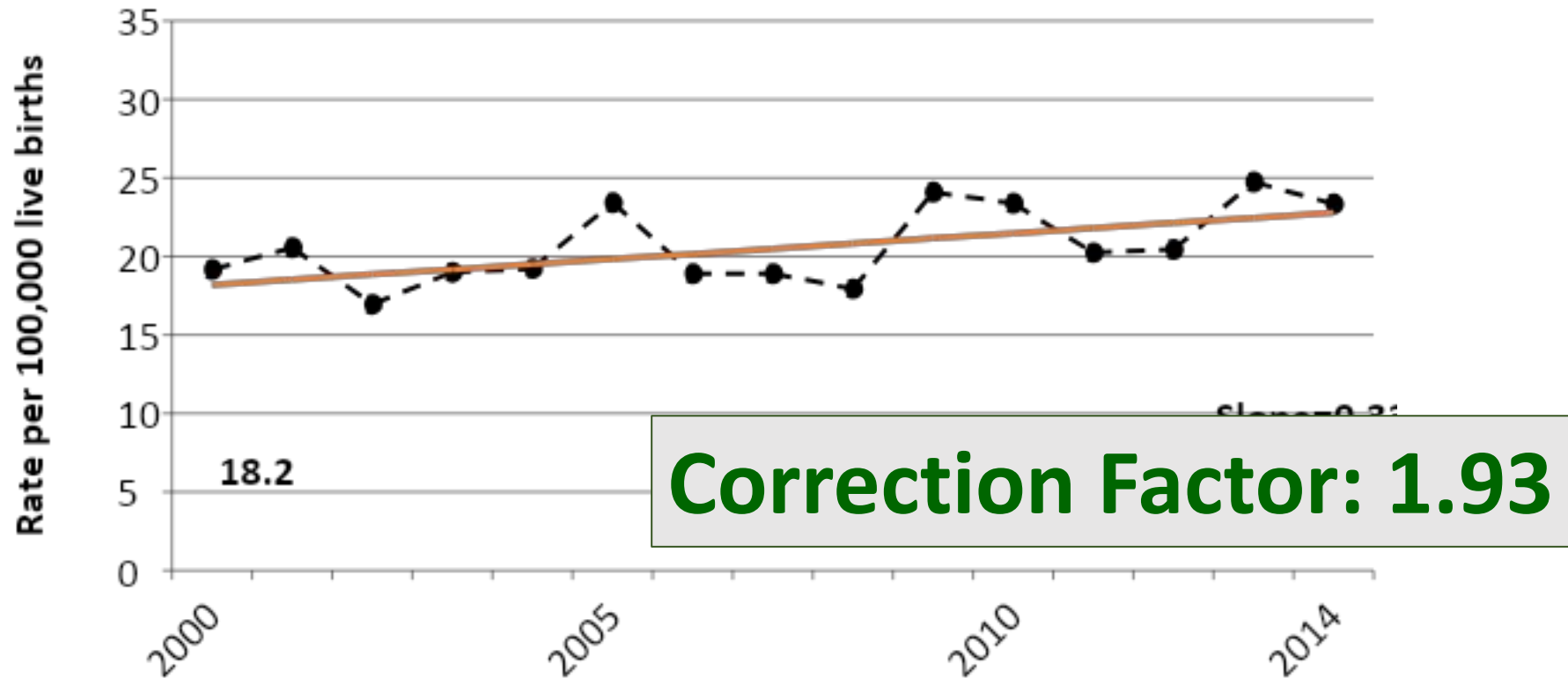


# Correcting for Impact of Adding Pregnancy Box

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

***Also did tests involving 1 year and 3 year periods with little change***

# States that had no question & added the checkbox



***Impact of adding the pregnancy checkbox was to approximately double a state's maternal mortality ratio***

Note: Includes 24 states that did not have a pregnancy question on their unrevised death certificate and which adopted the U.S. standard question upon revision: Arkansas, Arizona, Connecticut, Delaware, Georgia, Idaho, Kansas, Maine, Michigan, Montana, New Hampshire, Nevada, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Washington, and Wyoming.

# NVSS analyses of the impact of the pregnancy checkbox

## National Vital Statistics Reports

Volume 69, Number 1



January 30, 2020

### Evaluation of the Pregnancy Status Checkbox on the Identification of Maternal Deaths

by Donna L. Hoyert, Ph.D., Division of Vital Statistics, Sayeedha F.G. Uddin, M.D., M.P.H., Office of the Director, and Arialdi M. Miniño, M.P.H., Division of Vital Statistics

## National Vital Statistics Reports

Volume 69, Number 2



January 30, 2020

### Maternal Mortality in the United States: Changes in Coding, Publication, and Data Release, 2018

by Donna L. Hoyert, Ph.D., and Arialdi M. Miniño, M.P.H., Division of Vital Statistics



### The Impact of the Pregnancy Checkbox and Misclassification on Maternal Mortality Trends in the United States, 1999–2017

Analytical and Epidemiological Studies

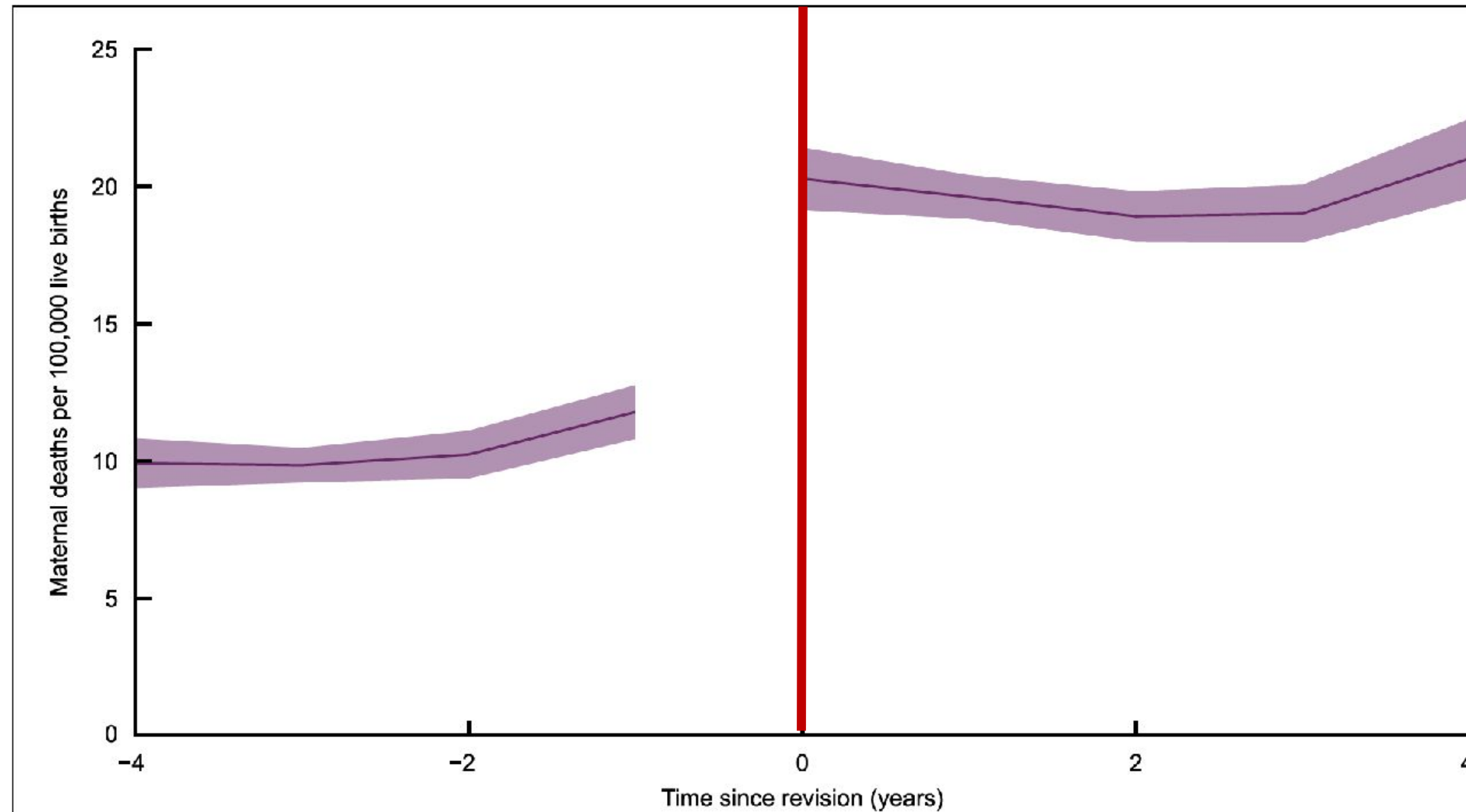
# Statistical Analysis

- *Objective 1: Quantify the impact of the staggered implementation of the pregnancy checkbox on Maternal Mortality Rates (MMRs)*
- *Objective 2: Estimate trends in MMRs from 1999 through 2017, accounting for the checkbox*
- *Objective 3: Examine the impact of potential misclassification of pregnancy status on the death certificate on MMR trends from 1999 through 2017*



# NCHS Analysis of the Impact of Checkbox

Figure 1. Average change in maternal mortality rates associated with the pregnancy checkbox implementation:  
United States, 2003–2017



Source: Rossen LM, et al. *The impact of the pregnancy checkbox, 1999–2017*. NCHS. Vital Health Stat 3(44). 2020.

State

Change in maternal  
mortality rate (95% CI)

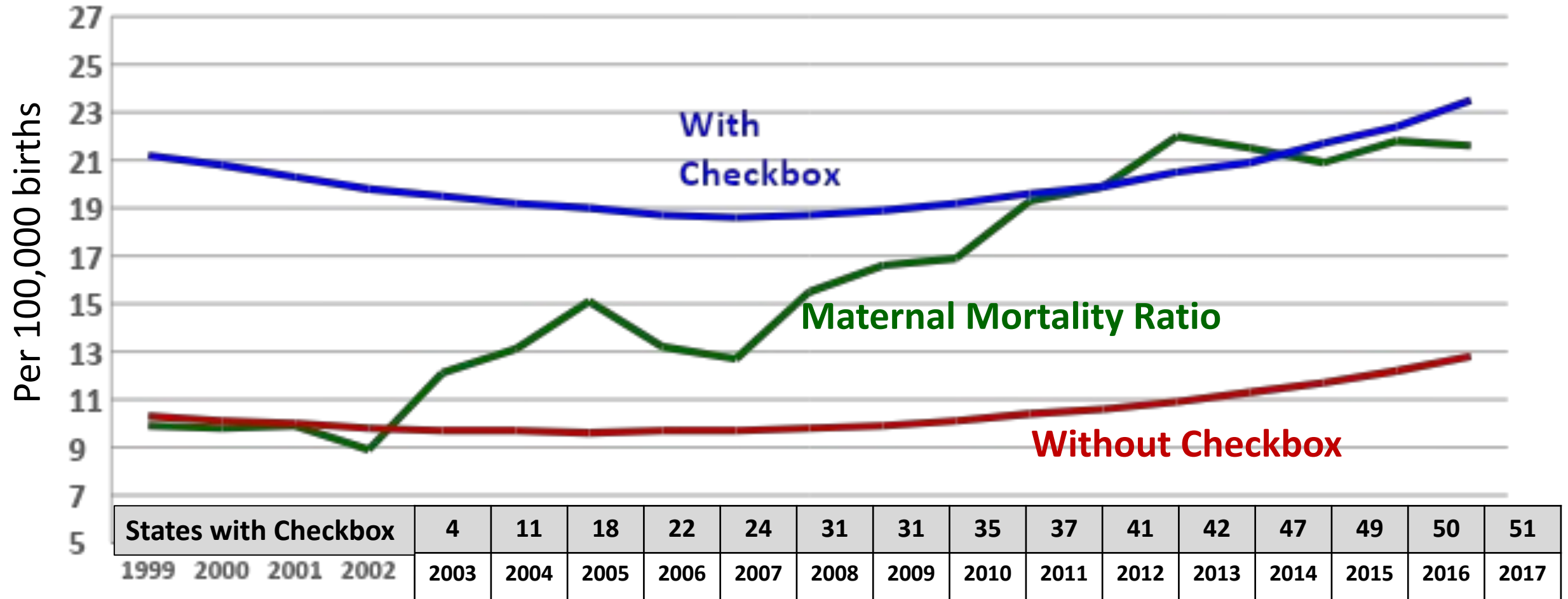
# ***Average % change in maternal mortality rates associated with the pregnancy checkbox implementation, by state of occurrence: U. S., 2003–17***

Alabama	29.0 (18.4 – 39.7)	New Jersey	16.1 (11.0 – 21.1)
Alaska	4.0 (–8.7 – 16.7)	New Mexico	15.7 (–5.9 – 37.2)
Arizona	10.2 (2.2 – 18.1)	New York City	9.3 (2.7 – 15.9)
Arkansas	15.7 (1.0 – 30.4)	New York State <sup>1</sup>	6.6 (1.8 – 11.3)
California	9.9 (5.2 – 14.7)	North Carolina	9.5 (5.0 – 14.1)
Colorado	2.0 (–4.8 – 8.8)	North Dakota	25.3 (–14.3 – 64.9)
Connecticut	5.7 (–0.6 – 12.0)	Ohio	19.6 (12.7 – 26.4)
Delaware	19.0 (–15.5 – 53.5)	Oklahoma	29.9 (16.0 – 43.8)
District of Columbia	2.3 (–9.9 – 14.6)	Oregon	5.1 (–3.7 – 13.9)
Florida	9.3 (4.8 – 13.7)	Pennsylvania	– 2.4 (–8.4 – 3.6)
Georgia	3.2 (–2.4 – 8.7)	Rhode Island	–0.8 (–13.5 – 11.8)
Hawaii	–6.4 (–22.3 – 9.5)	South Carolina	18.3 (9.8 – 26.7)
Idaho	23.9 (4.7 – 43.2)	South Dakota	14.8 (–7.1 – 36.7)
Illinois	17.9 (10.6 – 25.1)	Tennessee	18.8 (11.2 – 26.3)
Indiana	20.4 (14.3 – 26.5)	Texas	12.5 (8.8 – 16.1)
Iowa	9.5 (–1.7 – 20.7)	Utah	10.9 (0.1 – 21.6)
Kansas	14.0 (4.3 – 23.8)	Vermont	4.4 (–16.6 – 25.4)
Kentucky	11.6 (0.6 – 22.7)	Virginia	7.4 (2.5 – 12.3)
Louisiana	38.2 (28.4 – 48.0)	Washington	3.7 (–2.3 – 9.6)
Maine	6.9 (–13.5 – 27.3)	West Virginia	4.6 (–17.4 – 26.6)
Maryland	–7.8 (–13.3 – –2.4)	Wisconsin	–4.8 (–12.9 – 3.2)
Massachusetts	2.4 (–1.6 – 6.5)	Wyoming	84.4 (–22.5 – 191.3)
Michigan	29.9 (20.4 – 39.3)		
Minnesota	1.5 (–6.2 – 9.2)		
Mississippi	–10.0 (–21.4 – 1.5)		
Missouri	6.5 (–3.9 – 16.9)		
Montana	0.4 (–24.2 – 25.0)		
Nebraska	–2.6 (–16.8 – 11.7)		
Nevada	–1.3 (–12.7 – 10.0)		
New Hampshire	5.3 (–12.9 – 23.4)		

[www.birthingbythenumbers.org](http://www.birthingbythenumbers.org)

Source: Rossen LM, et al. *The impact of the pregnancy checkbox, 1999–2017*. NCHS. Vital Health Stat 3(44). 2020.

# Observed and predicted maternal mortality ratios: United States, 1999–2017



Source: Rossen LM, et al. *The impact of the pregnancy checkbox, 1999–2017*. NCHS. Vital Health Stat 3(44). 2020.

# Ratio of pregnancy associated deaths assigned using the checkbox item to maternal deaths assigned without using the checkbox item for maternal deaths: Selected states, 2015–2016

	Number of deaths		
State	Assigned by checkbox	Assigned w/out checkbox	Ratio
47 States & D.C.*	1,527	498	3.07
Florida	78	37	2.11
Georgia	134	28	4.79
Illinois	40	21	1.90
New York	72	41	1.76
Ohio	53	24	2.21
Texas	264	58	4.55

\* Excludes Alabama, California, & W. Virginia  
Source: Hoyert Dlet al. Evaluation of the pregnancy status checkbox on identification of maternal deaths. Nat’l Vital Stat Rep; V 69 # 1. Hyattsville, MD: NCHS. 2020.

# Two key problems raised by the checkbox

1. Over ascertainment

- 2 Loss of precision in identifying causes of maternal death – the rise of “other” causes.

# The problem with “other”

*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



## 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)**

**Maternal Death  
ICD-10 Codes**

# Over Ascertainment??

- Research into the cause of death category finds much of the increase is coming from *less specific ICD-10 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)

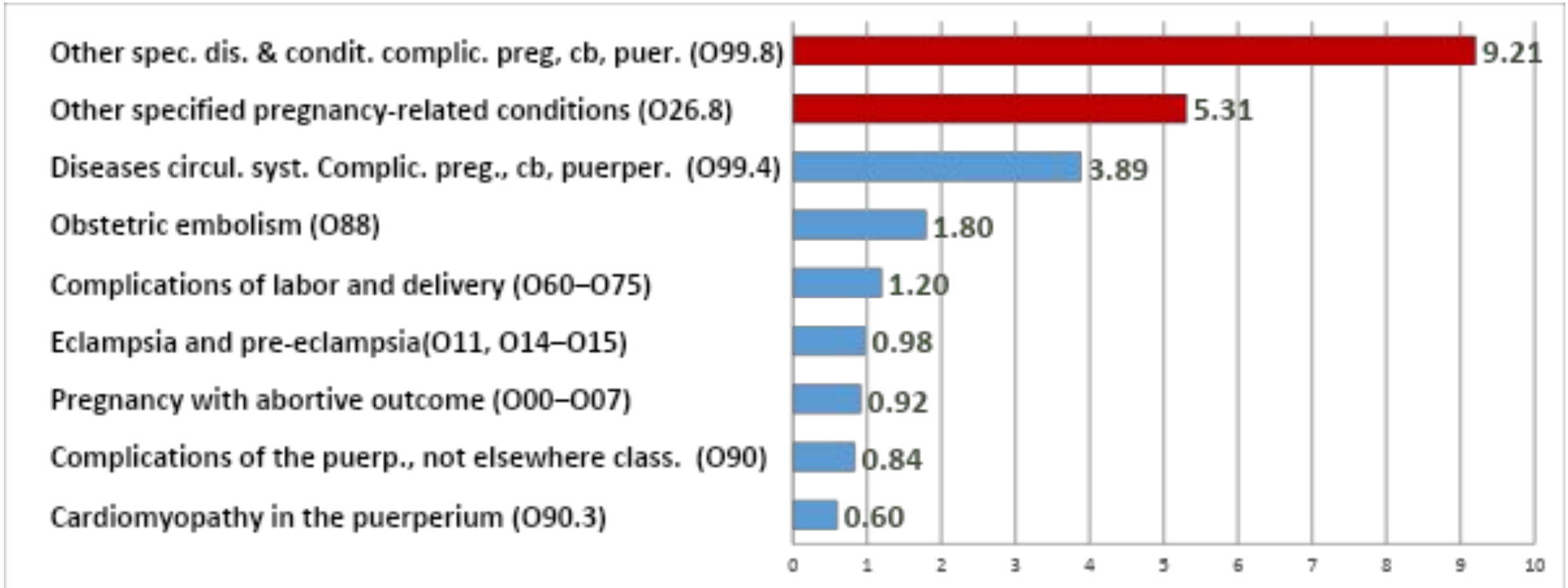


# Impact of ill-defined causes on maternal deaths by cause of death, 27 states & DC, 2008-2009 to 2013-2014

	2008-9	2013-14	% Change
Underlying Cause of Death	Rate	Rate	2008/2009-2013/2014
<b>Total Maternal</b>	20.6	25.4	<b>23.3</b>
Ill-defined "other" causes	7.0	10.4	<b>47.9</b>
<b><i>Total maternal minus ill defined</i></b>	13.5	15.0	<b>10.6</b>
<b>Total Direct Obstetric</b>	13.9	16.6	<b>19.7</b>
Other spec. pregnancy related cond.	3.4	5.9	<b>73.0</b>
<b><i>Total direct obstetric minus ill defined</i></b>	10.5	10.7	<b>2.3</b>
<b>Total indirect causes</b>	5.3	8.2	<b>54.4</b>
Other specified dis. & conditions	2.2	3.9	<b>75.9</b>
<b><i>Total indirect minus ill defined</i></b>	3.1	4.3	<b>38.7</b>

Source:  
MacDormanM.  
OBGYN.2017;129:811

# Ratios of deaths classified using pregnancy status checkbox to those classified without using the checkbox by Cause of Death, 47 states & D.C., 2015–2016



Source: Hoyert DL, et al. *Evaluation of the pregnancy status checkbox on the identification of maternal deaths.*

NVSR; vol 69 no 1. Hyattsville, MD: NCHS. 2020.

# Number of births and deaths with positive pregnancy responses in the checkbox: United States, 2013

Age	Births	Deaths
40-44	134,540	145
45-49	10,329	89
50-54	780	148
55-59	74	33
60-64	7	51
65-69		45
70-74		51
75-79		46
80-84		42
85+		147

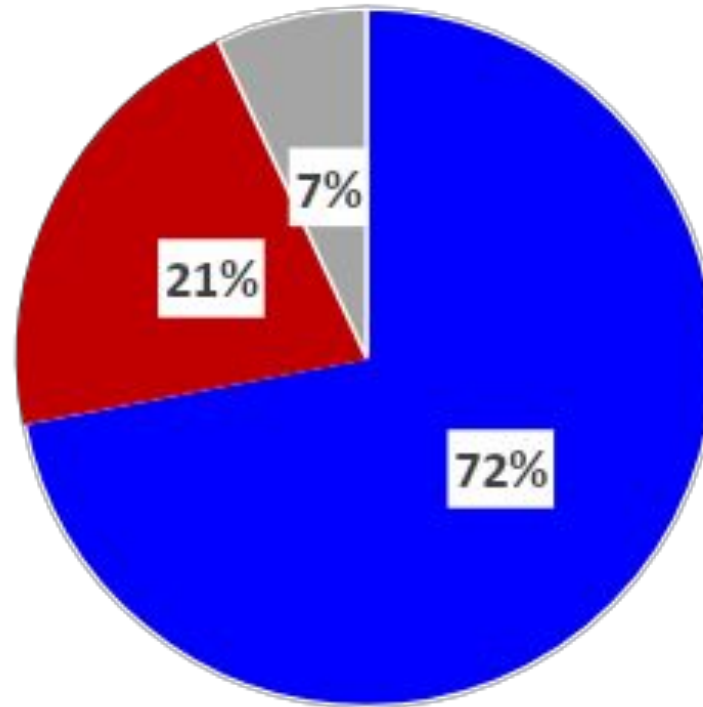
331 cases of positive pregnancy checkbox in deaths of women 65+

NOTE: Alabama, Alaska, Colorado, Hawaii, Massachusetts, North Carolina, Virginia, and West Virginia did not have the standard checkbox in 2013.

# Over-ascertainment: Results of a 4 state study (Georgia, Louisiana, Michigan, and Ohio)

## Pregnancy Checkbox Accuracy

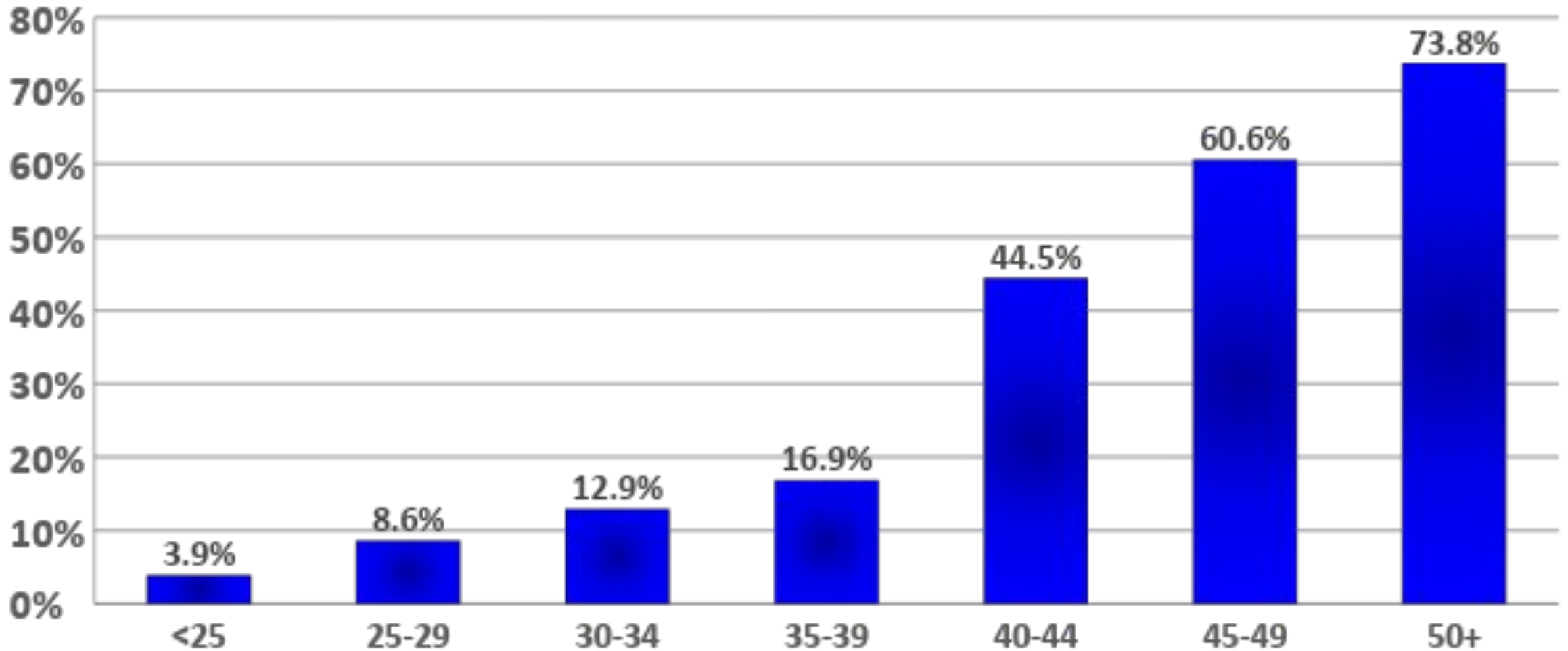
**In 28% of cases with pregnancy checkbox checked, reviewers were not certain the woman was pregnant**



■ **Pregnant** ■ **Not Pregnant** ■ **Unable to confirm**

Source: A. Daymude. Checking the pregnancy checkbox: Evaluation of a four-state quality assurance pilot. *Birth* 2019 online & Catalano A. Validity of the Pregnancy Checkbox. AJOG.2019.online.

