

# **Tracking Maternal Mortality in a COVID-19 Pandemic – Implications for Future Maternal Health**

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MCHB-NICHD Learning Opportunity series

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# Outline

- Background on Maternal Mortality in the U.S.
  - Definitions and data sources
  - Context: Obstetric health intersects with COVID-19 pandemic
- Maternal Mortality in the time of COVID-19
  - 2020
  - 2021
- Future Directions
  - Data considerations
  - Maternal health

# Background

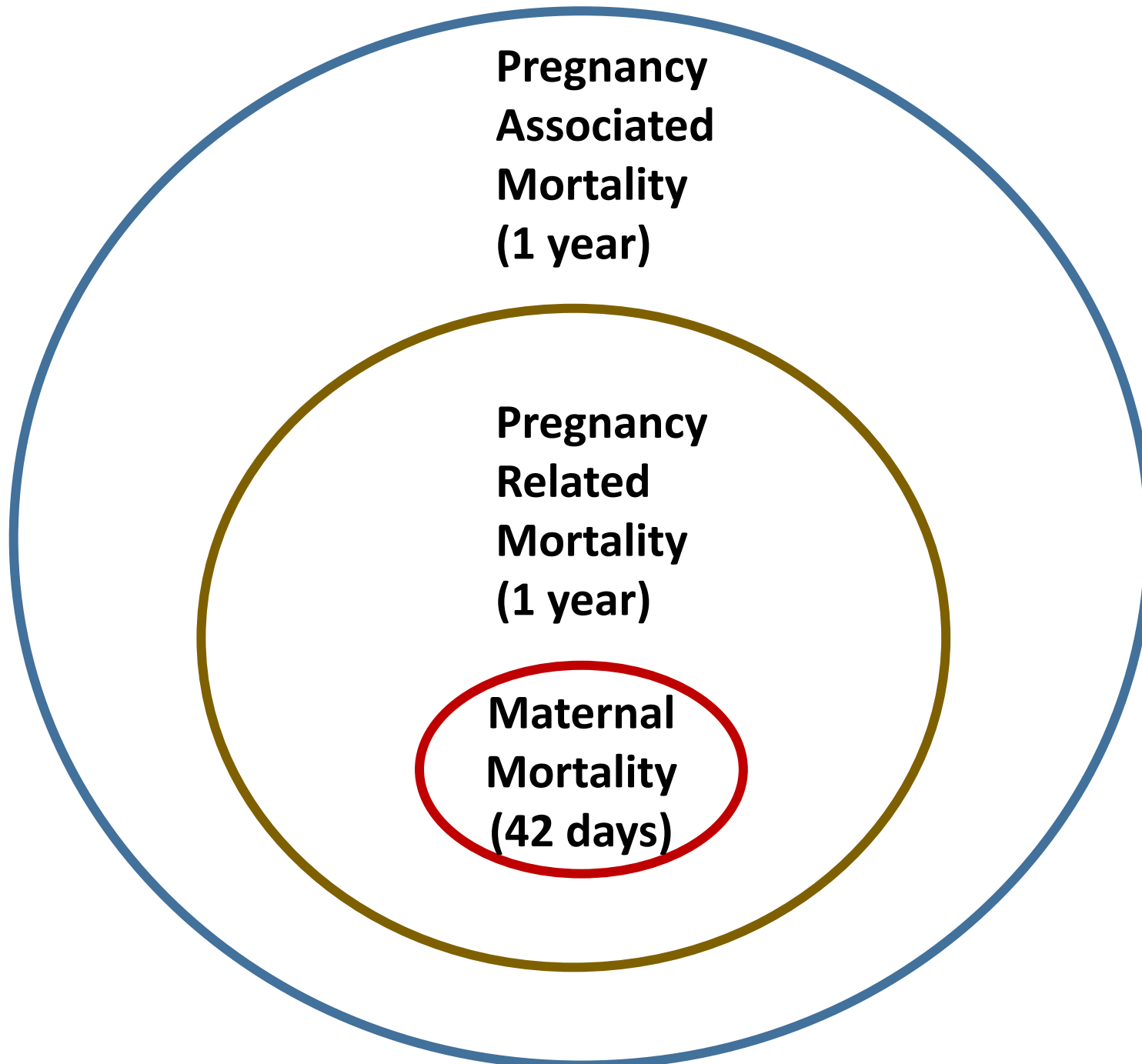
Definitions and Data Sources

# WHO Definitions

- **Maternal death**: The death of a woman **while pregnant or within 42 days of the end 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*.
  - ICD-10 codes: A34, O00-O95, and O98-O99 (corresponds to direct, indirect causes)
  - ***Official definition and coding scheme used for international comparisons***
- **Late maternal death**: The death of a woman from **direct or indirect obstetric causes  $\geq$  43 days but less than 1 year** after the end of pregnancy.
  - ICD-10 code: O96
  - ***Note: No differentiation of cause of death for all late maternal deaths***
- **Maternal Mortality Ratio (MMR)**: maternal deaths per 100,000 live births

# CDC Definitions

- **Pregnancy-related deaths**: 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 deaths**: Deaths during pregnancy and up to 1 year of the end of pregnancy.
  - *Starting point for Maternal Mortality Review Committees*



**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**

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

Pregnancy Associated Mortality (1 year)

91.7

Pregnancy Related Mortality (1 year)

27.8

Maternal Mortality (42 days)

18.6

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

# Data Sources

- **National Vital Statistics System (NVSS)**

- Based on **death certificates** (vital records) filed in the U.S.
- Official data source used for international comparisons of maternal mortality
- **Most recent data: 2021 – publicly available through CDC Wonder**

- **Pregnancy Mortality Surveillance System (PMSS)**

- Produces pregnancy-related mortality statistics (up to 1 year postpartum)