# False Positives on the Pregnancy Checkbox by Age



Source: Adapted from Catalano A. Validity of the Pregnancy Checkbox. *AJOG*.2019.online.

# It's Never Simple: Impact of the Checkbox – Worse and Better Ascertainment

- While the checkbox contributed to errors, a Four MMRC Committee study showed that the **checkbox also improved identification of pregnancy-related deaths**. **Without the pregnancy checkbox, states would have missed approximately:**
  - **50% of pregnancy-related deaths that occurred during pregnancy**
  - **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**

# How can there be so much misclassification?

## *Who completes death certificates?*

- *Death certificates can be signed by a medical examiner, a primary physician, an attending physician, a non-attending physician, a nurse practitioner, a forensic pathologist or a coroner, but it varies according to state law. In Texas, for example, a justice of the peace can sign. Typically, deaths have to be recorded with local health departments within 72 hours of the death, and to the state within five to seven days.*
- *Only about 8% of death certifications involve an autopsy*



# How can there be so much misclassification?

## Definitions of terminology involved in certifying death.

<b>Pronouncement of Death</b>	Date and time an individual was found to be legally dead. May be pronounced by a physician, medical examiner, or coroner.
<b>Date and Time of Death</b>	Date and time an individual is thought to have really died: may be actual or estimated by a physician, medical examiner, or coroner.
<b>Cause of Death</b>	Causal chain of events (disease or injury) that directly led to the death.
<b>Immediate Cause of Death</b>	Final event in the causal sequence that occurred closest to the time of death. Filled in as top line diagnosis on death certificate.
<b>Underlying Cause of Death</b>	Initiating event in the causal sequence that occurred most remote from the time of death. Filled in as bottom line diagnosis on death certificate.
<b>Manner of Death</b>	Classification of death based on circumstances surrounding it, i.e. suicide, homicide, accident, natural, or undetermined.
<b>Medical Certifier of Death</b>	Individual completing the medical portion of the death certificate including time, cause, and manner of death.



**Errors and grades of errors on 601 randomly selected death certificates completed by non–Medical Examiners (*physicians, advance practice registered nurses, and physician assistants*), Vermont, 7/1/15-1/31/16.**

Error	#	% (95% C.I.)
Any error	319	53 (49-57)
Major error	305	51 (47-55)
Minor Error	59	10 (7-12)
Major comorbidities error	232	39 (35-42)
UCoD not on last line	174	29 (25-33)
Correct UCoD not in Part I	158	26 (23-30)
Wrong UCoD on certificate	107	18 (15-21)

\* UCoD-Underlying Cause of Death

# Factors that can introduce error in death certificates

## Restrictive Form

- “They want it to be a cascade of events, which isn’t necessarily the way these health issues happen. Often, they are happening all at the same time.”

## Lack of Training or Feedback

- “I don’t recall having any training in medical school or in my residency. The first time I completed death certificates was in practice.”
- “I don’t think I’ve ever had it returned to me. Or no one has ever queried me on it.”

## Financial or personal impact on next of kin

- “Certain causes of death like end stage liver disease with a main cause of alcohol abuse can be contentious...I have had families come back and want to have it changed.”

## Challenges to clinical certainty

- Unexpected deaths & deaths following a prolonged period without medical care.

# Strategies Resulting from these Limits

## Use the most general cause of death

- “I always use respiratory failure if I don’t know” & “If I don’t know the cause of death I would...fill out the most general term.”

## Use admission diagnosis

- “I’ll default to their admissions diagnosis. If somebody comes in for sepsis, then other badness happens...I will put acute hypoxic respiratory failure secondary to sepsis.”

## Most likely cause based on expectations or epidemiology

- “The most common cause of death for a patient with dementia would be aspiration pneumonia. If the story fits, that’s what we sign it out as.”

## Obtain more information

- “I would fill in the history. You could do a chart review and talk to the family.”

# Transitioning Local reporting into National Rates

- The National Vital Statistics System must take the locally generated death certificates and translate them into national maternal mortality rates. Study examined the literal causes of death written on the certificate to ascertain if the coding of them is accurate.
- “US coding practices specify that if the pregnancy checkbox indicates the death occurred during or within 1 year of pregnancy, and the death is due to natural causes (i.e. excluding accidents, homicide and suicide) then the cause of death is automatically coded as a maternal or late maternal death, regardless of whether the condition was related to or exacerbated by the pregnancy.”

CAUSE OF DEATH (See instructions and examples)		Approximate interval: Onset to death
32. <b>PART I.</b> Enter the chain of events--diseases, injuries, or complications--that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.		
IMMEDIATE CAUSE (Final disease or condition resulting in death)  Sequentially list conditions, if any, leading to the cause listed on line a. Enter the <b>UNDERLYING CAUSE</b> (disease or injury that initiated the events resulting in death) <b>LAST</b>	a. <u>twin pregnancy</u> Due to (or as a consequence of):	_____
	b. <u>placenta previa</u> Due to (or as a consequence of):	_____
	c. _____ Due to (or as a consequence of):	_____
	d. _____ Due to (or as a consequence of):	_____
<b>PART II. ENTER OTHER SIGNIFICANT CONDITIONS CONTRIBUTING TO DEATH BUT NOT RESULTING IN THE UNDERLYING CAUSE GIVEN IN PART I</b>		

*In this example, the underlying cause of death based on NCHS rules was twin pregnancy, but researchers recoded to placenta previa.*

# Solving the problem with “other” causes of death by studying the “literals” on death certificates

*Among the 1691 records originally coded as maternal deaths, 735 (43.5%) were originally coded to ill-defined or non-specific causes (O26.8, O95, O99.8). We were able to recode 694 (94.4%) of these cases to more specific causes of death as more specific information was available from the cause-of-death literals. Thus, only 41 records (5.6%) retained a non-specific cause code (O26.8, O95, O99.8, or R99) in our recoding.*

# Summary

- *The introduction of the pregnancy checkbox served its stated purpose – it identified cases that would have been otherwise missed.*
- *Unfortunately, it also led to a significant overcounting of women's death as maternal deaths.*
- *Misclassification in maternal deaths is only part of a larger problem in death reporting.*
- *Even if you take a more conservative approach to determining the maternal mortality ratio, the U.S. data suggests we are not doing well.*

## ***4. The Pregnancy Related Mortality Surveillance System***



# Pregnancy Mortality Surveillance System



Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives, Protecting People™



CDC A-Z INDEX ▾

## Reproductive Health

### Reproductive Health

About Us



Data and Statistics



Emergency Preparedness



Maternal and Child Health  
Epidemiology Program



Pregnancy Risk Assessment  
Monitoring System

Infertility



Assisted Reproductive  
Technology (ART)

Depression Among Women



Maternal and Infant Health



Pregnancy Complications



Weight Gain During  
Pregnancy

Tobacco Use and Pregnancy



Pregnancy-Related Deaths



### Pregnancy Mortality Surveillance System

Perinatal Quality  
Collaboratives



Preterm Birth



[CDC](#) > [Reproductive Health](#) > [Maternal and Infant Health](#) > [Pregnancy-Related Deaths](#)

## 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 DC) 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 Reports*, 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.

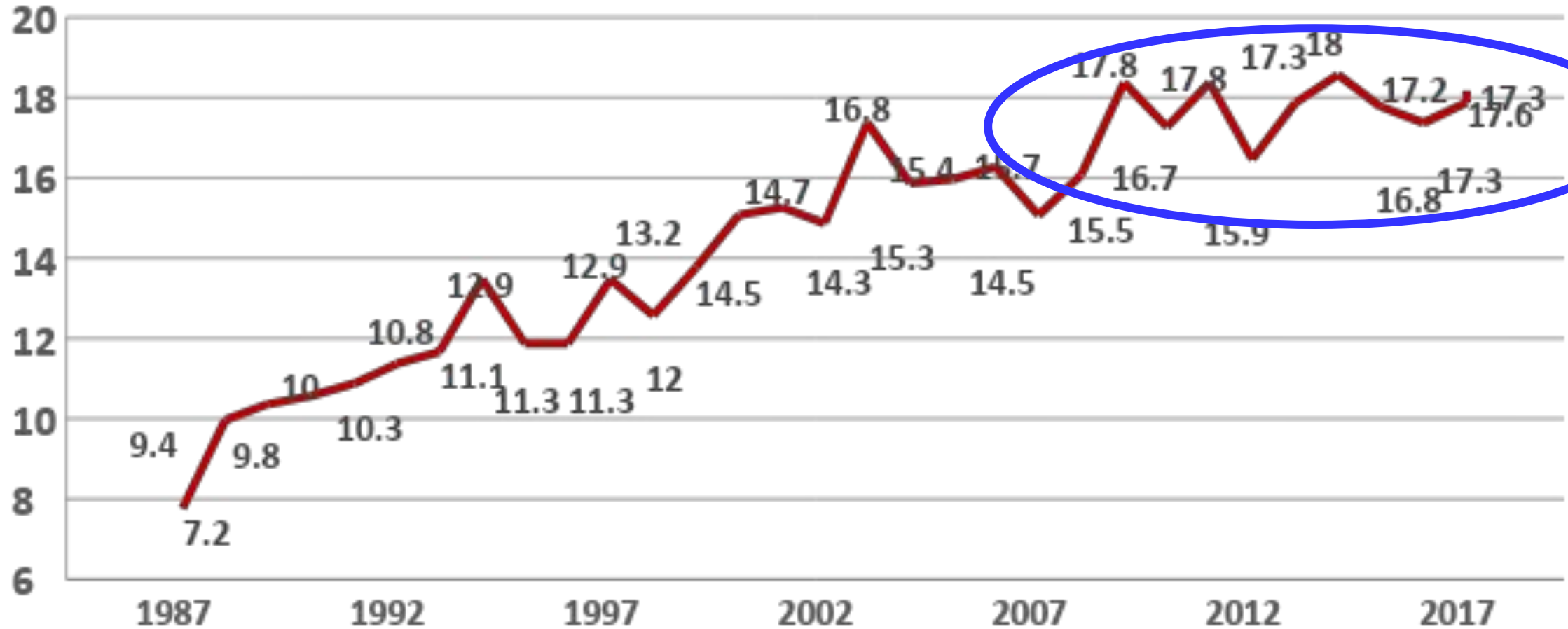


# Data for CDCs Pregnancy Related Mortality System

*Each year, CDC requests the 52 reporting areas (50 states, New York City, and Washington DC) 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.*

# Our best existing measure

## *Pregnancy Related Mortality, U.S., 1987-2019*

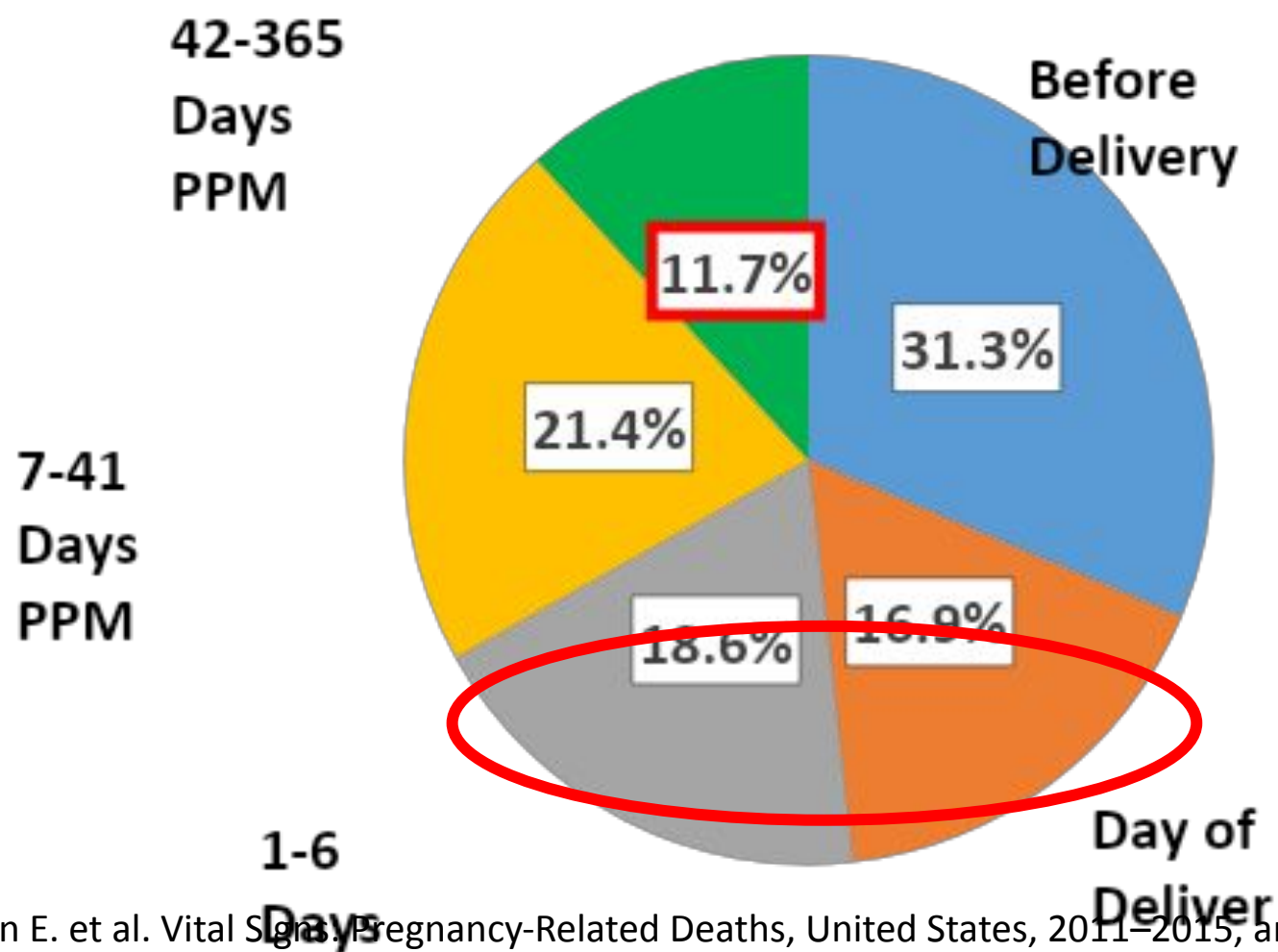


Pregnancy Related Mortality Ratio (per 100,000 births)

Source: CDC. <https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm>

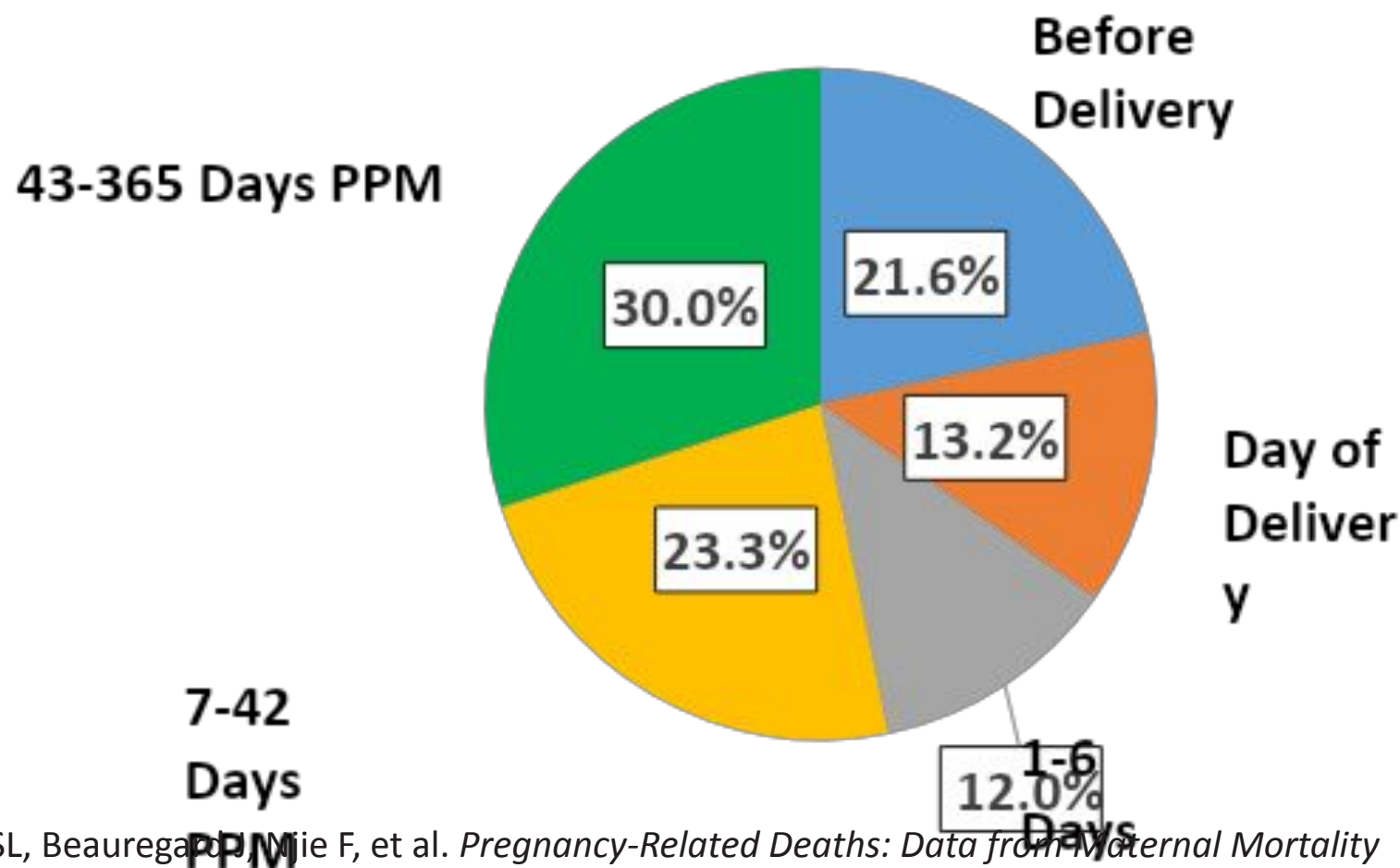
[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

# Timing of Maternal Deaths (2011-2015)



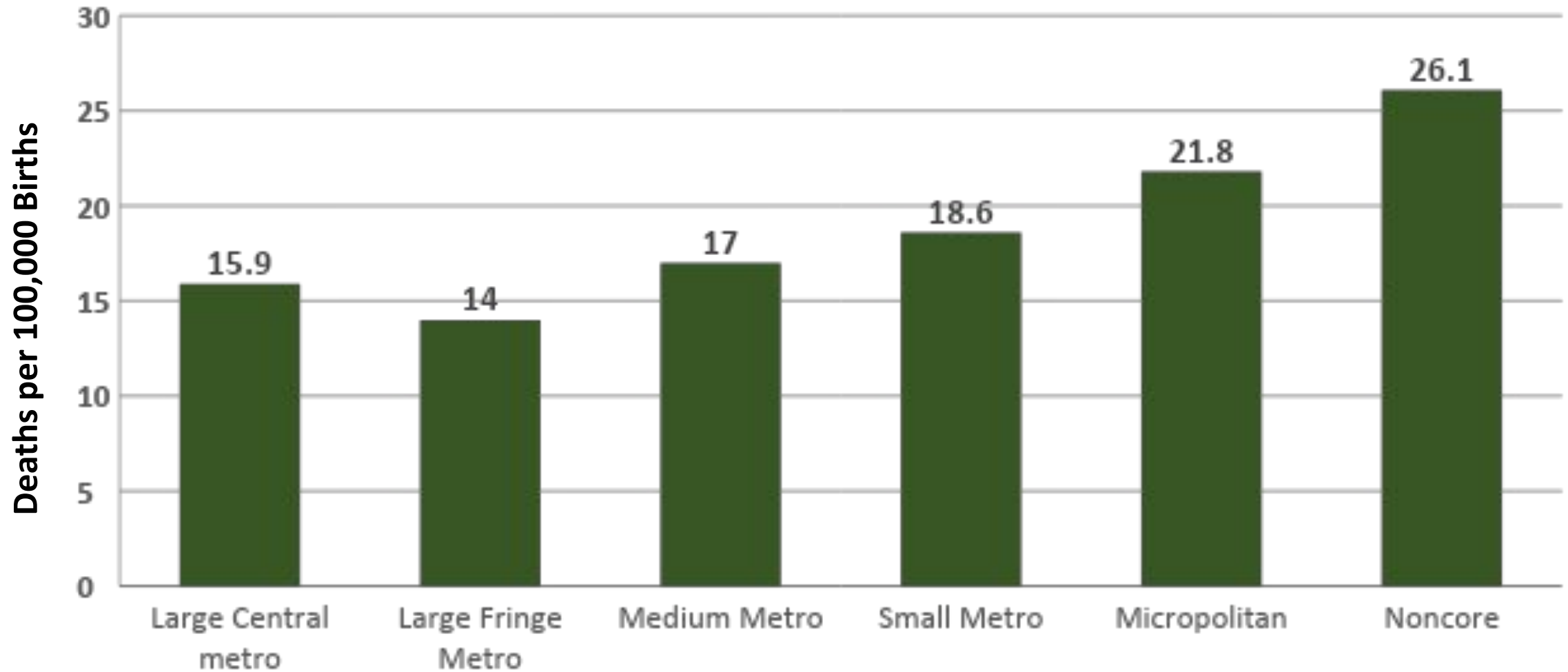
Source: Petersen E. et al. Vital Signs: Pregnancy-Related Deaths, United States, 2011–2015, and Strategies for Prevention, 13 States, 2013–2017. *MMWR* .vol.68. May 7, 2019. 1-7.

# Timing of Maternal Deaths (2017-19)



Source: Trost SL, Beauregard J, Mire F, et al. *Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019*. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2022.

# Pregnancy-related mortality ratio by urban-rural classifications: 2017-2019

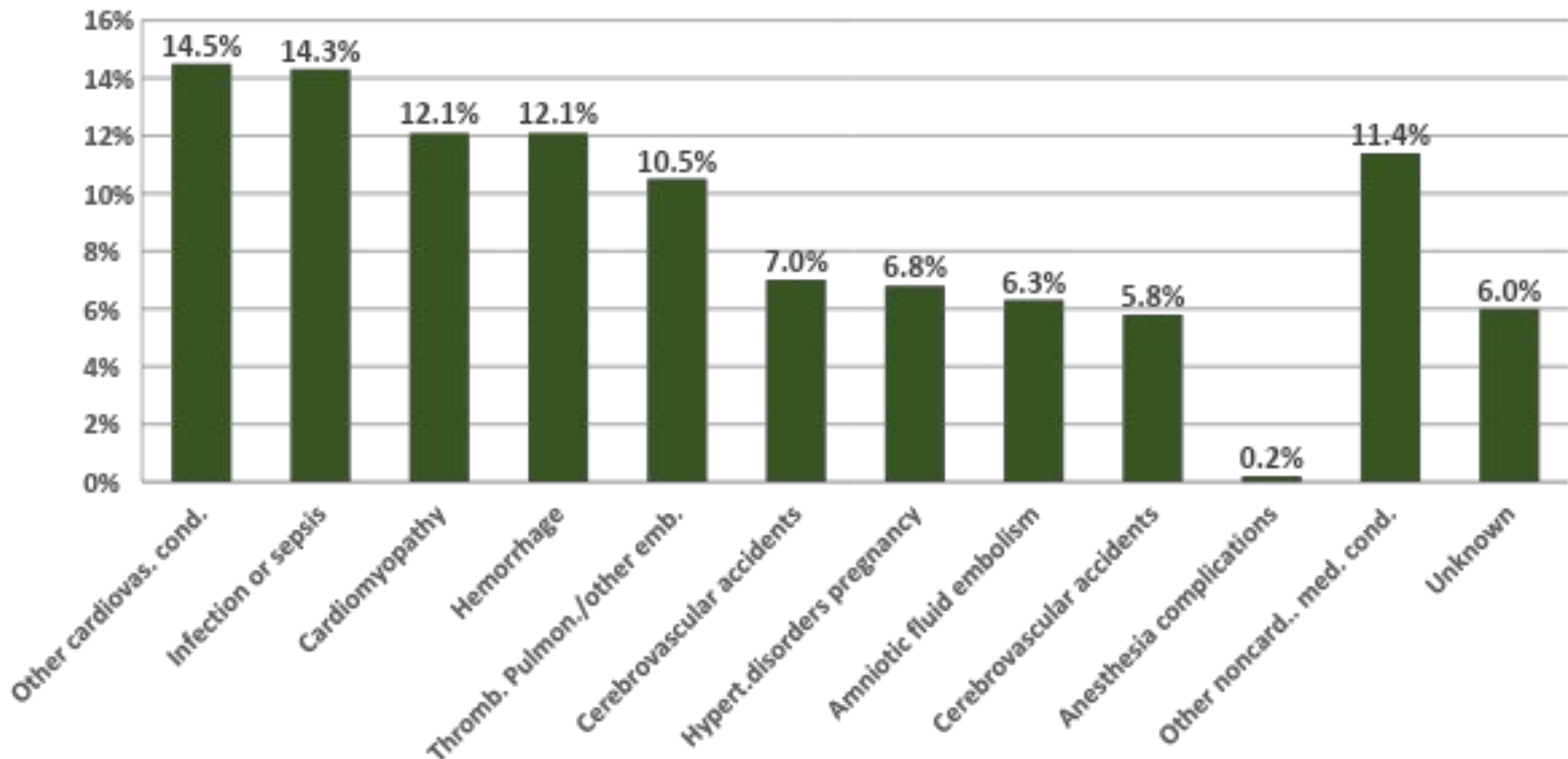


Source: CDC Website.

[https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm#:~:text=The%20Pregnancy%20Mortality%20Surveillance%20System%20\(PMSS\)%20defines%20a%20pregnancy%2D,or%20aggravated%20by%20the%20pregnancy%20](https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm#:~:text=The%20Pregnancy%20Mortality%20Surveillance%20System%20(PMSS)%20defines%20a%20pregnancy%2D,or%20aggravated%20by%20the%20pregnancy%20)



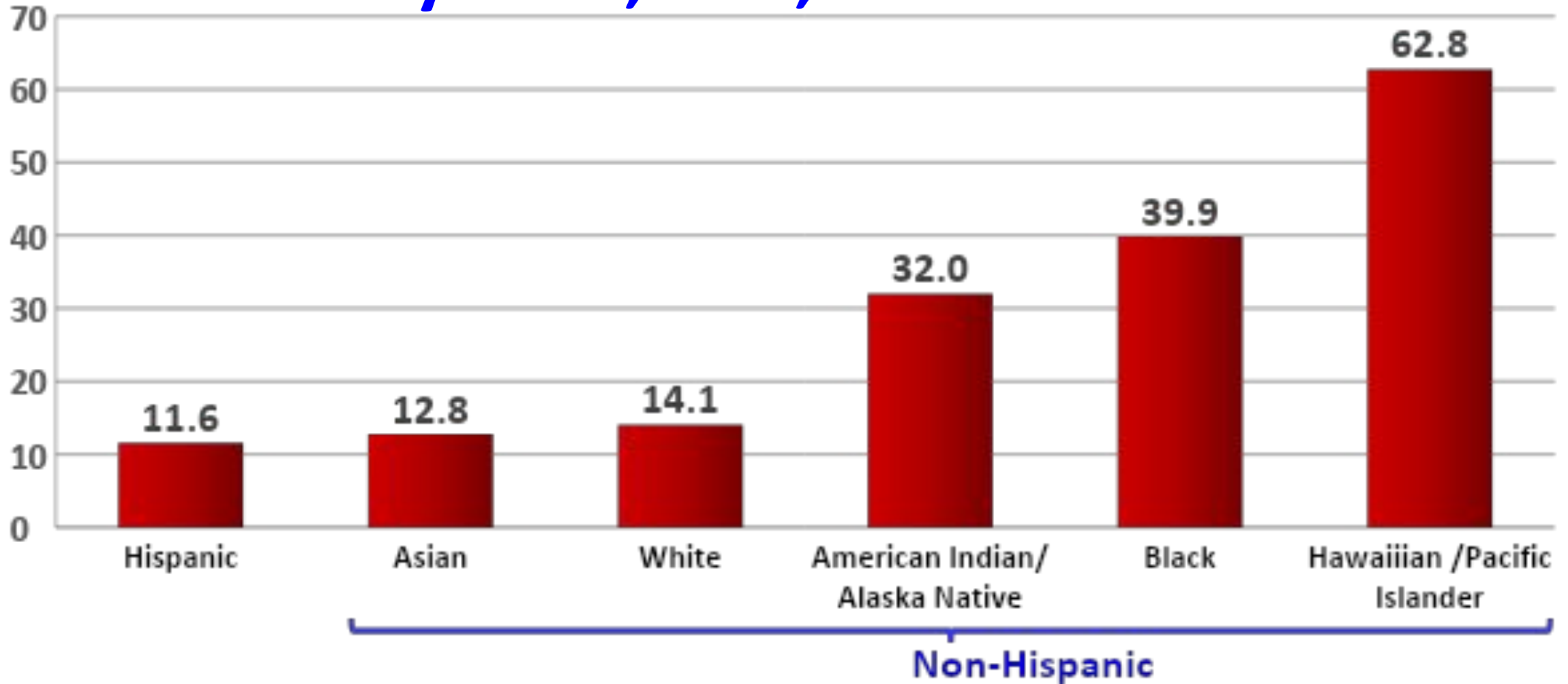
# Causes of pregnancy-related death in the U. S.: 2017-19



Source: CDC Website.

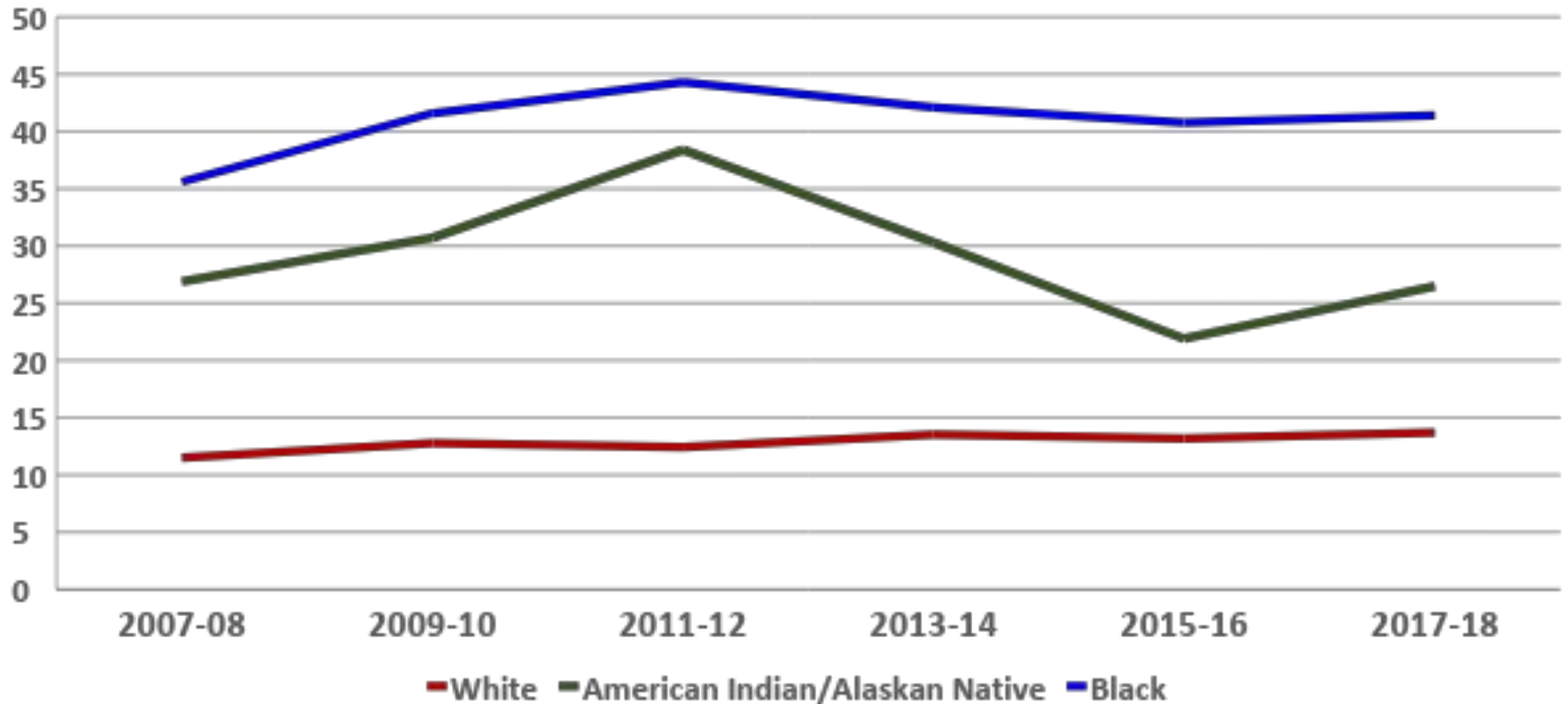
[https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm#:~:text=The%20Pregna ncy%20Mortality%20Surveillance%20System%20\(PMSS\)%20defines%20a%20pregnancy%2D,or%20aggravated%20by%20the%20pre](https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm#:~:text=The%20Pregna ncy%20Mortality%20Surveillance%20System%20(PMSS)%20defines%20a%20pregnancy%2D,or%20aggravated%20by%20the%20pre)

# Pregnancy Related Mortality Ratios by Race, U.S., 2017-2019



Source: CDC. <https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm>

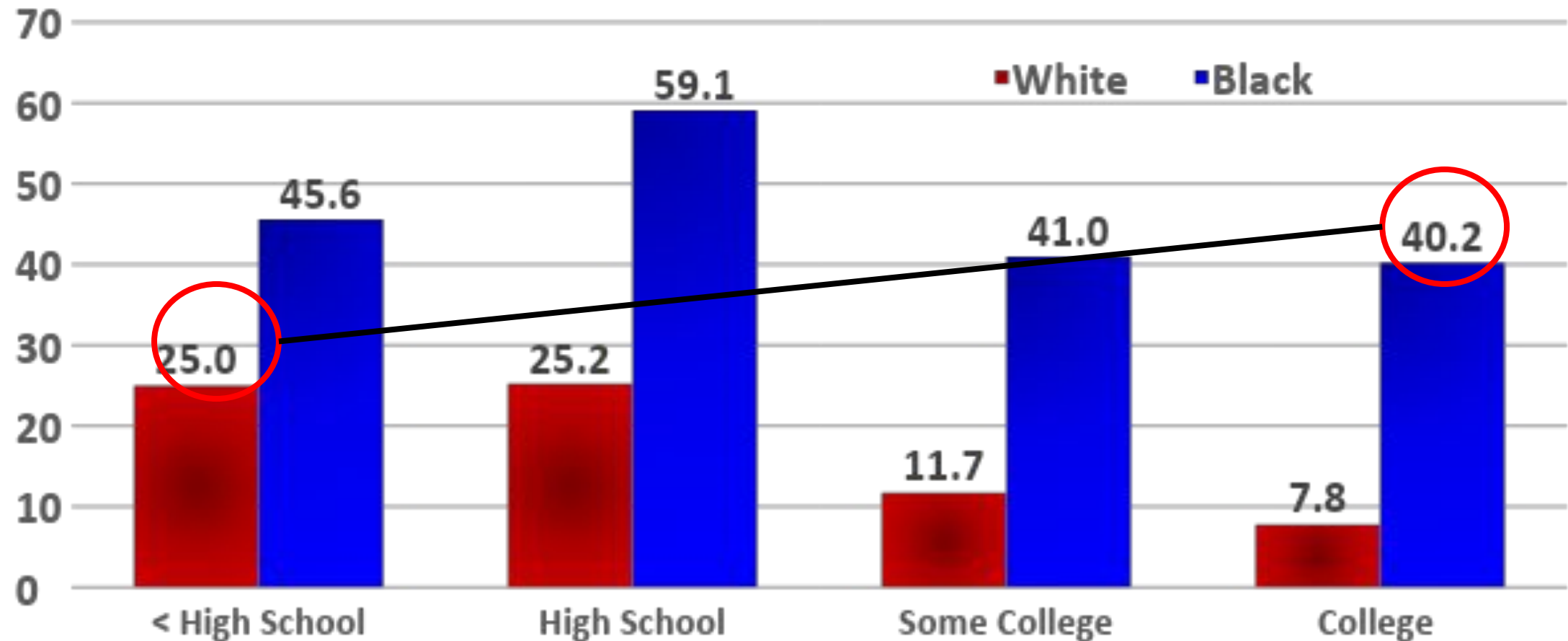
# Pregnancy Related Mortality Ratios (per 100,000 births) by Race/Ethnicity, U.S. 2007-2018.



Source: Petersen E. et al. Racial/Ethnic Disparities in Pregnancy-Related Deaths — U.S., 2007–2016 . *MMWR*. 9/6/19; 68(35):762-765. & CDC Website (2016-18).

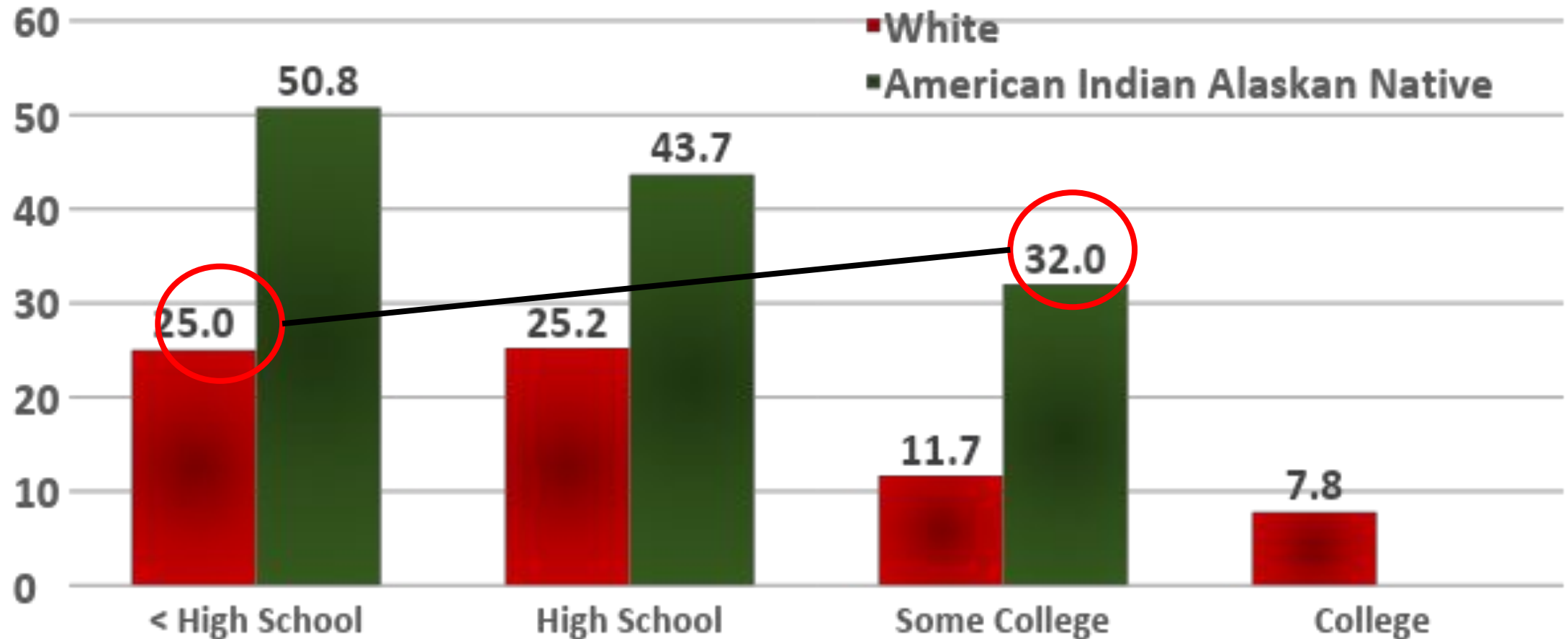
[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

# Pregnancy-related mortality ratios (per 100,000 live births) by race/ethnicity, U.S. 2007-2016



Source: Petersen E et al. Racial/Ethnic Disparities in Pregnancy-Related Deaths — United States, 2007–2016. *MMWR* 2/7/19; 68 (35): 762-765.

# Pregnancy-related mortality ratios (per 100,000 live births) by race/ethnicity, U.S. 2007-2016



Source: Petersen E et al. Racial/Ethnic Disparities in Pregnancy-Related Deaths — United States, 2007–2016. *MMWR* 2/7/19; 68 (35): 762-765.

# **Moving from the CDC Pregnancy Related Mortality Surveillance to the National Vital Statistic System Data**





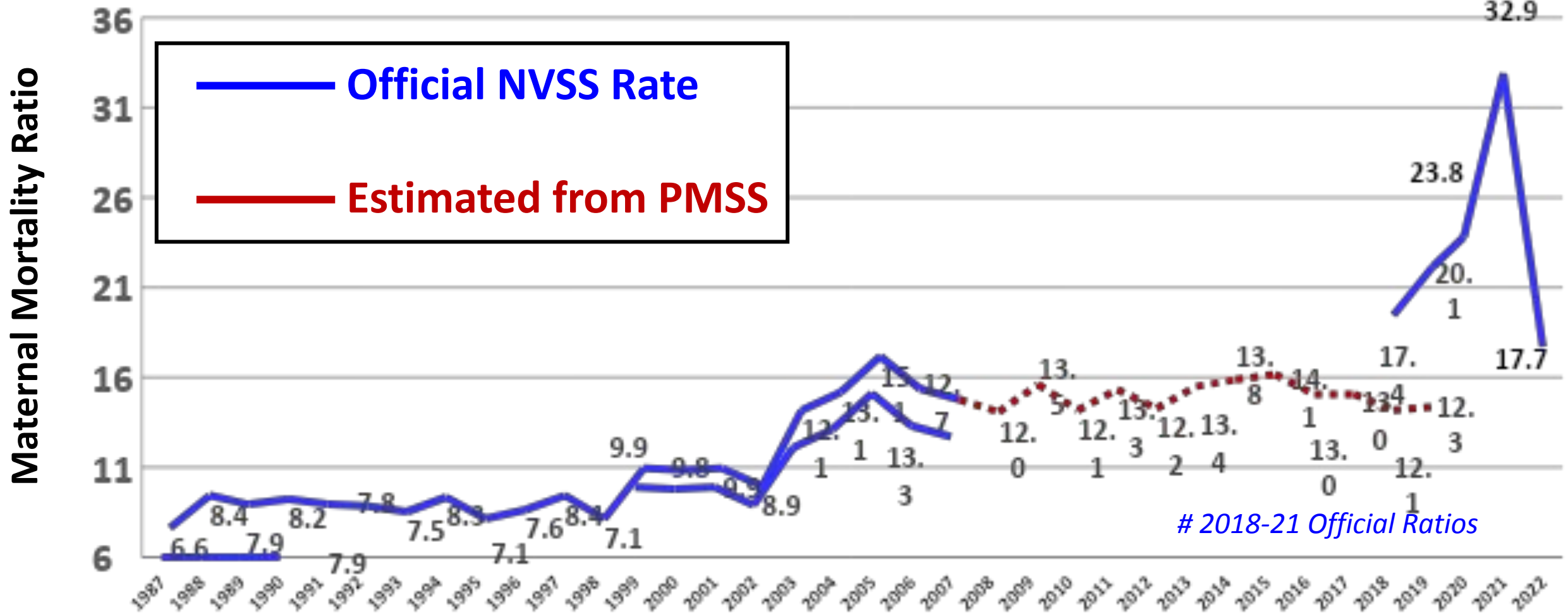
## Maternal Mortality Rates in the United States, 2021

by Donna L. Hoyert, Ph.D., Division of Vital Statistics

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This report presents maternal mortality rates for 2021 based on data from the National Vital Statistics System. A maternal death is defined by the World Health Organization as “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (1).” Maternal mortality rates, which are the number of maternal deaths per 100,000 live births, are shown in this report by age group and race and Hispanic origin.

# Maternal Mortality Ratios (per 100,000 live births), U.S. 1987-2022 (2022 is provisional)\*

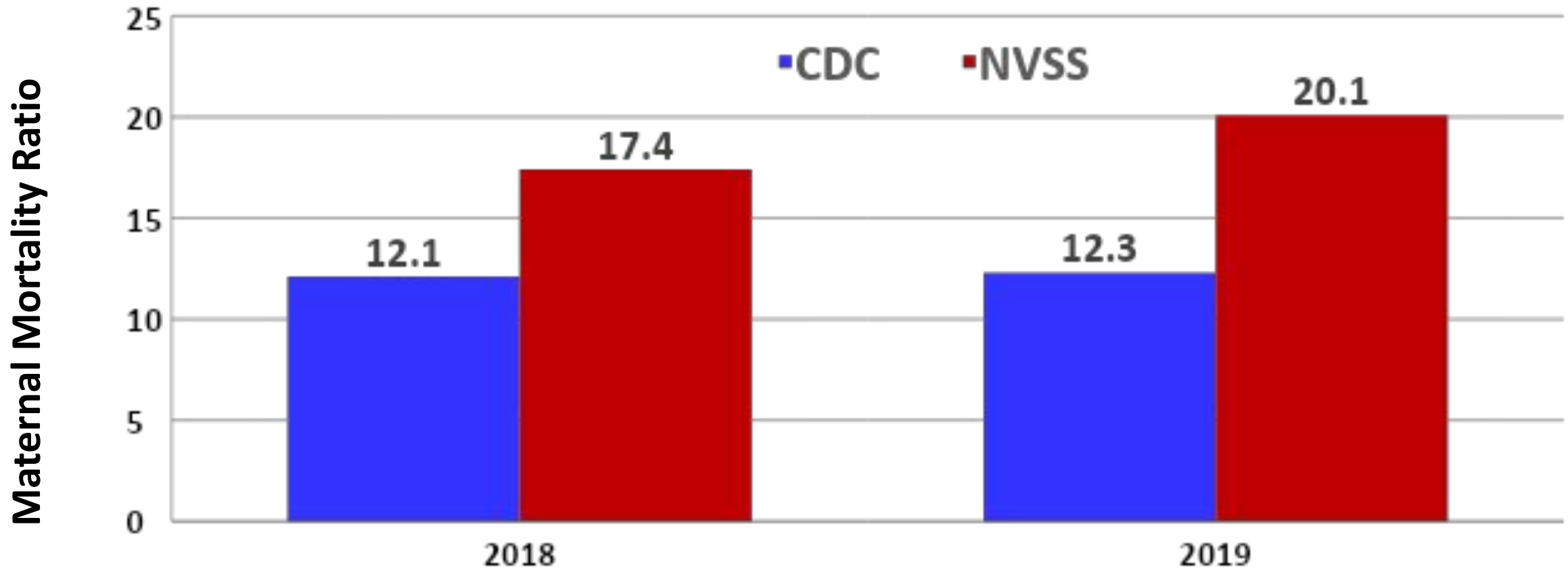


\* 1987-2007 & 2018-21 based on official NVSS reported ratio; 2008-2016 estimated based on Pregnancy-Related Mortality Ratio limited to 42 days postpartum.

Source: Adapted from: Callaghan W. <https://www.cdc.gov/grand-rounds/pp/2017/20171114-presentation-maternal-mortality-H.pdf>

[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

# Comparing CDC & NVSS Estimates of U.S. Maternal Mortality, 2018 & 2019



**NVSS** – National Vital Statistics System; **CDC** – Pregnancy Mortality Surveillance System

Sources: NVSS Hoyert. Maternal mortality rates in the United States, 2021. NCHS Health E-Stats. 2023; CDC: adapted from <https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm> .

# Summary

- The Pregnancy Related Maternal Mortality System provides a reasonable alternative to the National Vital Statistics Syst. & it documented a steady increase in maternal deaths, 1987 to 2005.
- It has also shown a plateauing of the ratio from 2008-2019, though the difference between the two ratios in 2018-2019 has increased.
- The question is whether that plateauing is at an acceptable level and for that we need to place the U.S. in a comparative context.
- The resumption of the official reporting shows a rapid increase from 2018-2021, partially the result of the COVID pandemic.

# **5. Comparing the U.S. to the Rest of the World**

# U.S. in a Comparative Context, 1910, 1927, 2020

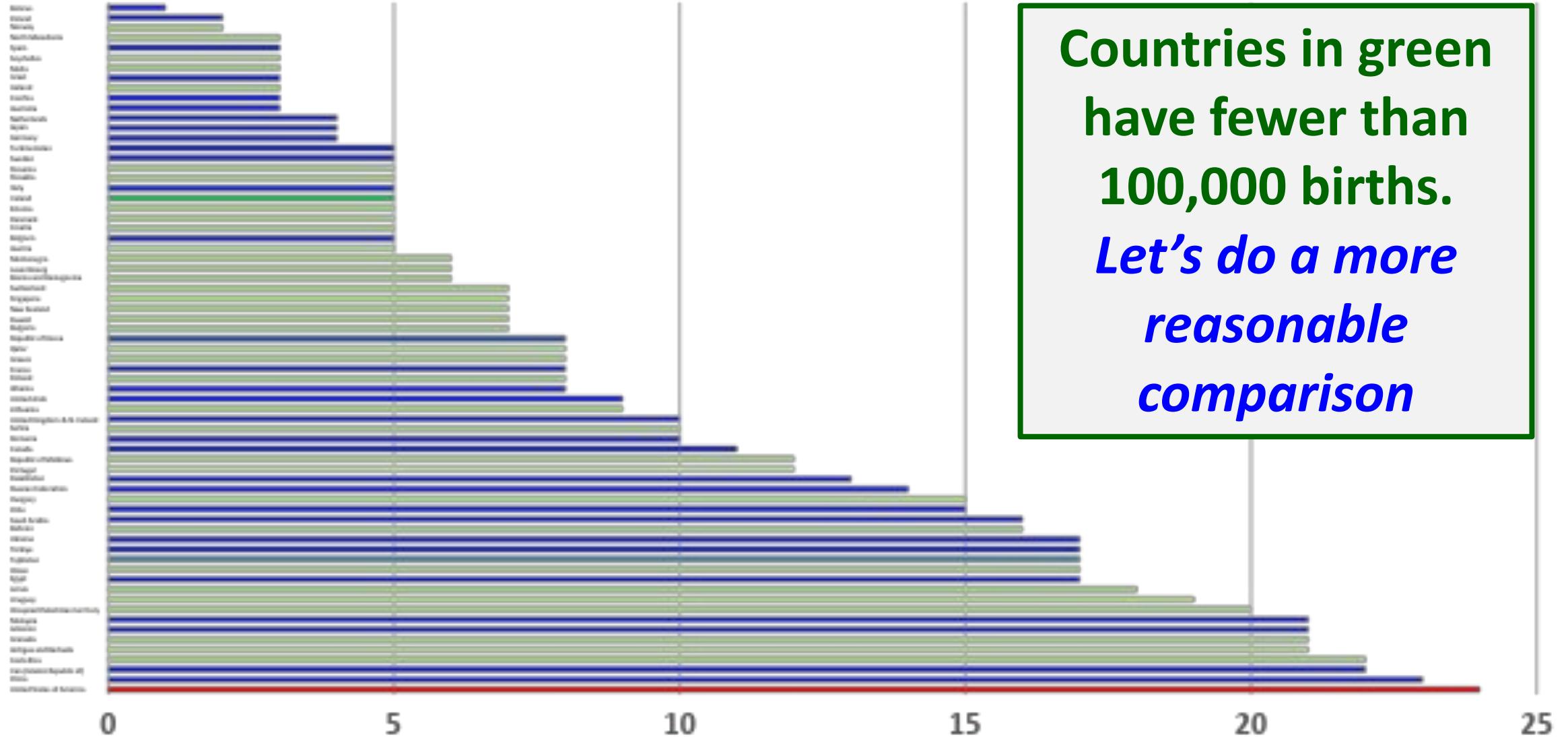
	1901-1910 <sup>1</sup>	1927 <sup>2</sup>	2020 <sup>3</sup>
	per 100K births	per 100K births	per 100K births
Norway	290	245	2
Australia	530	592	3
Italy	270	264	5
Sweden	230	278	5
Northern Ireland	550	480	5
New Zealand	460	491	7
France	520	287	8
England & Wales <sup>4</sup>	410	411	10
United States <sup>5</sup>	650	647	24

## Sources & Notes:

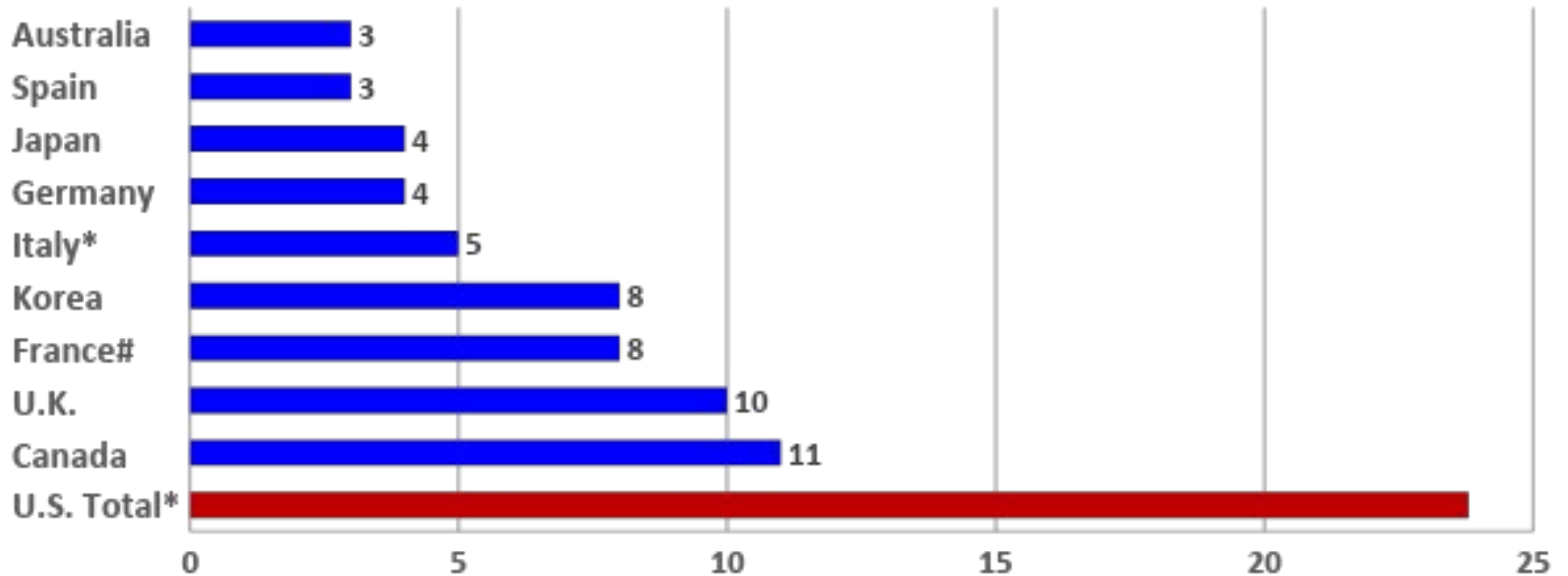
1. Meigs. *Maternal Mortality in U.S. & other countries*. 1917; 2. Tandy. *Comparability of Maternal Mortality Rates in the United States and Certain Foreign Countries*. 1933; 3. WHO. *Trends in Maternal Mortality, 2000-2020*; 4. UK rate in 2020; 5. Based on 10 reporting areas (CT,ME,MA,MI,NH,PN,RI,VT,NYC, DC) in 1910 & about 90% of all births in 1927.



# Maternal Mortality Ratios (per 100,000 births), 2020

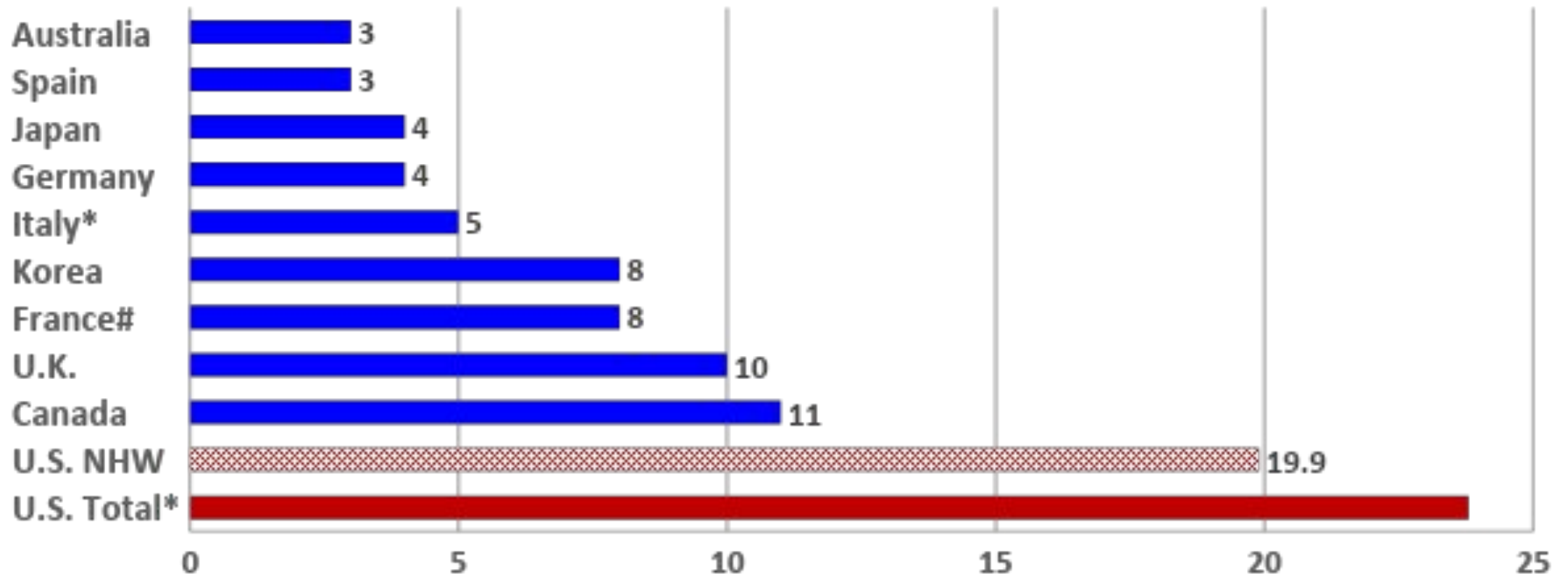


# U.S. Maternal Mortality Ratio (per 100,000 births ) Compared to Industrialized Countries with 300,000+ births, 2020



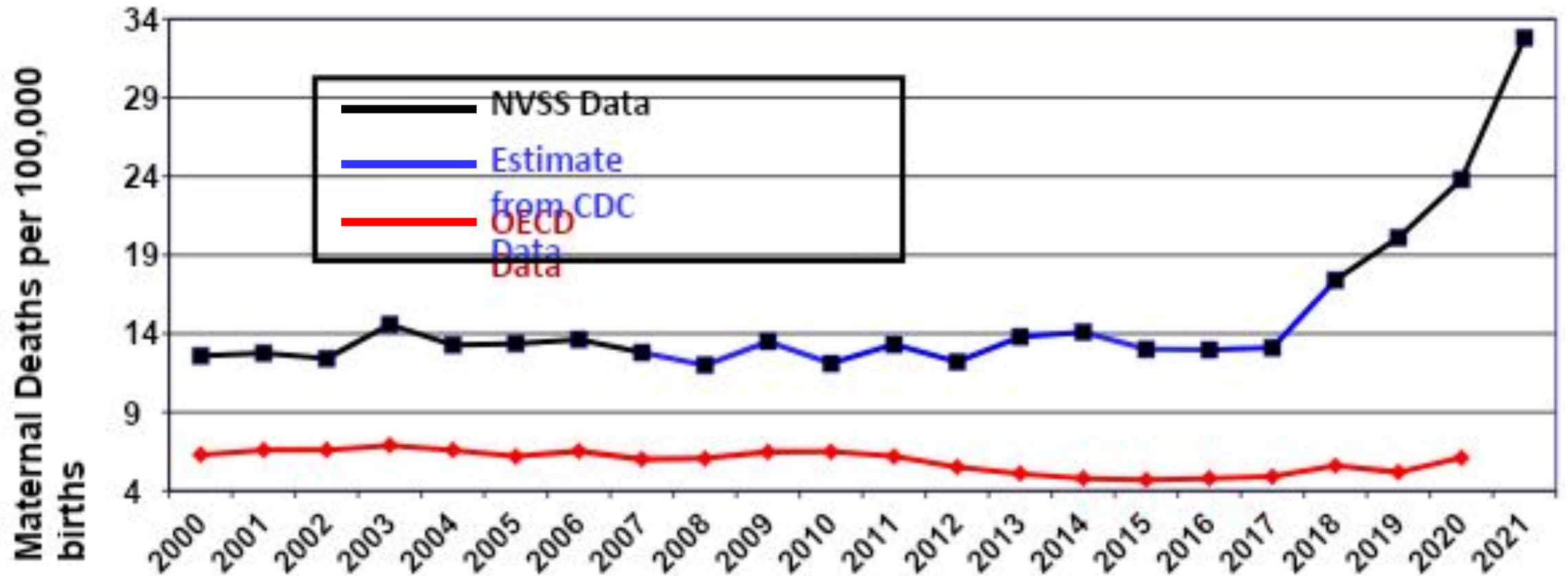
Source: OECD Health Data 2023 & U.S. Hoyert DL . NCHS Health E-Stats; 3/23.

# U.S. Maternal Mortality Ratio (per 100,000 births ) Compared to Industrialized Countries with 300,000+ births, 2020



Source: OECD Health Data 2022 & U.S. Hoyert DL . NCHS Health E-Stats; 3/23.

# *Maternal Mortality Ratio (per 100K births), 2000-2021, U.S. & Comparable Countries\**



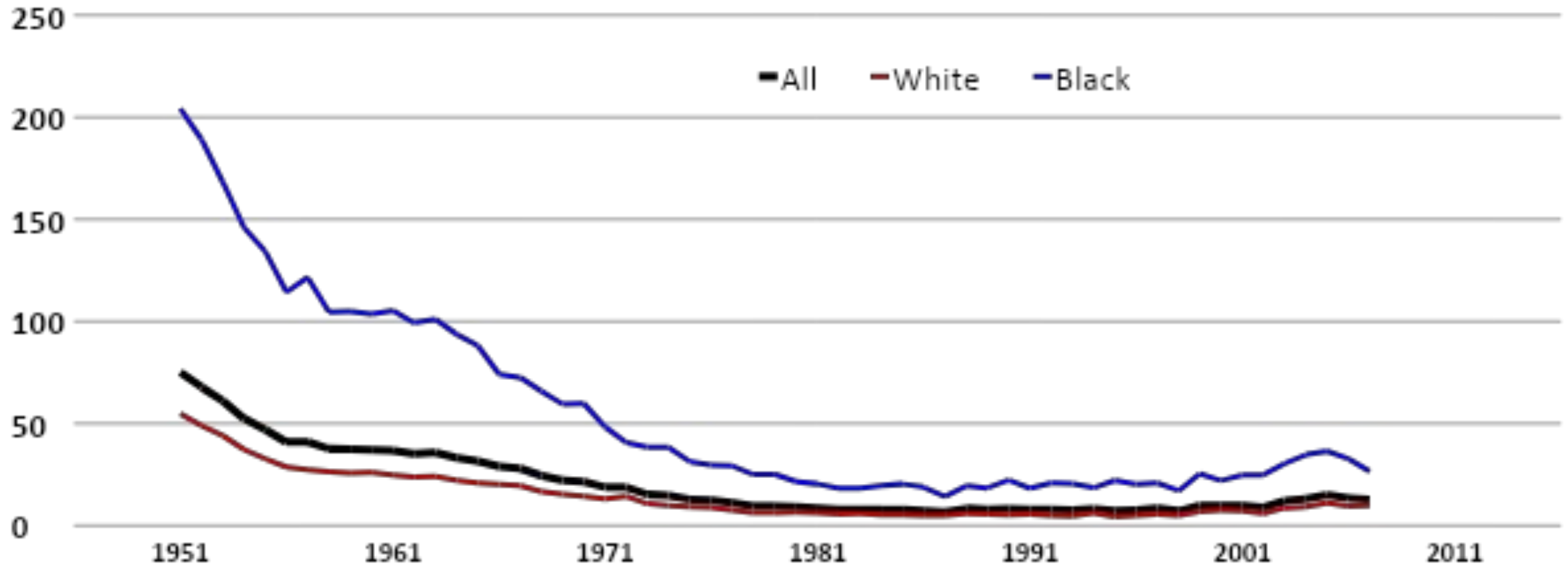
\* Countries with **300,000+** births (2017): Australia, Canada, France, Germany, Italy, Japan, S. Korea, Spain, United Kingdom

# Summary

- No matter how you structure a comparison, the U.S. fares poorly in cross-national comparisons.
- If you include all countries, the U.S. ranks in the 60s; if you limit it to large wealthy countries, the U.S. ranks 10<sup>th</sup>...out of 10 countries.
- In terms of comparative trends, the U.S. in 2000 had a maternal mortality rate double the average for the comparison countries and over the next 20 years fell further behind.

# **6. The Persistence of Racial Disparities**

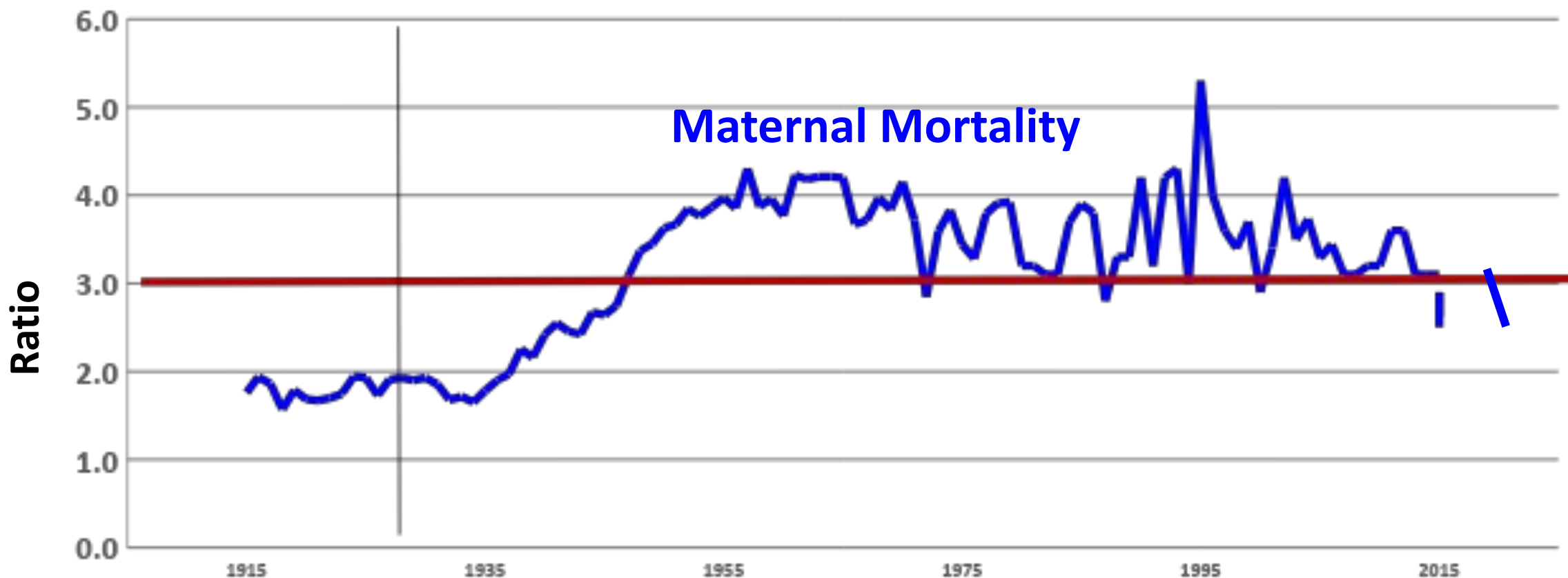
# U.S. Maternal Mortality (per 100,000 live births), 1951-2007 by Race



**Source:** NCHS. Maternal Mortality and Related Concepts. Vital & Health Statistics. Series 33; #3. & annual data reports. 1915-1960 data from NCHS. *Vital Statistics Rates In The United States 1940-1960*. NOTE: Shifts in measurement (e.g. not all states were part of registration system prior to 1933; infant race was based on race of the child until 1980 & then race of the mother post 1980) accounts for some of the variation over time. 2007-2016 based on 2 year estimates of the pregnancy related mortality rate: Petersen E. *MMWR*.9/6/19.

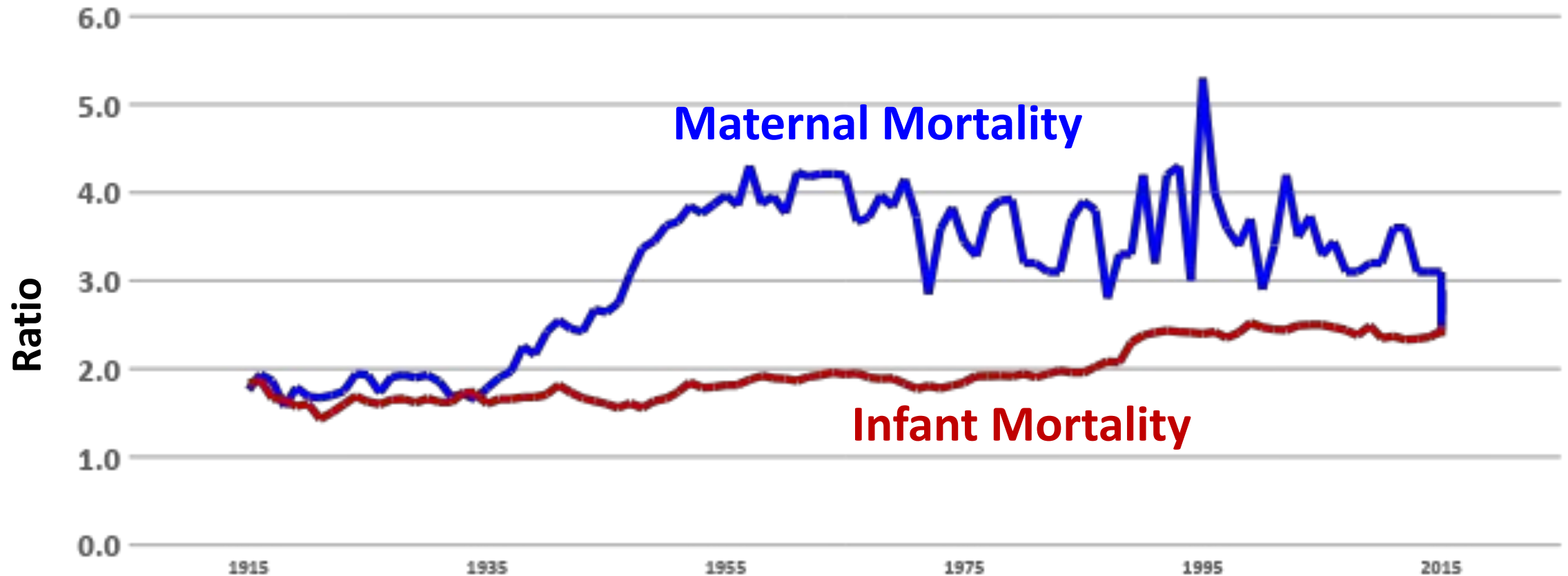


# ***Black to White Ratios, U.S. Maternal Mortality, 1915-2021***



**Source:** NCHS. Maternal Mortality and Related Concepts. Vital & Health Statistics. Series 33; #3. & annual data reports. 1915-1960 data from NCHS. *Vital Statistics Rates In The United States 1940-1960*. NOTE: Shifts in measurement (e.g. not all states were part of registration system prior to 1933; infant race was based on race of the child until 1980 & then race of the mother post 1980) accounts for some of the variation over time. 2007-2016 based on 2 year estimates of the pregnancy related mortality rate: Petersen E. *MMWR*.9/6/19.

# ***Black to White Ratios, U.S. Infant & Maternal Mortality, 1915-2021***

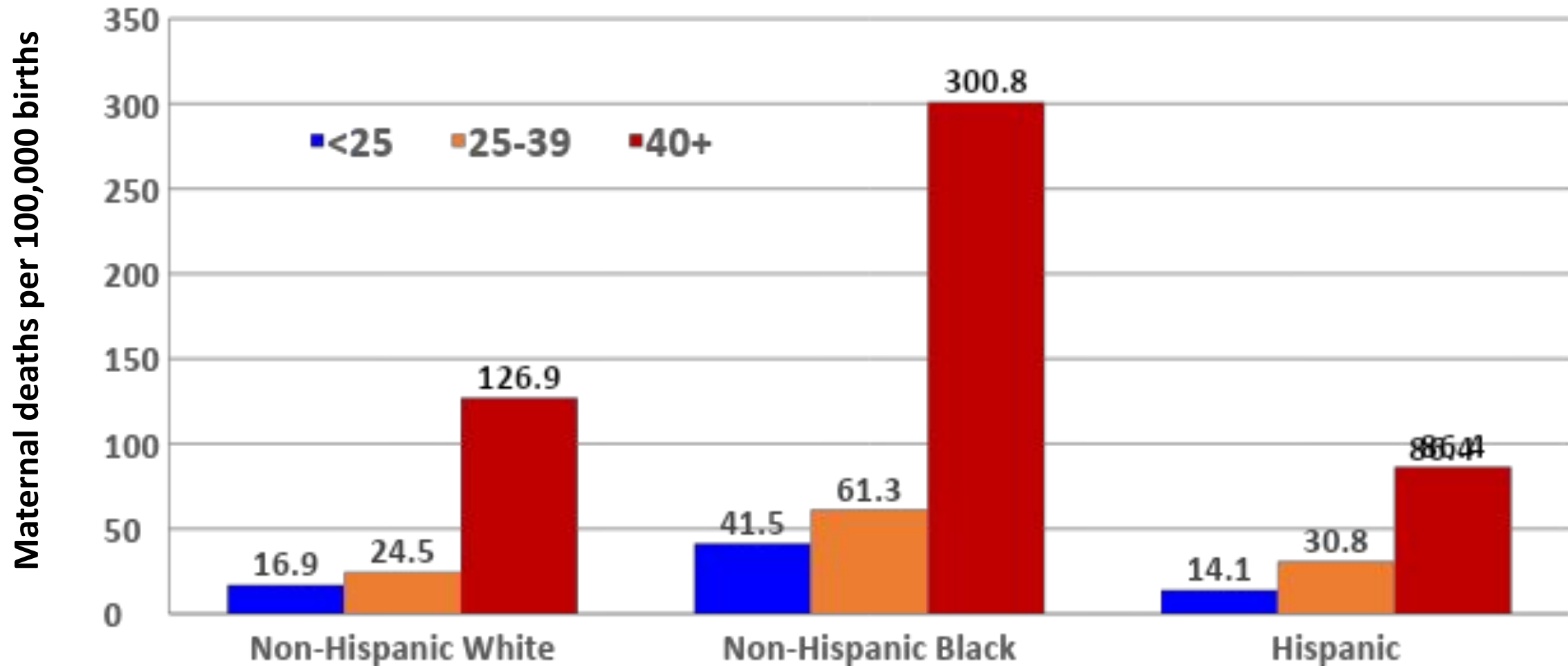


**Source:** NCHS. Maternal Mortality and Related Concepts. Vital & Health Statistics. Series 33; #3. & annual data reports. 1915-1960 data from NCHS. *Vital Statistics Rates In The United States 1940-1960*. NOTE: Shifts in measurement (e.g. not all states were part of registration system prior to 1933; infant race was based on race of the child until 1980 & then race of the mother post 1980) accounts for some of the variation over time. 2007-2016 based on 2 year estimates of the pregnancy related mortality rate: Petersen E. *MMWR*.9/6/19.

# U.S. Maternal Mortality, by Race/Ethnicity, 2018-2021

	2018	2019	2020	2021
<b>Non-Hisp. White</b>	14.9	17.9	19.1	26.6
<b>Non-Hisp. Black</b>	37.3	44.0	55.3	69.9
<b>Hispanic</b>	11.8	12.6	18.2	28.0
<b>Non-Hisp Asian</b>	13.3	13.8	12.3	24.3
<b>Non-Hisp. AIAN</b>	*	49.2	48.5	118.7
<b>All</b>	17.4	20.1	23.8	32.9
<b>40 years of Age +</b>				
<b>All</b>	81.9	75.5	107.9	138.5

# Maternal mortality rates, by race & Hispanic origin and age: United States, 2021



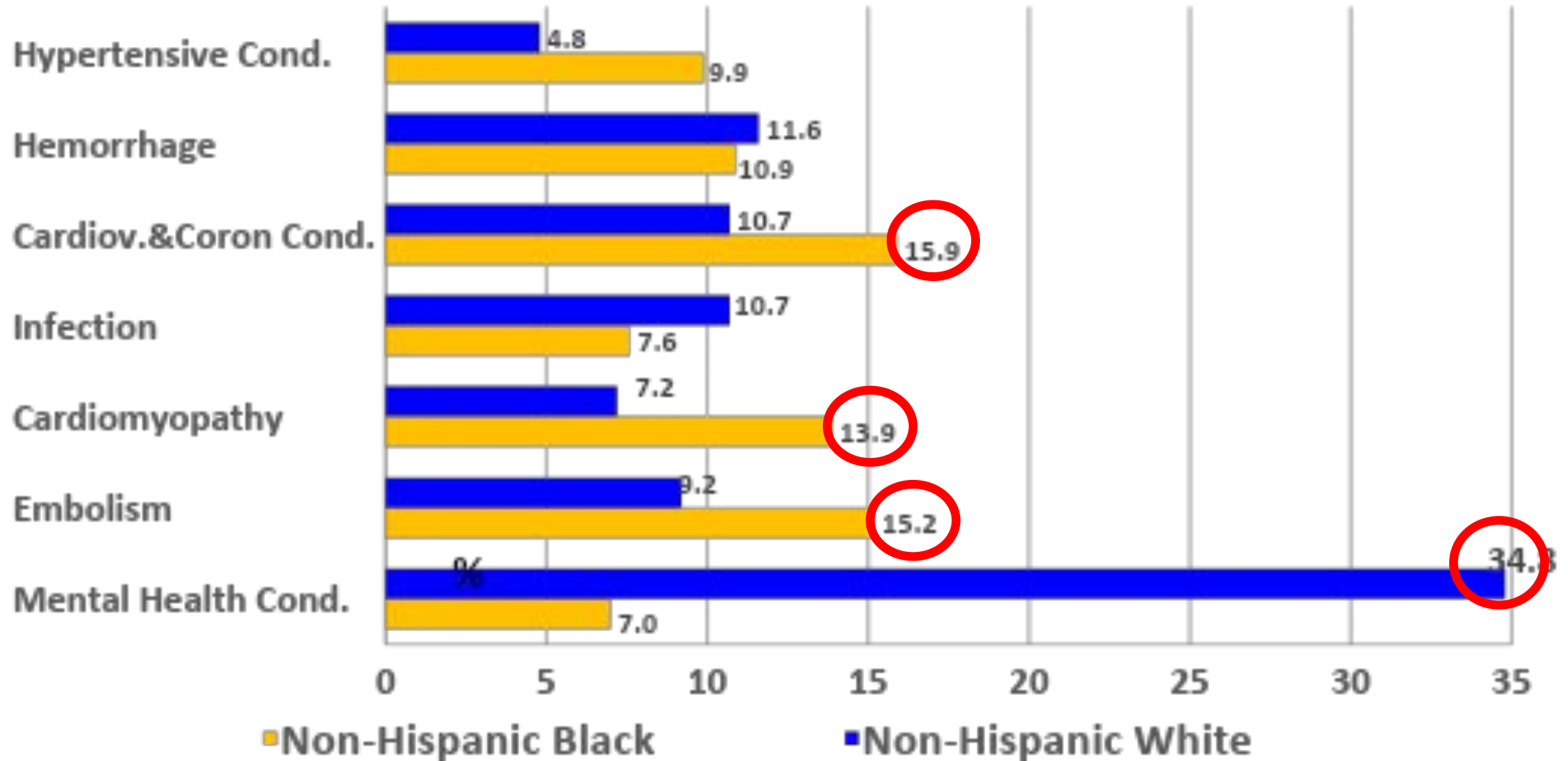
Source: Hoyert DL. Maternal mortality rates in the United States, 2021. NCHS Health E-Stats. 2023.

DOI: <https://dx.doi.org/10.15620/cdc:124678>.

[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

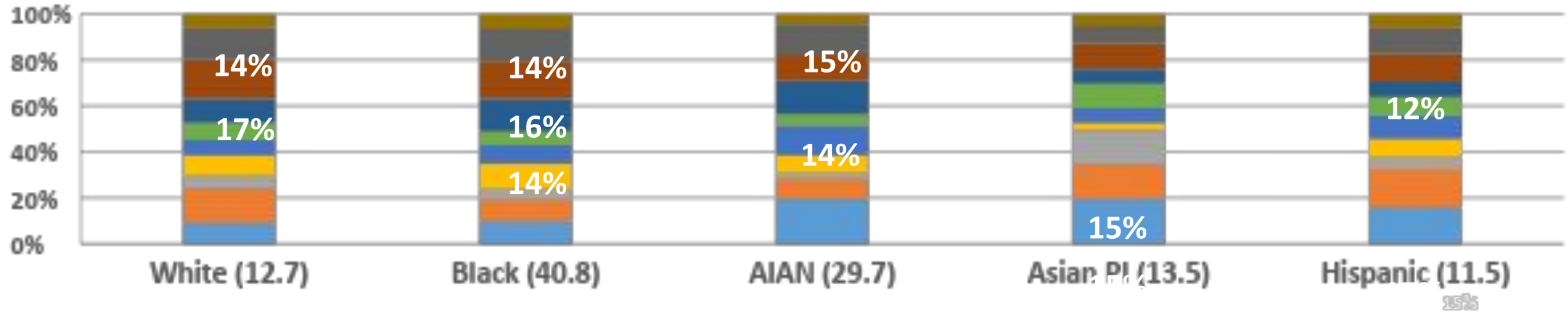
# Manifestation of Racial Disparities 2017-2019

*Leading Underlying Causes of Pregnancy-Related Deaths, by Race-Ethnicity*



Source: Trost SL, et al. Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019. Atlanta, GA: CDC, 2022.

# Cause-specific pregnancy-related mortality, by race/ethnicity, U.S., 2007-2016 (%)



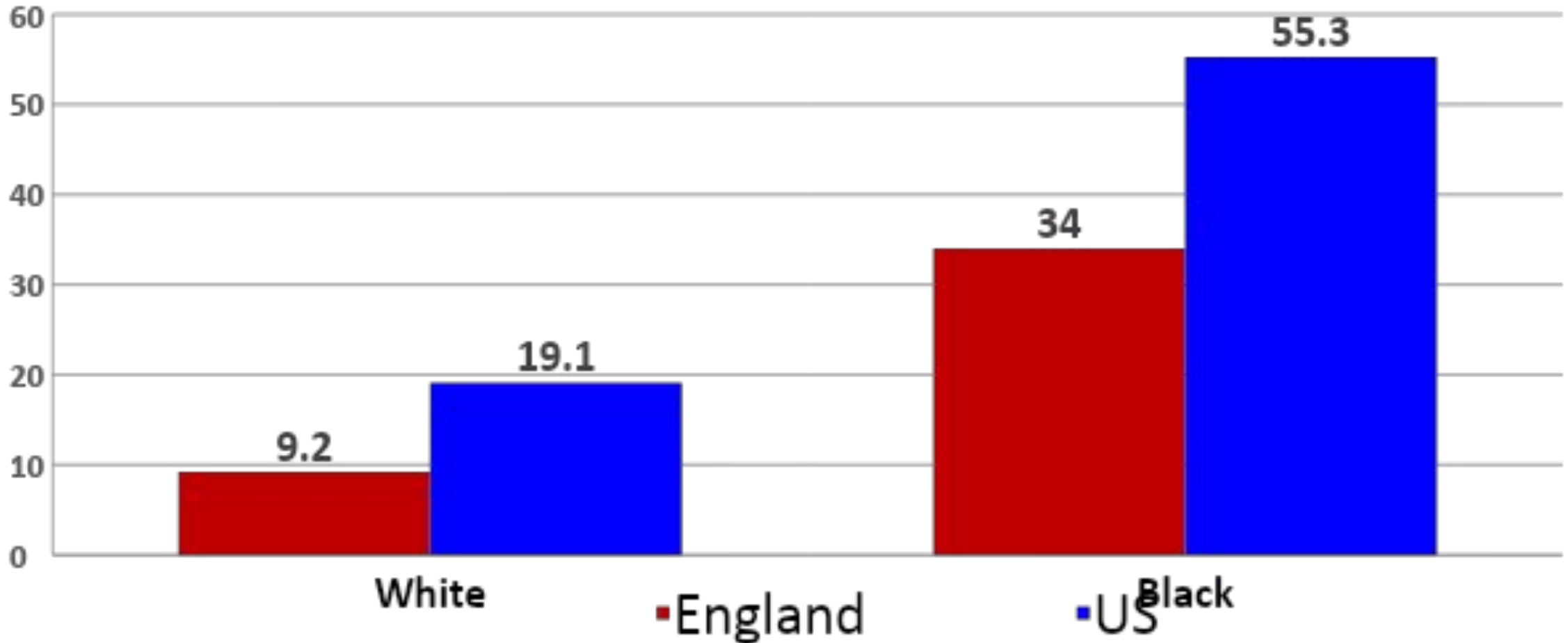
■ Hemorrhage  
■ Infection  
■ Amniotic Fluid Embolism  
■ Blood Clots  
■ Hypertension

**AIAN** – American Indian, Alaskan Native; **Asian PI** – Asian Pacific Islander

Source: Petersen E et al. Racial/Ethnic Disparities in Pregnancy-Related Deaths — United States, 2007–2016. *MMWR* 2/7/19; 68 (35): 762-765.

[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

# Maternal Mortality (per 100,000 births) by Race, U.S. (2020) and England (2018-2020)



Sources: U.S., Hoyert DL . NCHS Health E-Stats; 2/22/22; MBRRACE-UK. UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2018-20. Oxford:NPEU, 2022.

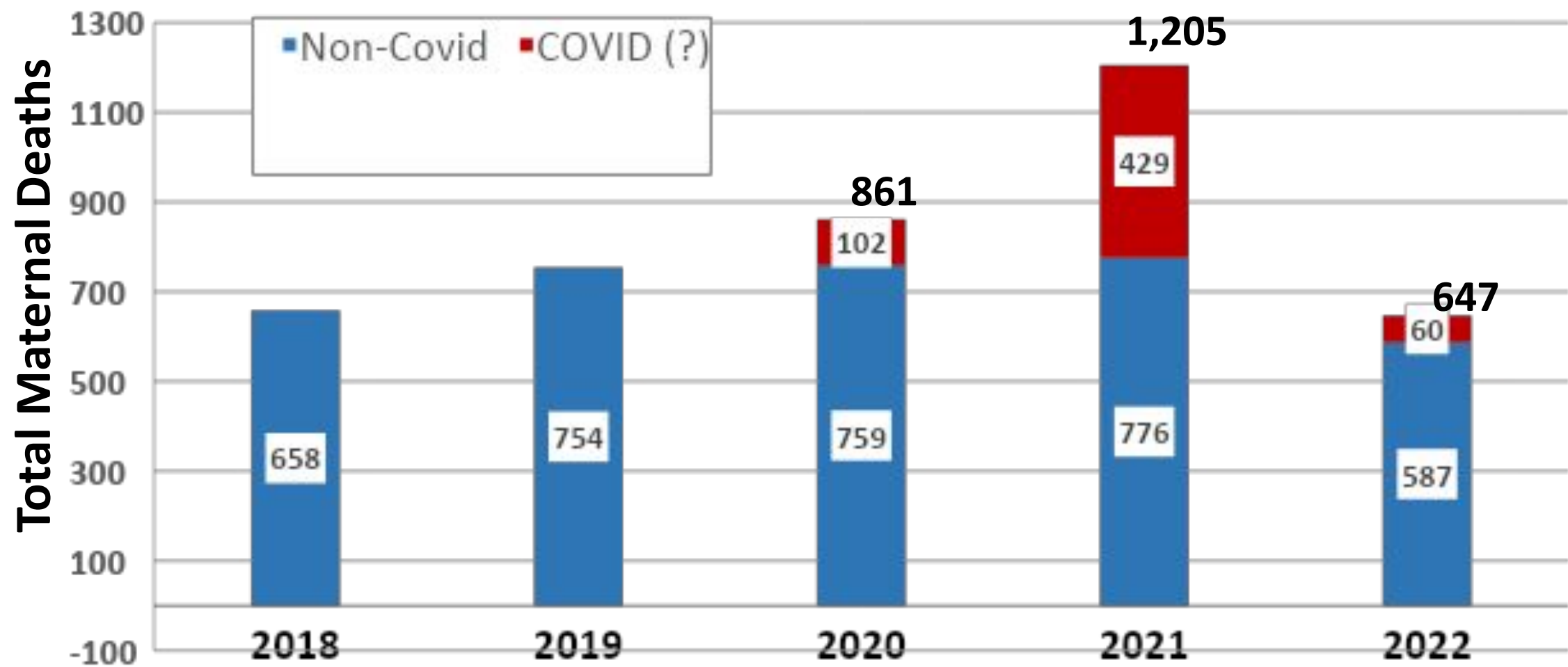


# Summary

- Racial disparities in maternal mortality have existing in the U.S. as long as data has been collected.
- The consistency of the disparity with Black maternal mortality ratios 3 to 4 times that of white maternal mortality for decades reflects the lack of progress made in the U.S.
- Presently, the disparity does not reflect SES differences, with maternal education providing no protection for Black mothers.
- The maternal mortality ratios for American Indian/Alaskan natives were also far higher than those for white and Hispanic mothers.

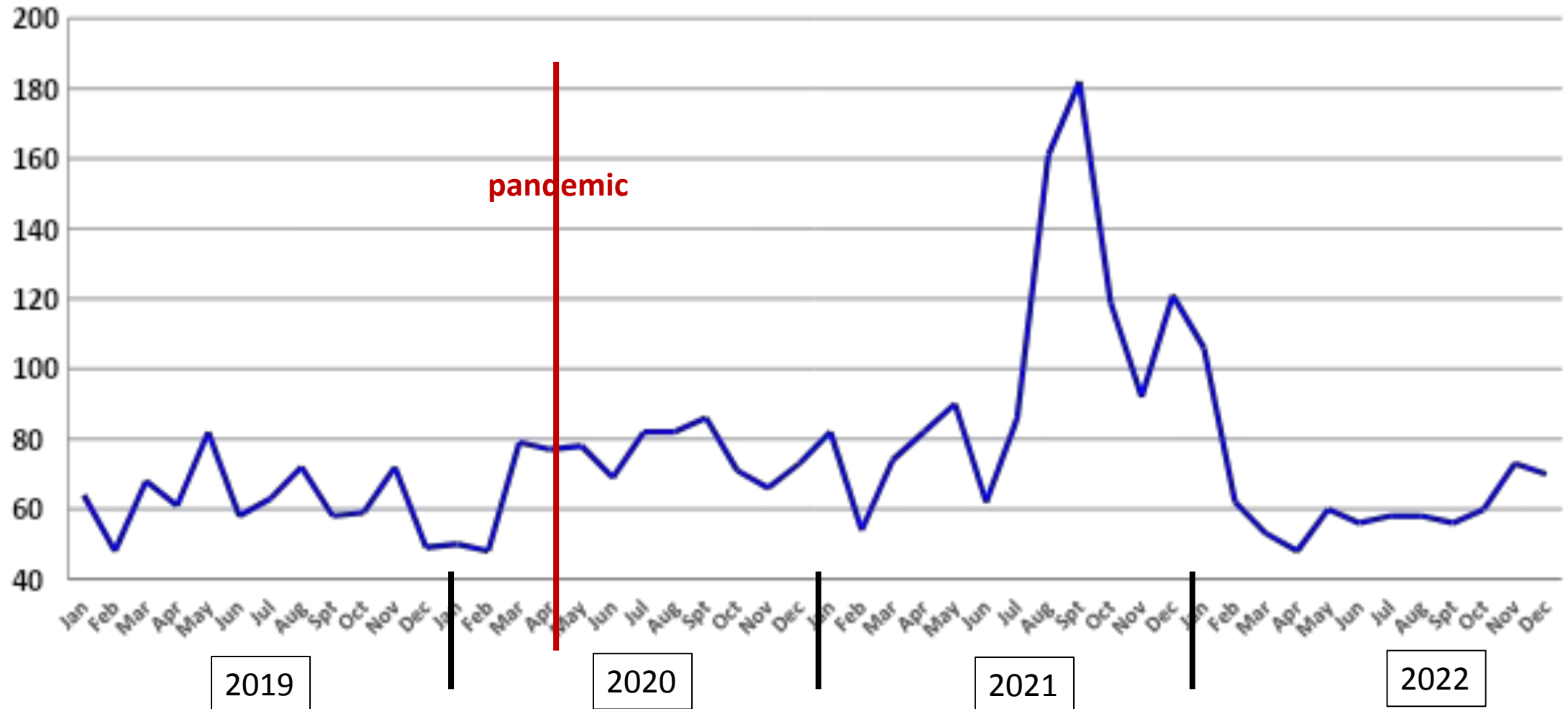
# **7. Maternal Mortality during a Pandemic**

# 2018-2022 COVID & Maternal Deaths Update

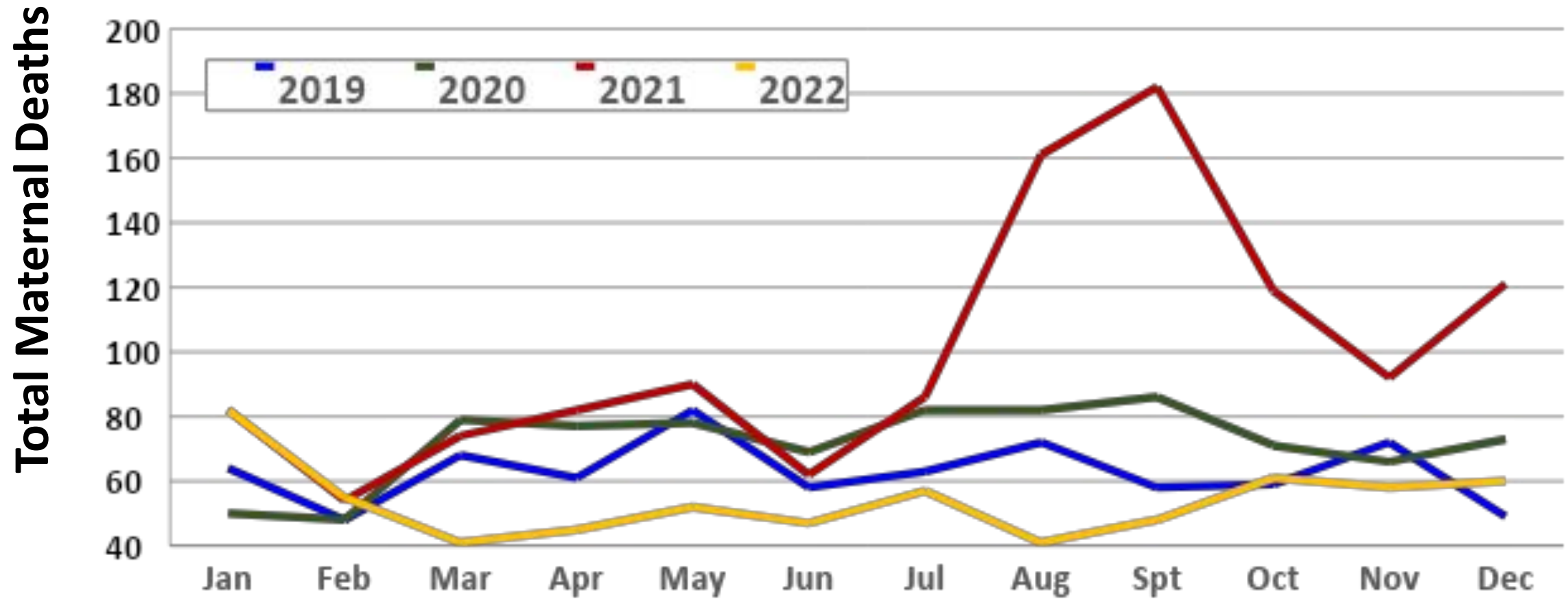


Provisional

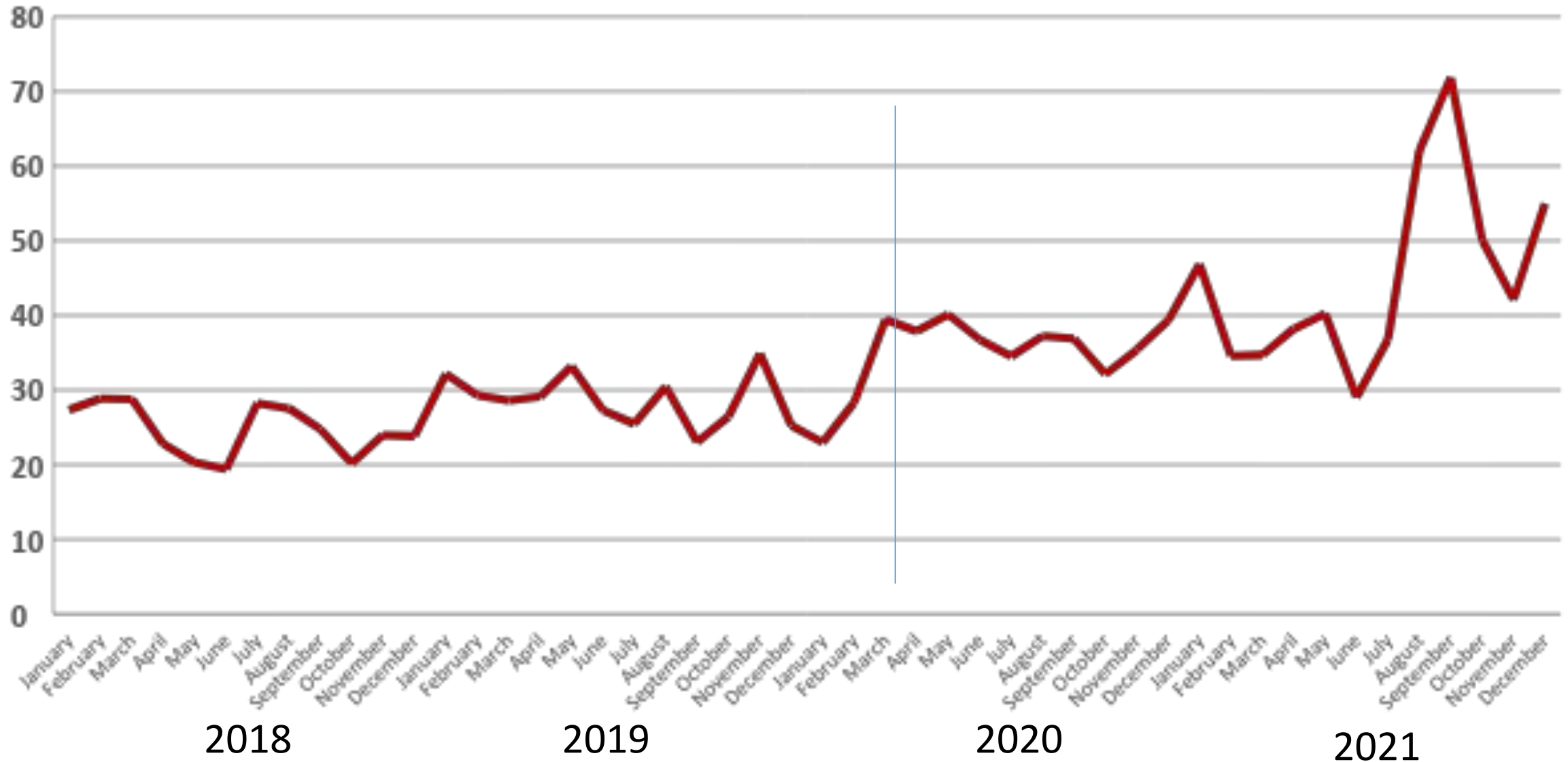
# Maternal Deaths (Preg-42 days ppm)per Month, 2019-2022 (2022 Provisional)



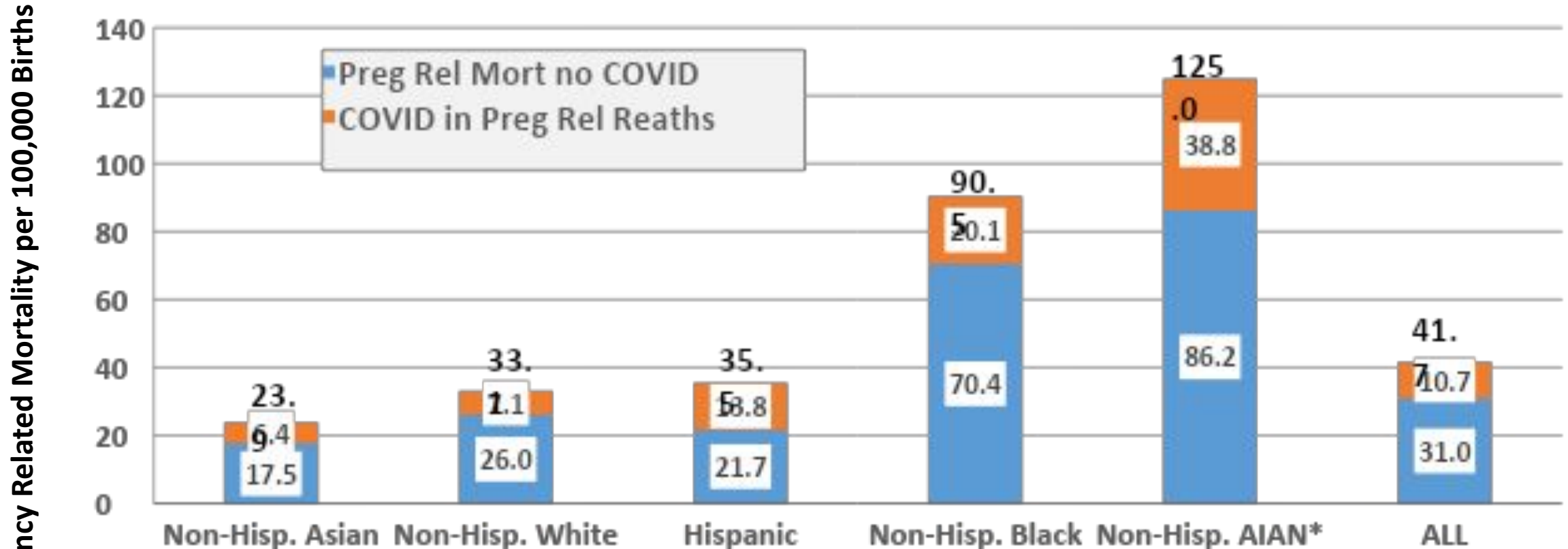
# U.S. Maternal Deaths per Month, 2019-2022 (2022 Provisional)



# MM (per 100,000 births) by Month, 2018-2021



# Pregnancy Related # Death Ratios with & without a COVID Code by Race-Ethnicity, April, 2020 – December, 2021



# Deaths during pregnancy and up to 1 year after delivery;

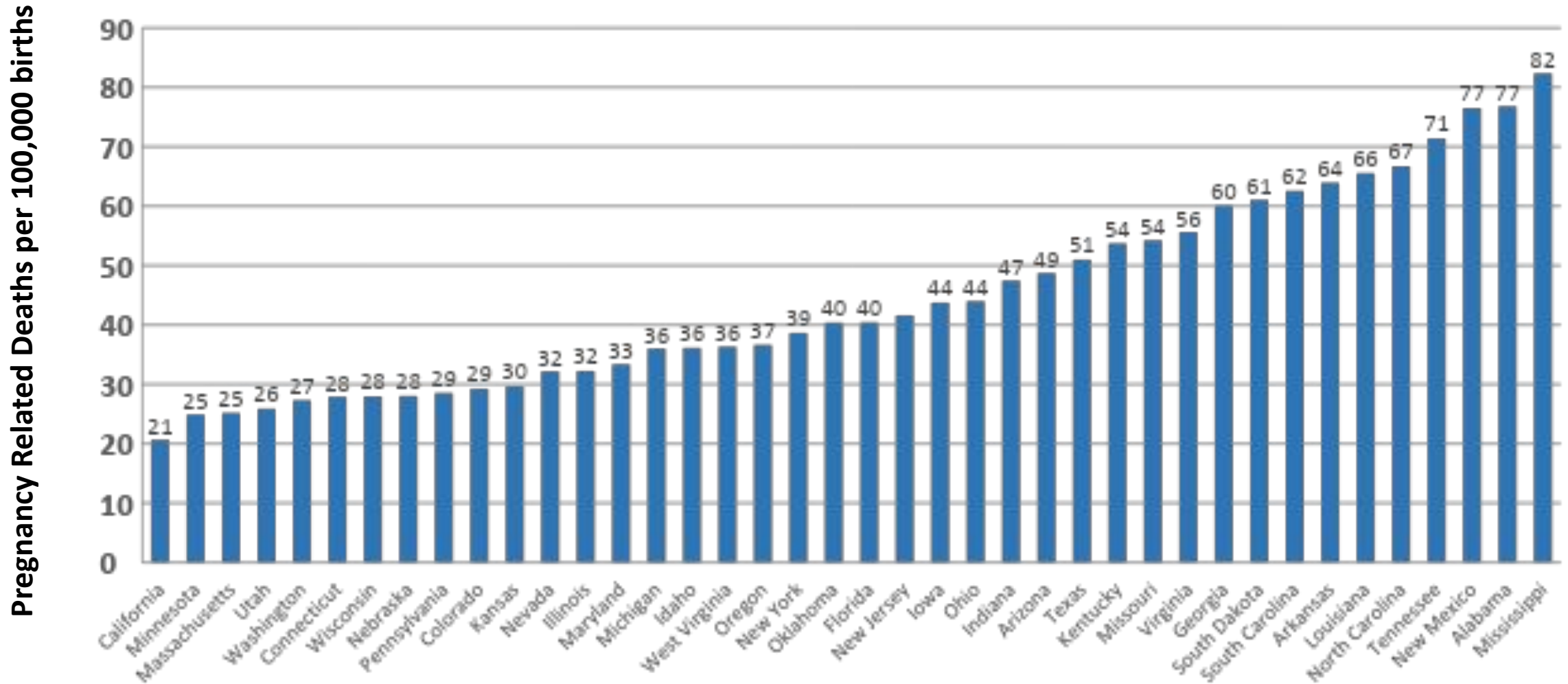
\*AIAN – American Indian Alaskan Native

Source: CDC Wonder





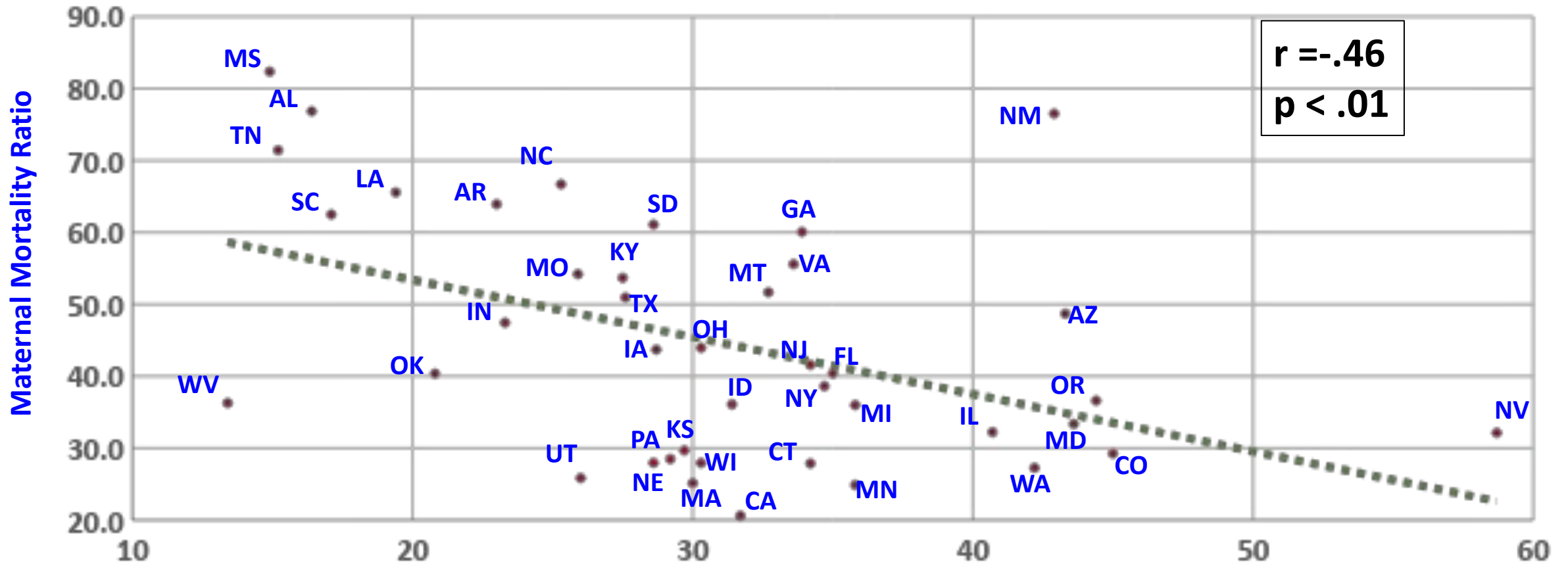
# Pregnancy Related Mortality\* by State during the Pandemic (2020Q2-Q4, 2021)



\* States with > 10 maternal deaths

Source: CDC Wonder

# Pregnancy Related Mortality (per 100,000 births) 2020-2021\* and % Female State Legislators 2021



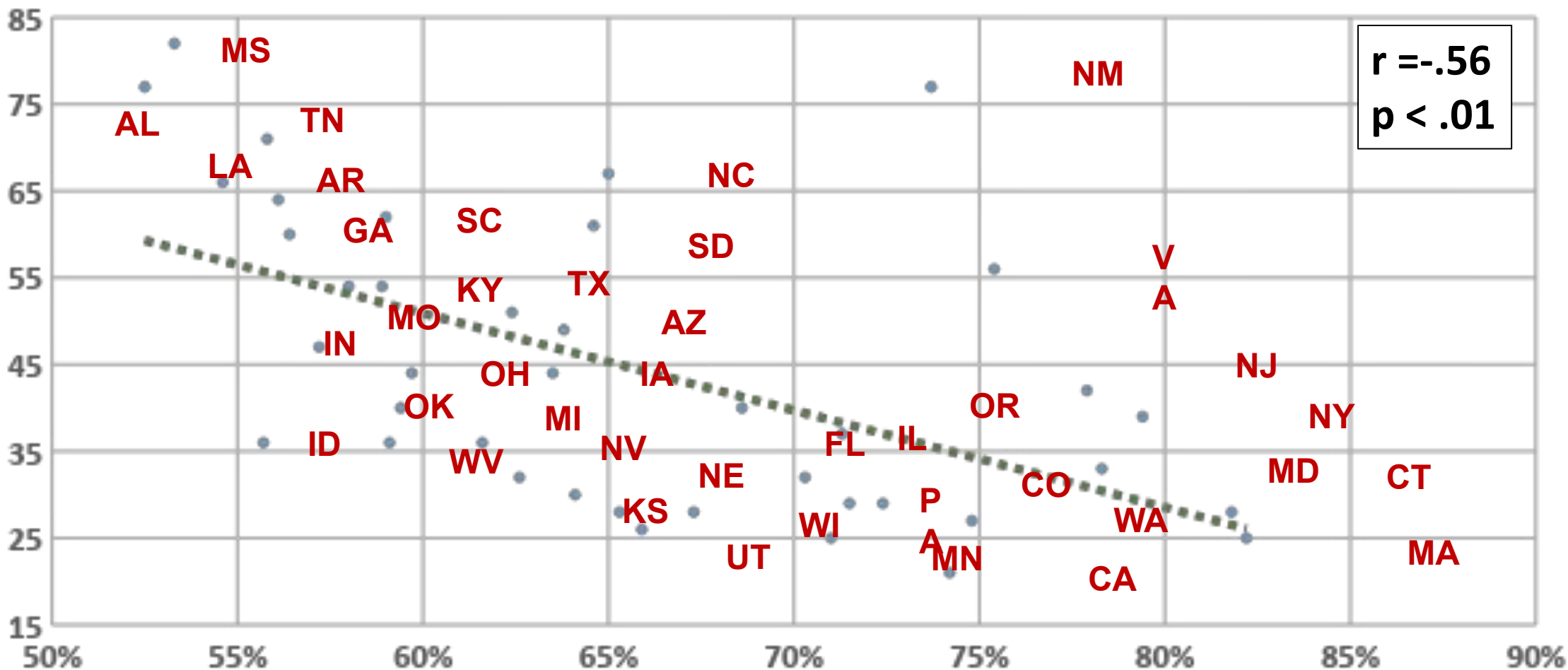
\* 41 states with at least 10 maternal deaths April, 2020– Dec. 2021.

% Female Legislators

Sources: % Female Legis – Nat’l Conf State Legisl.; Pregnancy Related Mortality – CDC Wonder

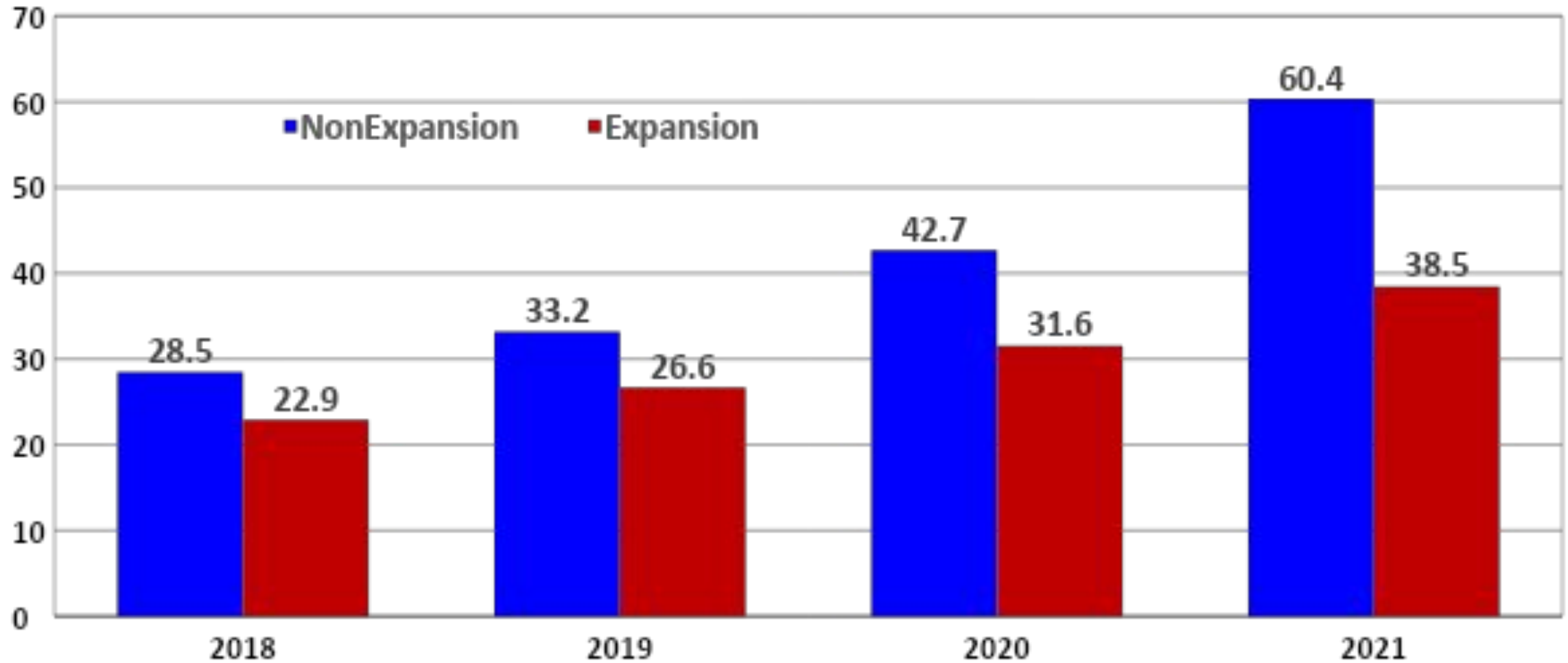
# State Pregnancy Related Mortality (per 100,000 births) (4/20-12/21) & Vaccination Rates

Maternal Mortality (per 100,000) during Pandemic



Proportion of Population Fully Vaccinated

# Average Pregnancy Related Mortality\* in Medicaid Expansion and non-Expansion States, 2018-2021



Non-Expansion States:

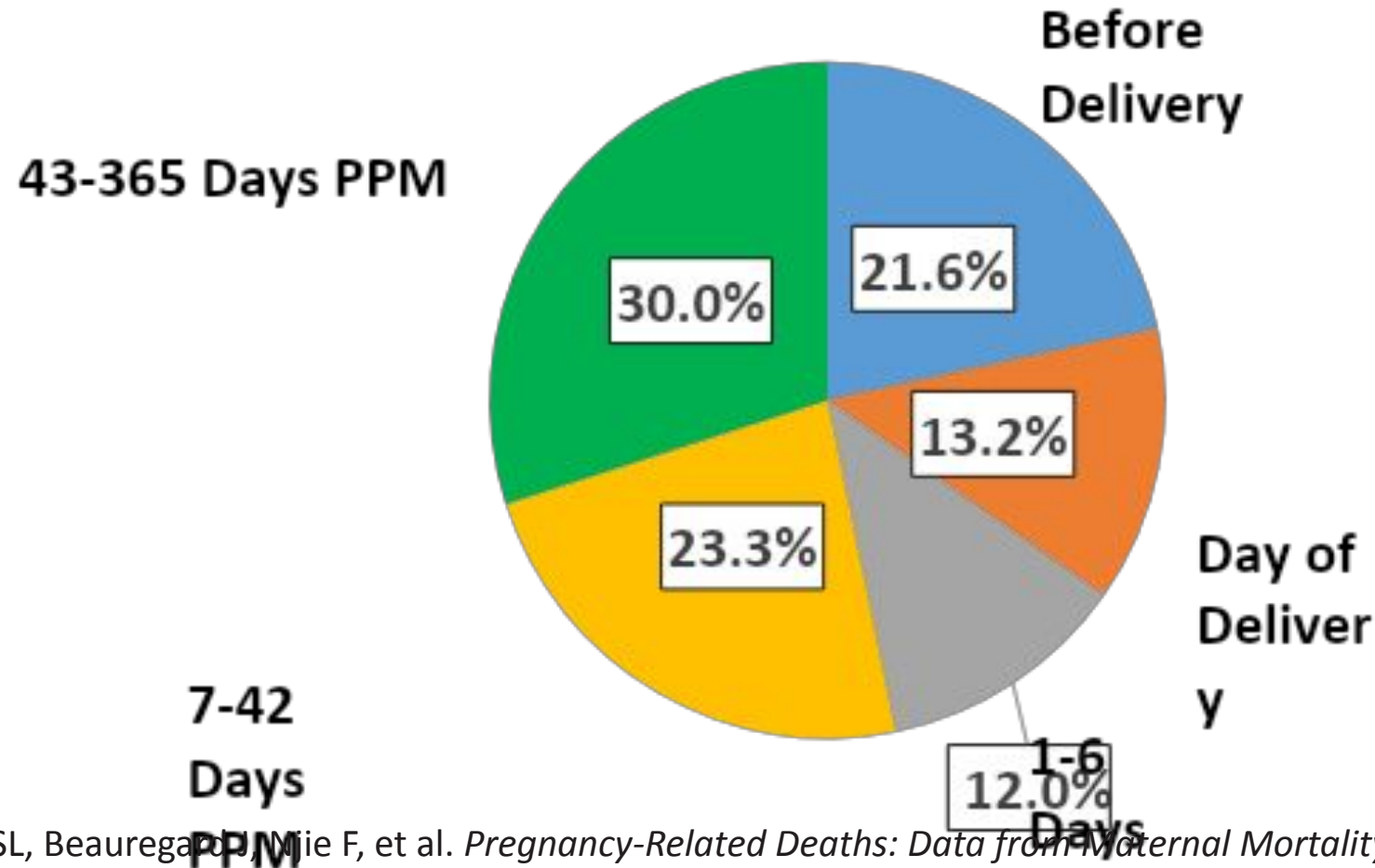
# Summary

- The COVID pandemic contributed more than 50% to the number of maternal deaths in 2021. It appears to have lost its impact in 2022.
- The pandemic exacerbated existing disparities between different groups, with especially high ratios among American Indians/Alaskan Natives and non-Hispanic Blacks.
- State political systems appear to be related to the likelihood of a pregnancy related death.

# 8. Maternal Mortality as a Public Health Problem: *Timing & Causes of Death*



# Timing of Maternal Deaths (2017-19)

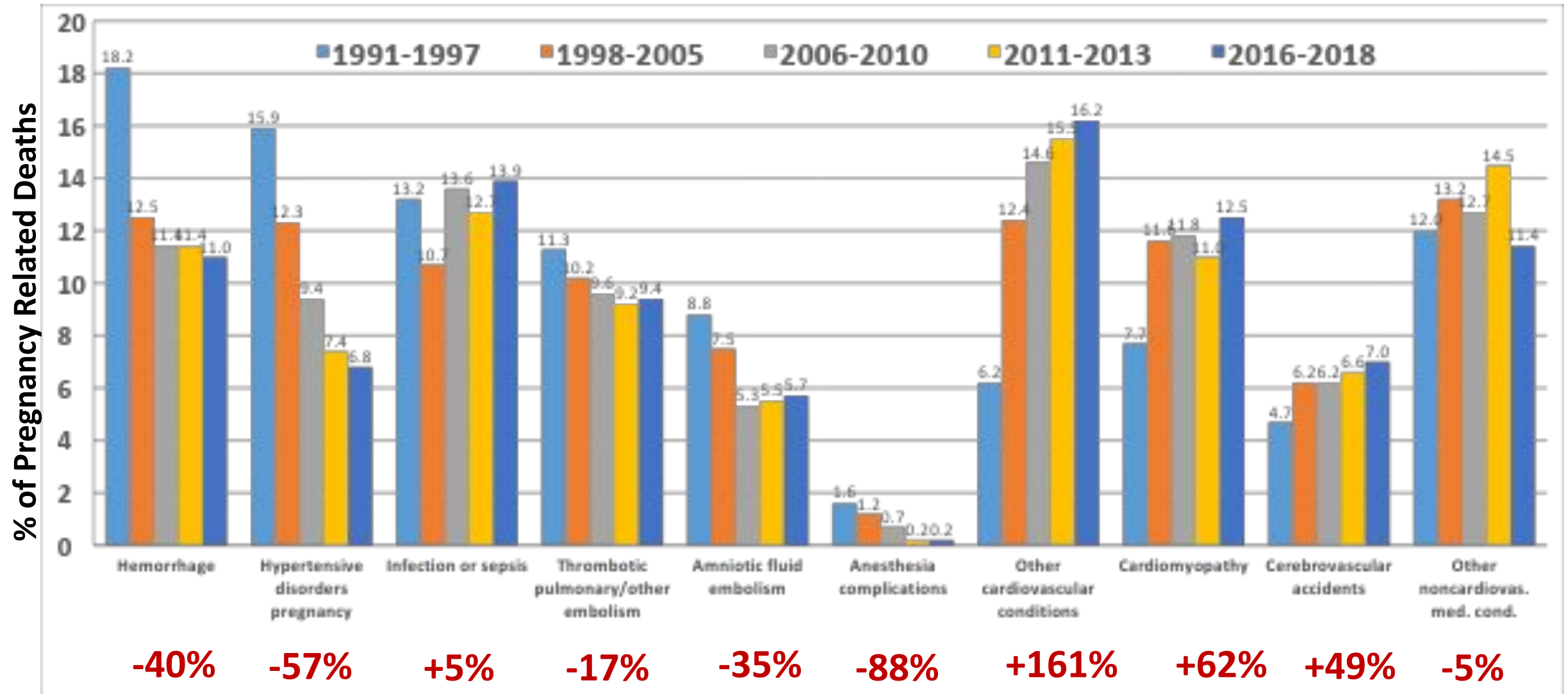


***Maternal deaths are a public health issue as much as a clinical care issue.***

Source: Trost SL, Beauregard J, Mire F, et al. *Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019*. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services; 2022.

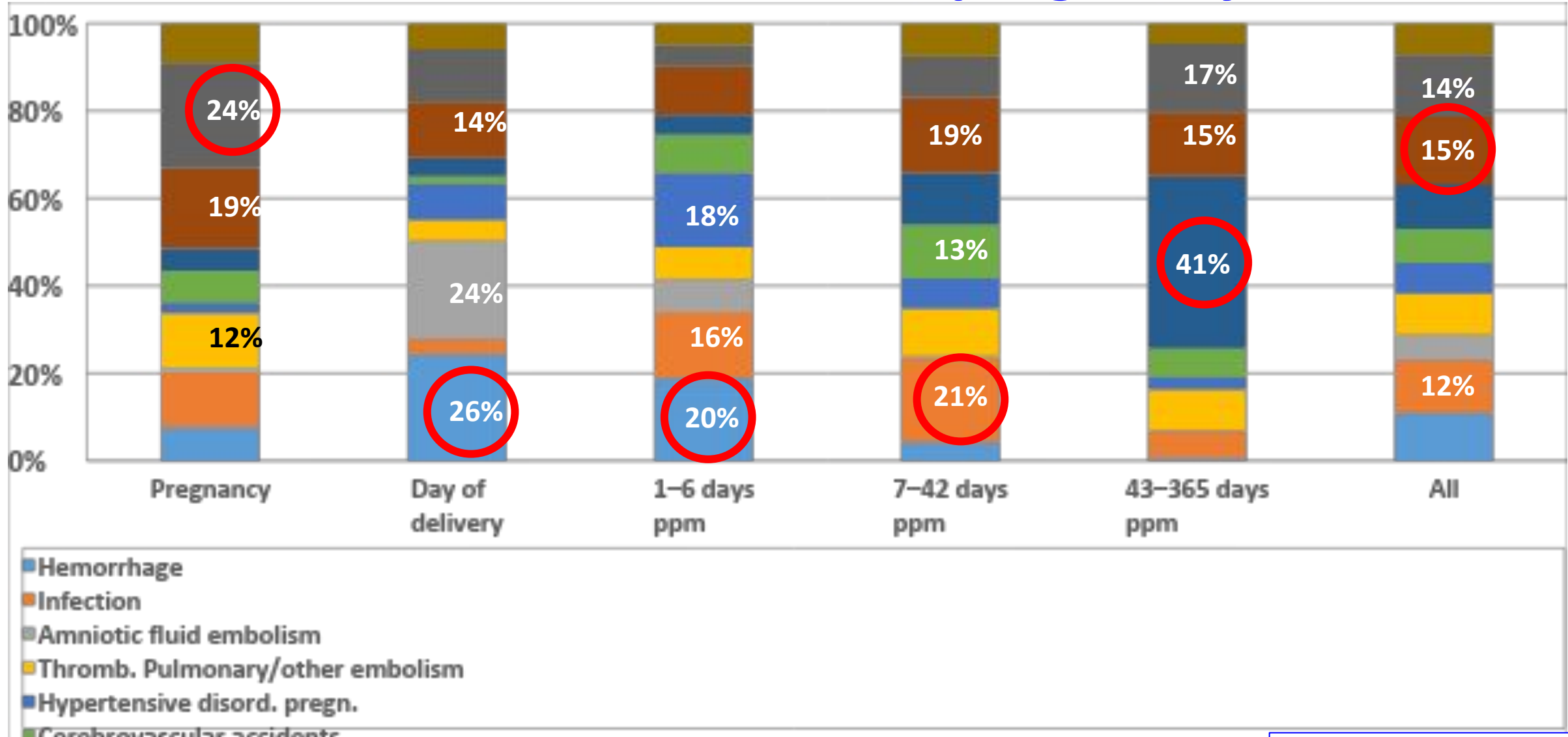
# Maternal Mortality as a Public Health Problem

*Cause-specific proportionate **Pregnancy-Related** mortality: U. S., 1991–2018.*



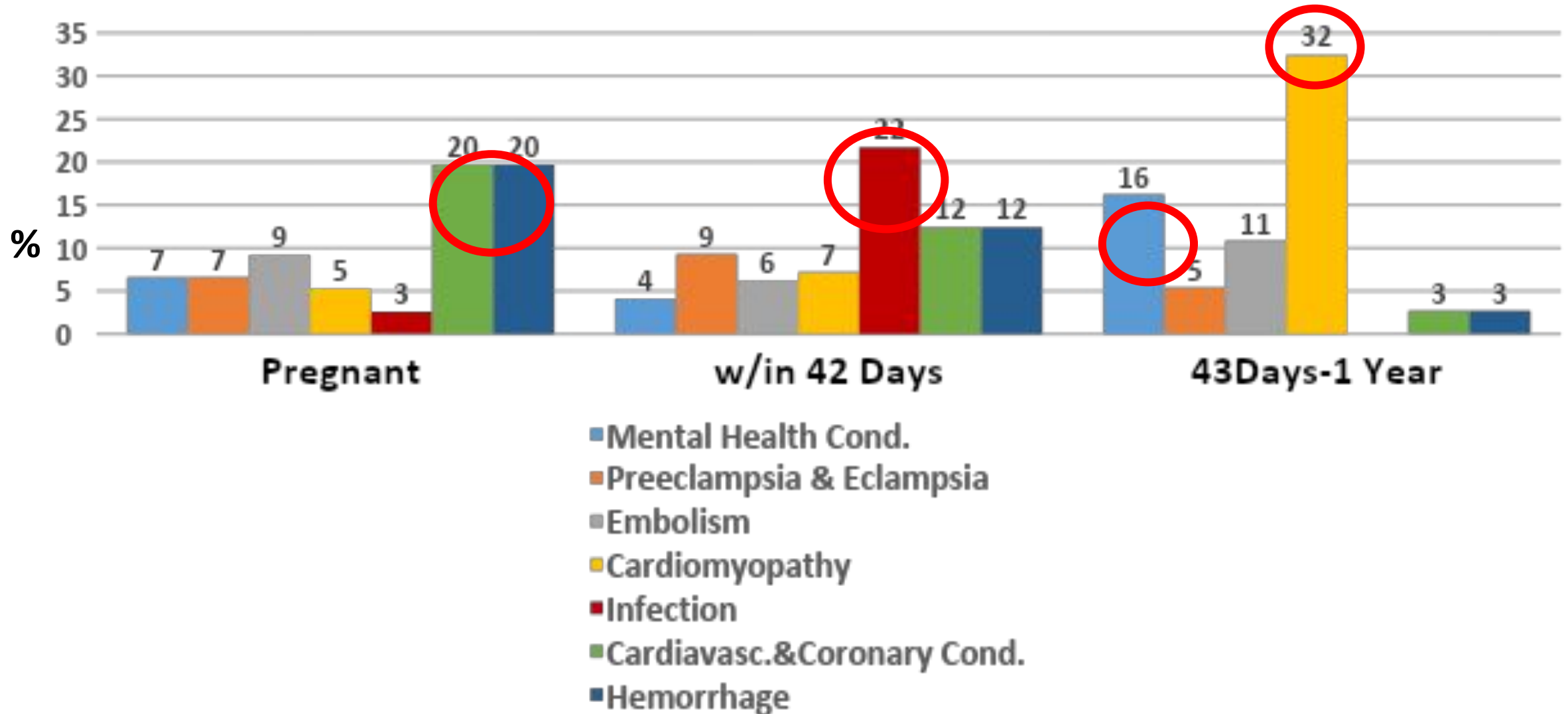
Source: Creanga. Pregnancy-Related Mortality in the United States.  
*Obstet Gynecol* 2017(1991-2013); CDC PRMSS (2016-2018).

# Pregnancy-related deaths, by cause of death and **timing of death** relative to the end of pregnancy, 2011-15



# Moving to a Public Health Approach

## *Underlying Causes of Pregnancy-Related Deaths, by **Timing of Death***



Source: CDC. 2018. *Report from 9 Maternal Mortality Review Committees.*

# Summary

- If only a quarter of maternal deaths occur at the time of birth, solutions have to look beyond the birth hospitalization to improve outcomes.
- We have made considerable strides in improving care at the time of birth. The recent increases have been largely among cardiovascular conditions, many of which only manifest after the birth.
- There are clearly different patterns of causes of death by timing indicating a need for more nuanced approaches.
- Research into the underlying causes of death suggests a need for a greater focus on maternal mental health, particularly in the postpartum period.

# **9. The Issue is Broader than Maternal Mortality**

# Not just about maternal mortality

## National Vital Statistics Reports



Volume 70, Number 8

July 26, 2021

### Deaths: Final Data for 2019

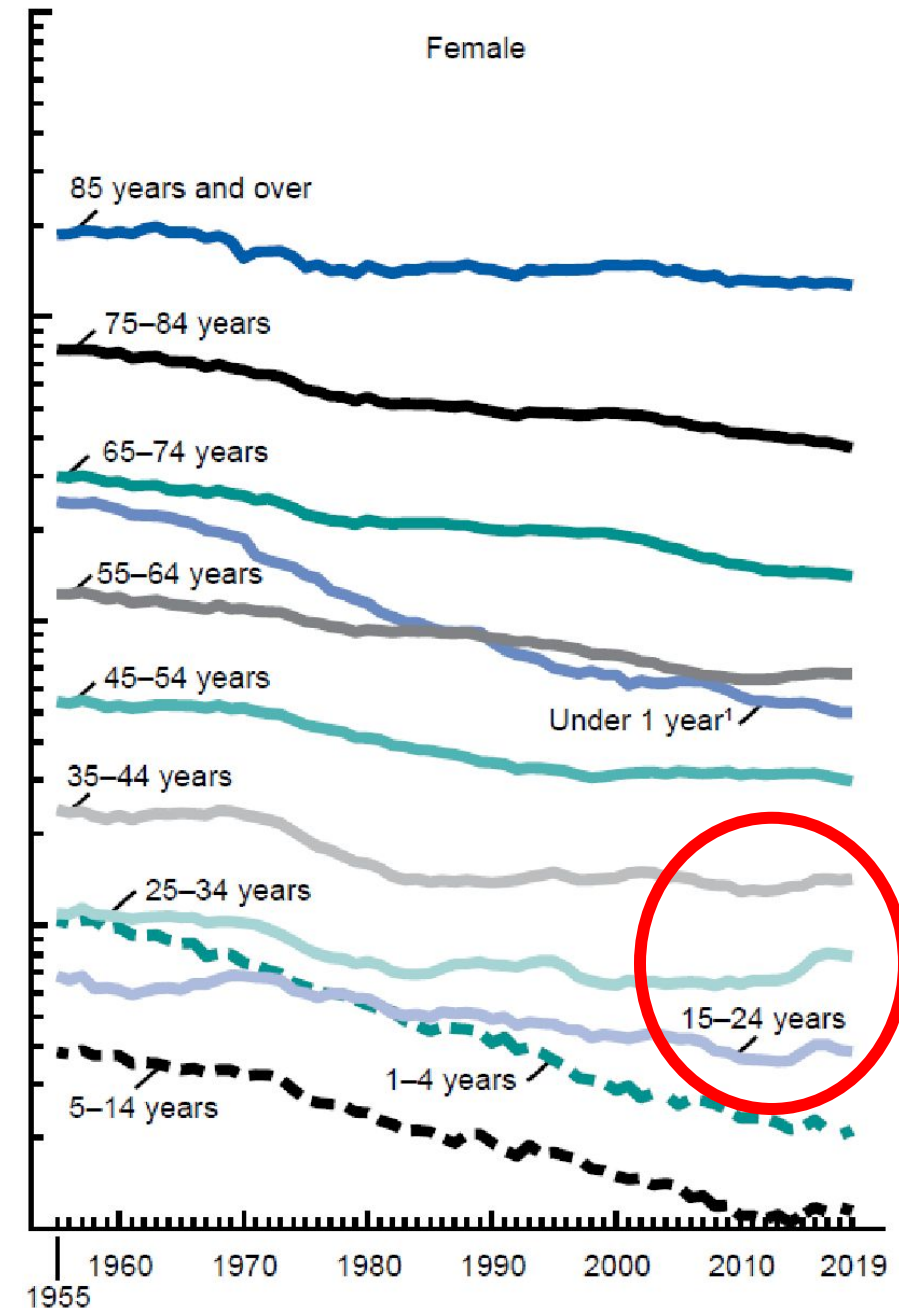
by Jiaquan Xu, M.D., Sherry L. Murphy, B.S., Kenneth D. Kochanek, M.A., and Elizabeth Arias, Ph.D.,  
Division of Vital Statistics

## STAT

**Maternal deaths represent the canary in the coal mine for women's health**

By Eugene Declercq and Neel Shah

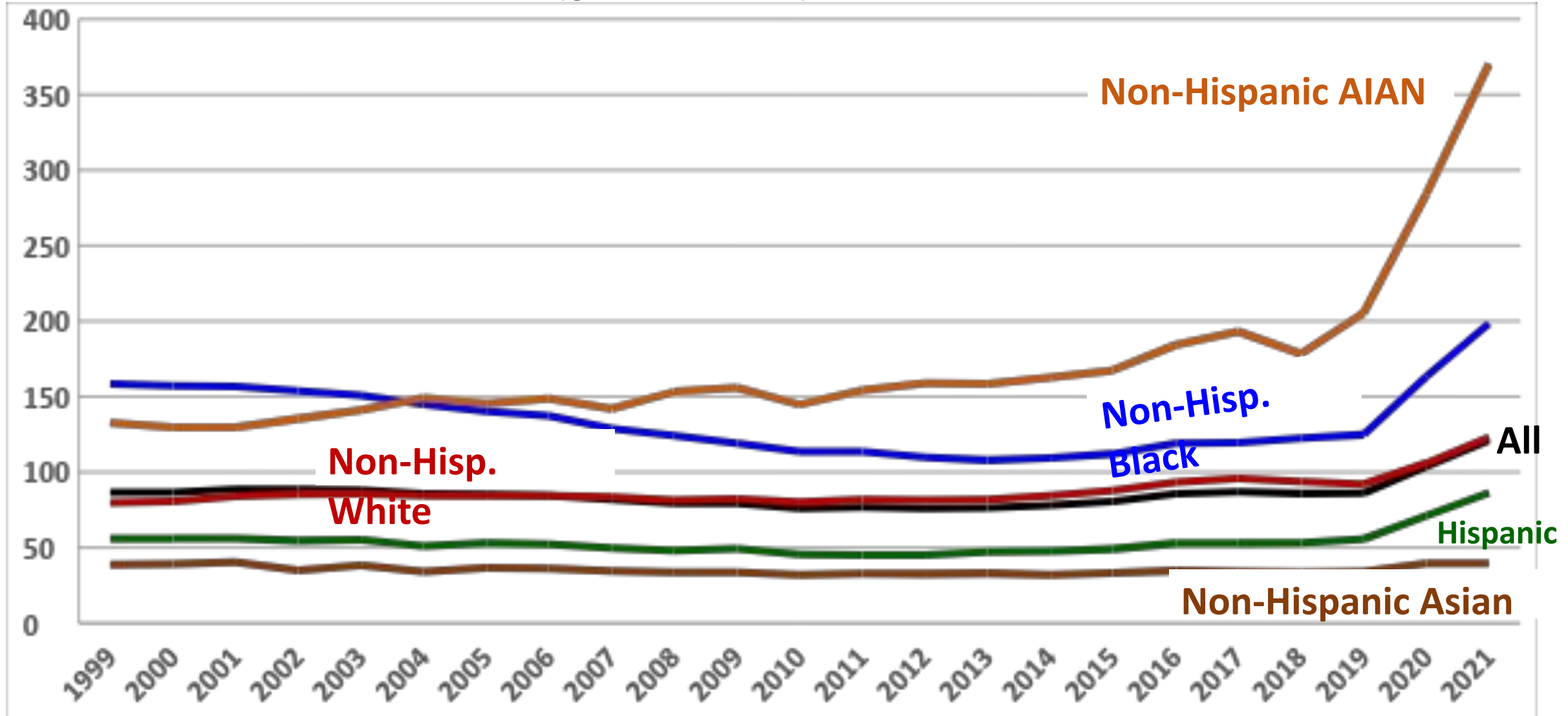
August 22, 2018





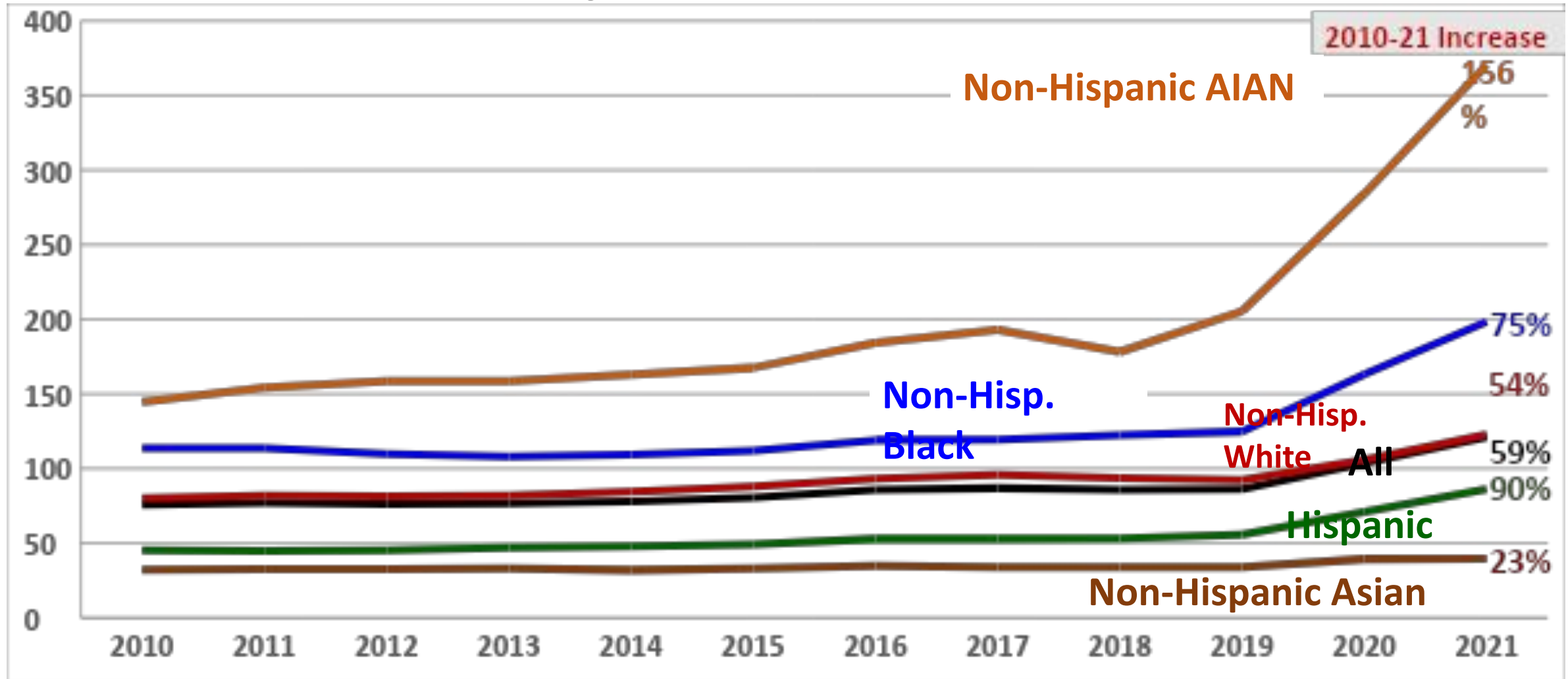
# The Problem is Bigger than Maternal Mortality

*Overall Deaths rates (per 100K), Females 15-44, 1999-2021*



# The Problem is Bigger than Maternal Mortality

## Overall Deaths rates (per 100K), Females 15-44, 2010-2021

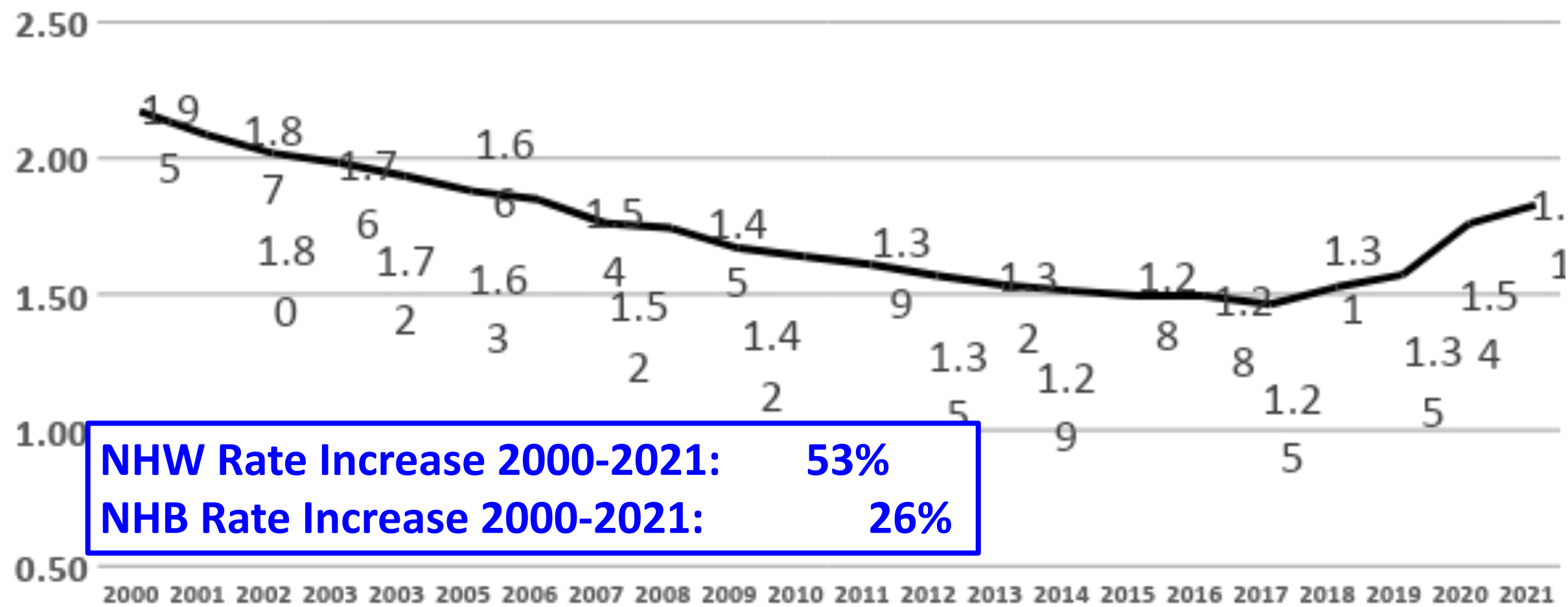


All Female Deaths 15-44

2010 -- 47,427; 2021 – 78,110 (COVID 8,885)

[www.birthbythenumbers.org](http://www.birthbythenumbers.org)

# Ratio of Black/White Female Death Rates, Women 15-44, 2000-2021



# Problem is Bigger than Maternal Mortality

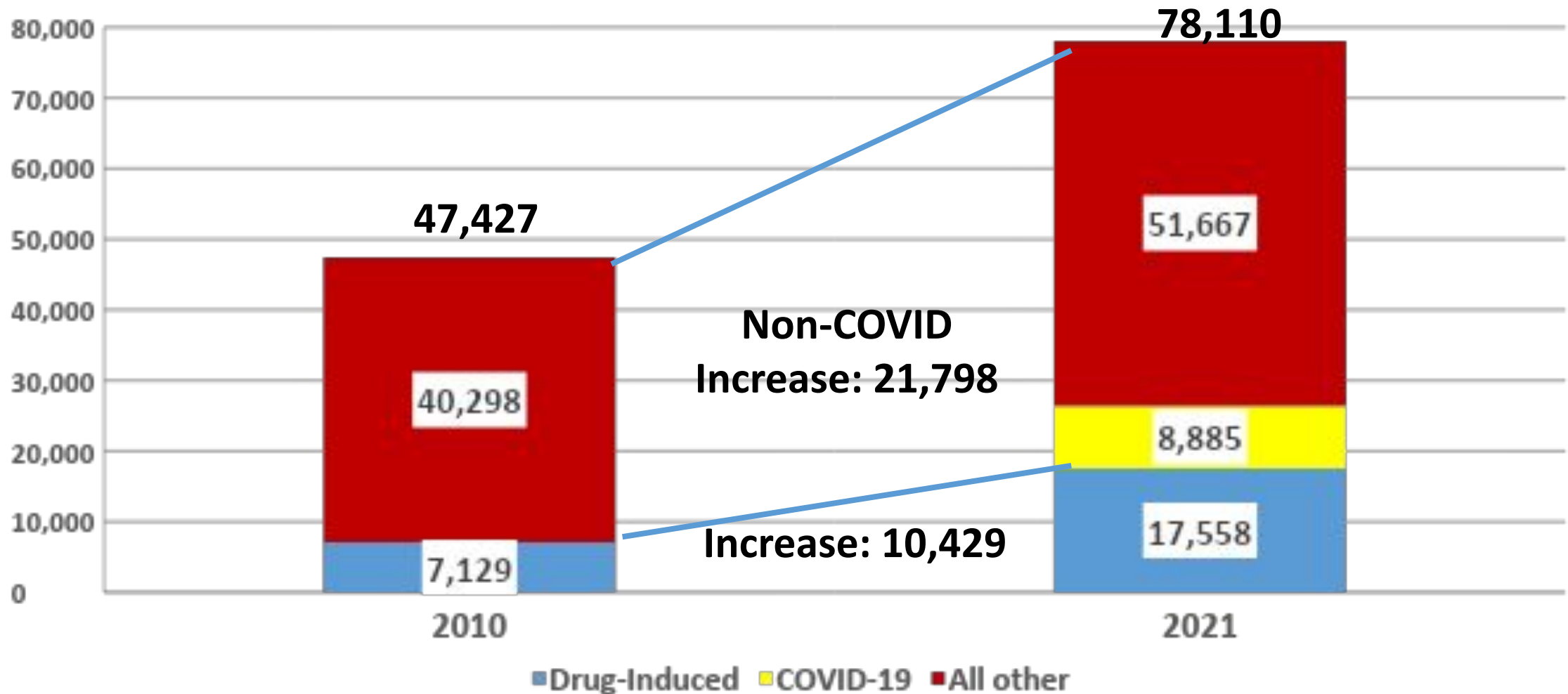
## *Top 10 Causes of Death for Women 15-44 in 2021*

	2021 Total Deaths	% of total	Rate per 100 K	% Change in rate 2010-2021	Proportion of 2010-21 Increase
<b>All causes</b>	78,110	100.0	120.0	57.9%	---
<b>Accidents (unintentional inj.)</b>	23,562	30.2%	36.5	96%	38.9%
COVID-19	8,885	11.4%	13.8	---	29.0%
Malignant neoplasms	8,740	11.2%	13.5	-8%	-1.2%
Diseases of heart	5,694	7.3%	8.8	21%	3.7%
<b>Intentional self-harm (suicide)</b>	4,549	5.8%	7.0	27%	3.6%
Assault (homicide)	3,032	3.9%	4.7	57%	3.7%
<b>Chronic liver disease and cirrhosis</b>	2,858	3.7%	4.4	175%	6.0%
Diabetes mellitus	1,747	2.2%	2.7	59%	2.2%
<b>Pregnancy, childbirth &amp; puerperium</b>	1,665	2.1%	2.6	117%	3.0%
Cerebrovascular diseases	1,254	1.6%	1.9	0%	0.1%
All other causes (residual)	16,124	24.8	21.2	19.5%	10.1%

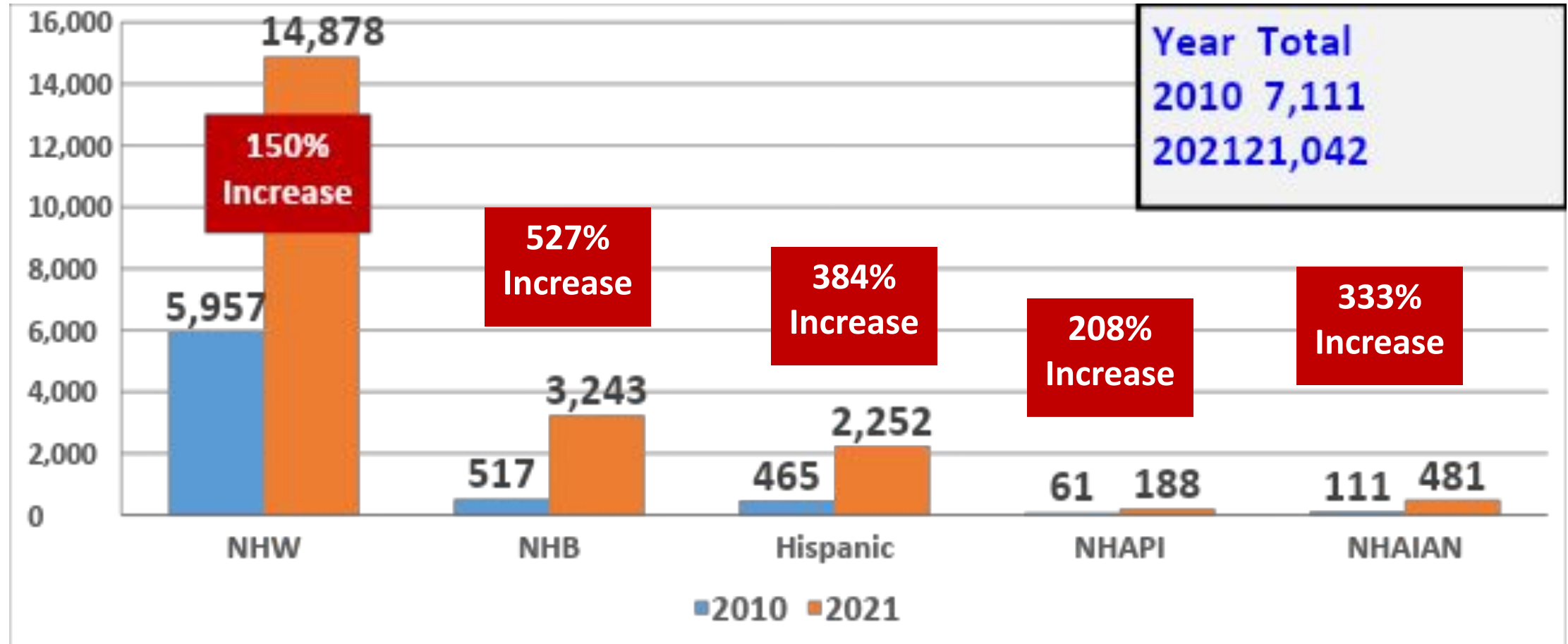
Sources: CDC, NCHS. Underlying Cause of Death 1999-2021 on CDC WONDER Detailed Mortality Database, released in 2022. Accessed at <http://wonder.cdc.gov/ucd-icd10.html> on Feb. 9, 2023

[www.birthingthenumbers.org](http://www.birthingthenumbers.org)

# Increases in Female Deaths (15-44) 2010-2021: 47% of the non-COVID increase came from 1 cause



# Increase in Drug Induced Deaths, Women 15-44, by Race/Ethnicity, 2010 & 2021



CDC, NCHS. CDC WONDER Online Detailed Mortality Database, released in 2020. Accessed at <http://wonder.cdc.gov/ucd-icd10.html> on Aug 12, 2022

# Summary

- Pick your idiom: tip of the iceberg or canary in the coal mine – the 800 maternal deaths are a warning about a much larger problem in the U.S. -- the rising death rate among women of reproductive age.
- While the pregnancy related mortality rate has remained steady since 2010, the overall death rate for women 15-44 has increased by 13% through 2019 and 59% overall when the pandemic is taken into account.
- The death rate for non-Hispanic White women was rising 2010-2017 at a much faster rate than the rate among non-Hispanic black women, but that has shifted.
- The primary cause of these increases in deaths is substance use.

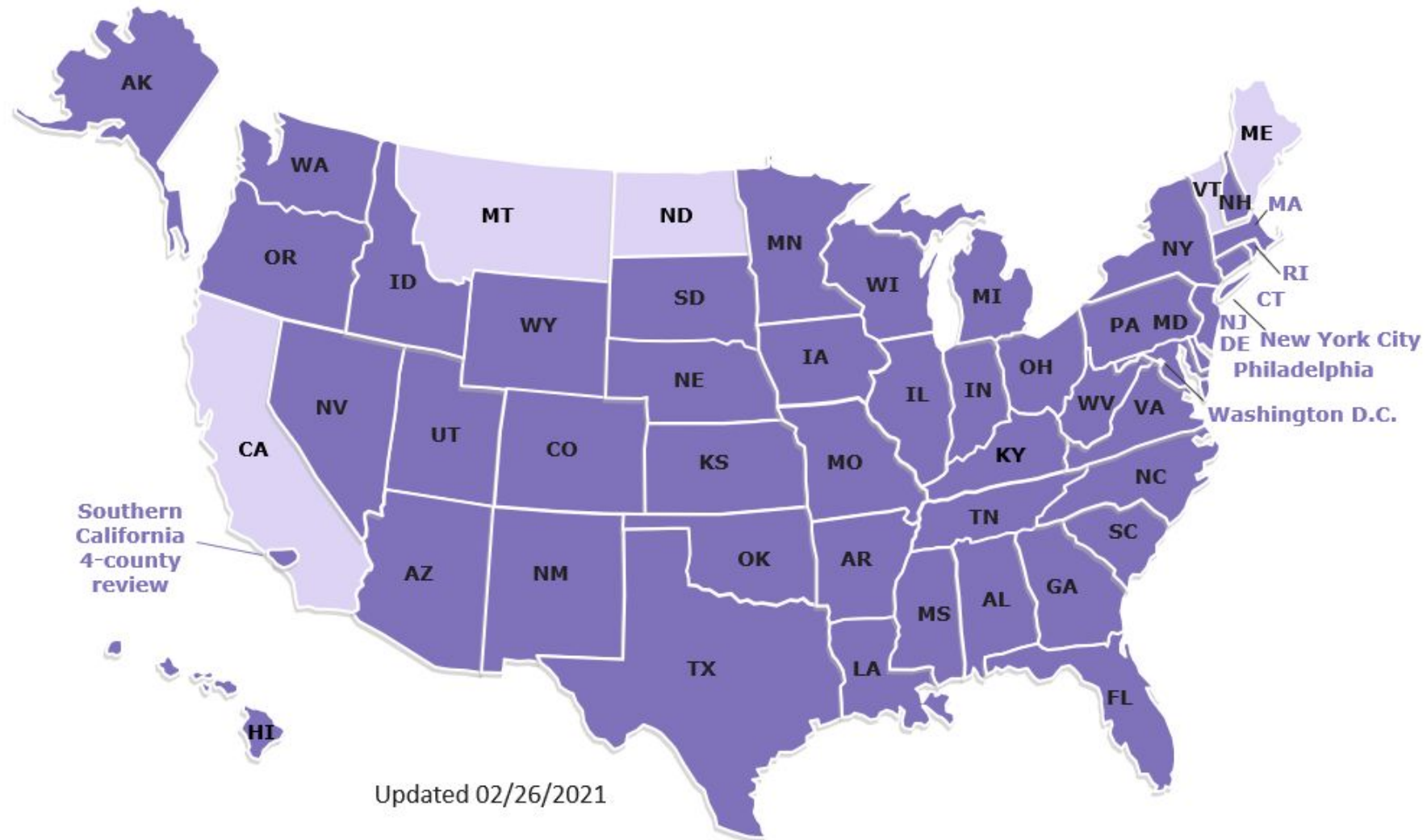


# 10. The Way Forward

# Preventability

- **Definition:** 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 to patient, family, provider, facility, system and/or community factors.

# Maternal Mortality Review Committees (MMRCs) in 50 State and Local Jurisdictions

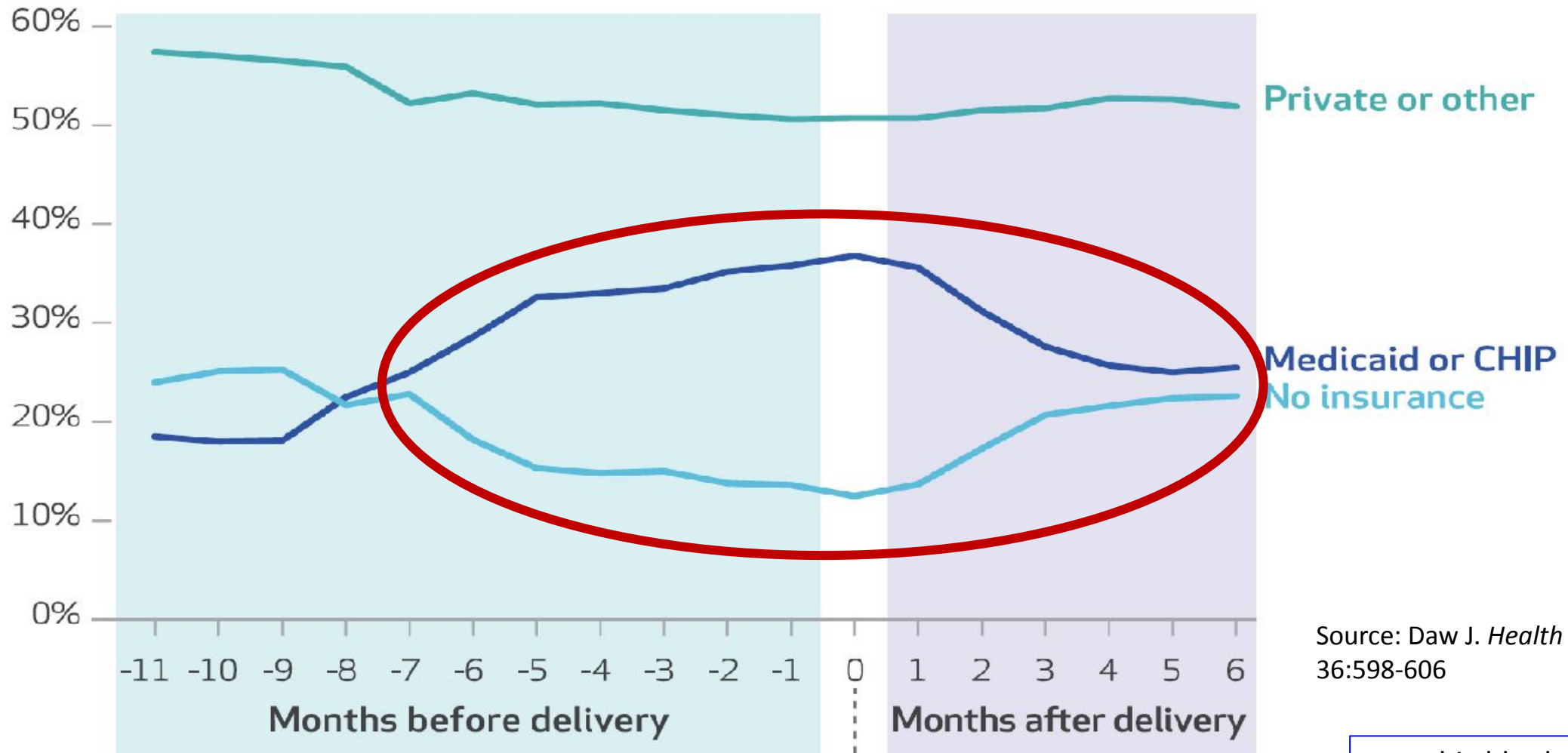


# **The Challenge of Keeping Women in the Health System: Insurance Coverage**

# 9. The Way Forward

## *Keeping Women in the System*

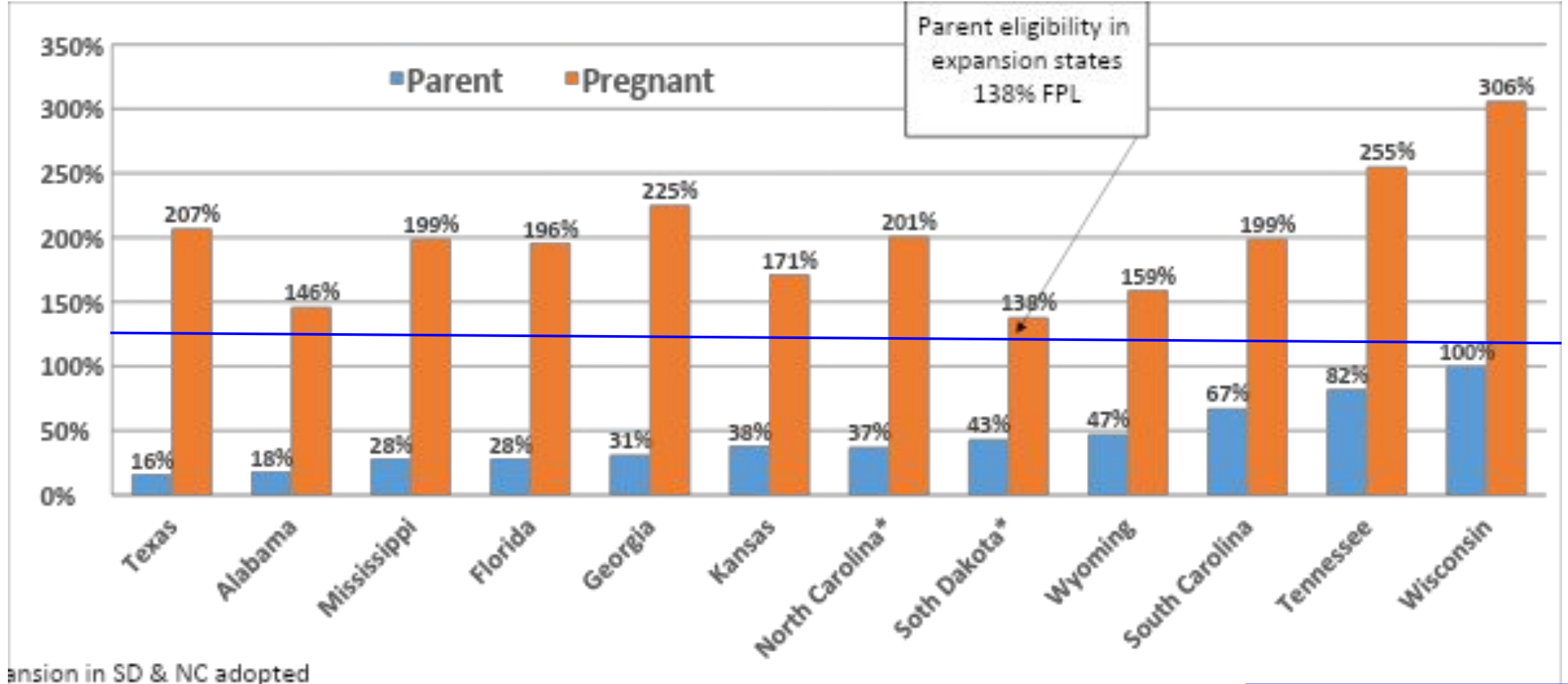
**Percentages of women who gave birth in the period 2005-13, by health insurance type and month before or after delivery**



Source: Daw J. *Health Affairs* 2017;  
36:598-606

# Medicaid Eligibility for Parent vs Pregnant Women in 12 Non-Expansion States

## *Medicaid eligibility thresholds, Jan., 2023*

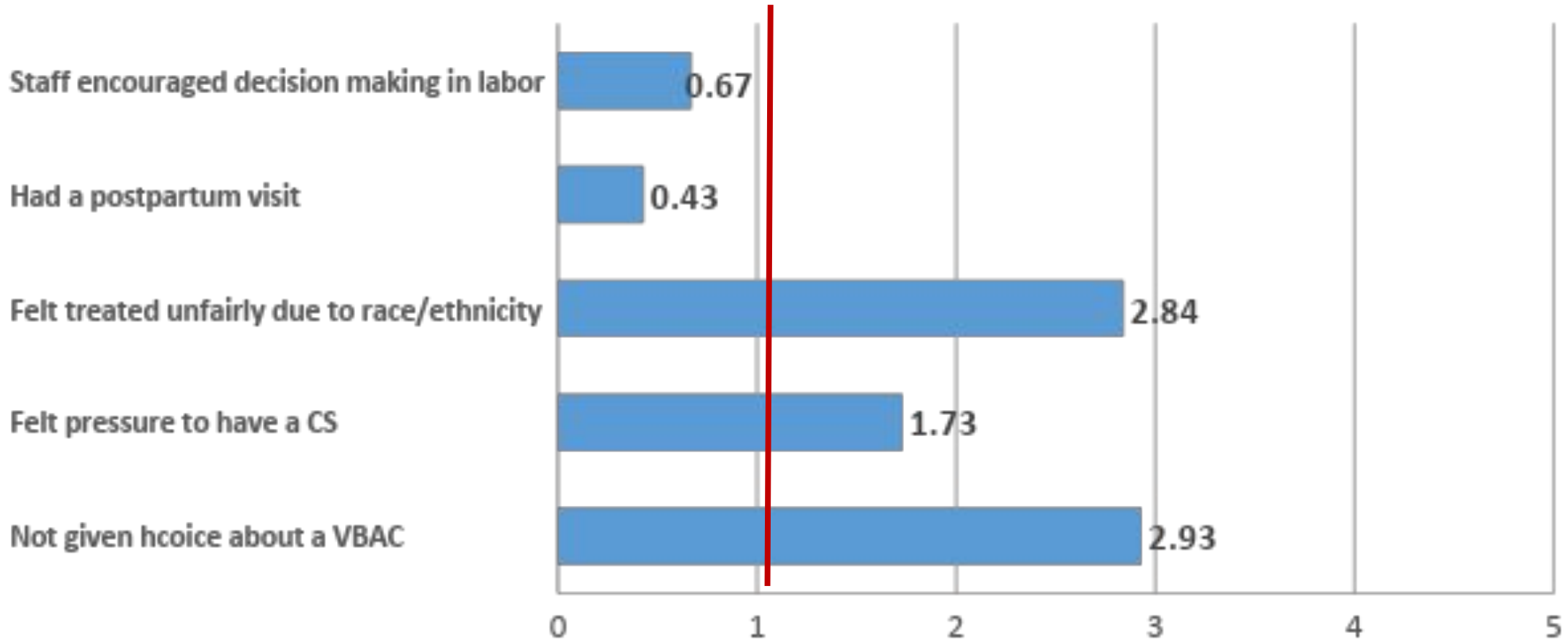


# Is expanding Medicaid eligibility out to 1 year postpartum the answer?

- Sort of...
- Since a significant proportion (30%) of maternal deaths occur between 42-365 postpartum, keeping women, especially vulnerable women, in the health care system makes sense.
- There is also the matter of how women on Medicaid are treated when they are getting care.



# Survey Results (Adjusted Odds Ratios\*) among women on Medicaid compared to private insurance



\* Adjusted for maternal age, prenatal provider, race/ethnicity, maternal education, US born, pregnancy complications, and agreement with statement “childbirth shouldn’t be interfered with unless medically necessary.” All ratios significant at  $p < .05$ .

Source: Declercq, E. Women’s experience of agency & respect in maternity care by type of insurance in Cal.. PLOS One. 2020; 15(7): e0235262

# States Implementing\* 12 Month Extension of Postpartum Eligibility (as of 6/2/23)

Alabama	Indiana	North Carolina
Arizona	Kansas	North Dakota
California	Kentucky	Ohio
Colorado	Louisiana	Oklahoma
Connecticut	Maine	Oregon
Delaware	Maryland	Pennsylvania
District of Columbia	Massachusetts	Rhode Island
Florida	Michigan	South Carolina
Georgia	Minnesota	Tennessee
Hawaii	New Jersey	Virginia
Illinois	New Mexico	Washington
		West Virginia

\* Only lists states that have implemented the extension. Several more are planning to implement.

# *Four Policy Recommendations to Reframe Maternal Deaths Review into Women's Health Campaign*

- 1. Use Maternal Mortality Review Committees to **explore pregnancy associated deaths** for causes and possible bases for prevention;*
- 2. Use linked datasets to examine women's health **through the lifecourse** and identify critical moments (e.g. pregnancy?) where intervention might matter;*
- 3. **Fund a systematic process for listening to women** tell us about their lives and experiences **in pregnancy and beyond** to craft sustainable solutions that are meaningful to them.*
- 4. Craft policies that keep **women of all ages** within the health and social system to prevent problems that lead to pregnancy associated deaths.*

# Black Maternal Health Week

April 11 - 17, 2021

BLACK MAMAS MATTER:  
CLAIMING OUR POWER, RESILIENCE & LIBERATION



Join us April 11-17 for a week of activism and community building for Black Mamas! In solidarity with National Minority Health Month and the International Day for Maternal Health and Rights, **Black Mamas Matter Alliance** founded BMHW to raise awareness, inspire activism, and strengthen organizing for Black maternal health. Join the conversation: **#BMHW21** and **#BlackMaternalHealthWeek**

[www.blackmamasmatter.org/bmhw](http://www.blackmamasmatter.org/bmhw)



# 10 YEARS

2010 2020



## EVERY MOTHER COUNTS

# NBEC

## NATIONAL BIRTH EQUITY COLLABORATIVE



# Lamaze

INTERNATIONAL

60TH ANNIVERSARY

# Midwives Alliance

NORTH AMERICA



# QMNC

QUALITY MATERNAL & NEWBORN CARE

# AMCHP

ASSOCIATION OF MATERNAL & CHILD HEALTH PROGRAMS




# AIM

ALLIANCE FOR INNOVATION ON MATERNAL HEALTH



# AMERICAN COLLEGE of NURSE-MIDWIVES

# NATIONAL MATERNAL HEALTH WEEK

MAY 5th-12th, 2019



## #MarchforMoms

## #BeyondMothersDay

- Promote State & Federal Legislative Efforts to Improve Maternal Health
- Drive Media Attention on State of Maternal Health
- Seek City, State and National Proclamations
- Organize Visits in DC on Capitol Hill May 10th
- Rally on National DC Mall on May 11th
- Livestream the Rally on Facebook Live
- Curate and Promote Daily Themes Related to Maternal Health

[www.birthbythenumbers.org](http://www.birthbythenumbers.org)





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