- Uses **death certificates** + supplemented with linkages to birth and fetal death records and other data sources
- Records reviewed to determine whether deaths were pregnancy-related
- **Most recent data: 2019 (data not available to researchers outside of CDC)**

- **Maternal Mortality Review Committees**

- Start with a list of pregnancy associated deaths from **death certificates**
- Investigate those deaths in to identify pregnancy related cases
- Goal: to assess causes, contributing factors, and preventability, and provide recommendations for prevention and monitor progress toward action
- **Being compiled by the MMRIA system into a proposed national database**
- **MMRCs in almost all states – most recent data: 36 states compiled, 2017-2019**



**Illinois Maternal Morbidity and Mortality Report**  
October 2018

This cover features a black and white photograph of a pregnant woman's hands resting on her belly. The title is in large white font on a dark background.

**LOUISIANA PREGNANCY-ASSOCIATED MORTALITY REVIEW**

The cover has a dark blue background with the title in white, bold, sans-serif font.

ALABAMA PUBLIC HEALTH  
Alabama Department of Public Health  
Bureau of Family Health Services

**2020**  
Maternal Mortality Review

The cover features a photograph of a pregnant woman in profile, wearing a yellow long-sleeved shirt. The title is in gold and teal text.

A MULTI YEAR LOOK AT MATERNAL MORTALITY IN MISSOURI, 2017-2019  
**PREGNANCY-ASSOCIATED MORTALITY REVIEW**

The cover has a light gray background with a photograph of a pregnant woman's hands. The text is in white and red.

**FLORIDA DEPARTMENT OF HEALTH**  
Florida's Maternal Mortality Review Committee 2020

Prepared by:  
Amy Robertson, PhD  
Vera Beloshitzkaya, PhD  
Angela Thompson, RN, BSN

Maternal and Child Health Section  
Bureau of Family Health Services  
Division of Community Health Promotion

October 2022

The cover features a circular image of a sunset over water. The Florida Health logo is prominent.

**NORTH CAROLINA Maternal Mortality Review Report**

The cover has a white background with the title in teal and blue text.

**Maternal Mortality Review**  
A Report on Maternal Deaths in Washington 2014-2015

The cover has a teal and yellow background with the title in dark teal.

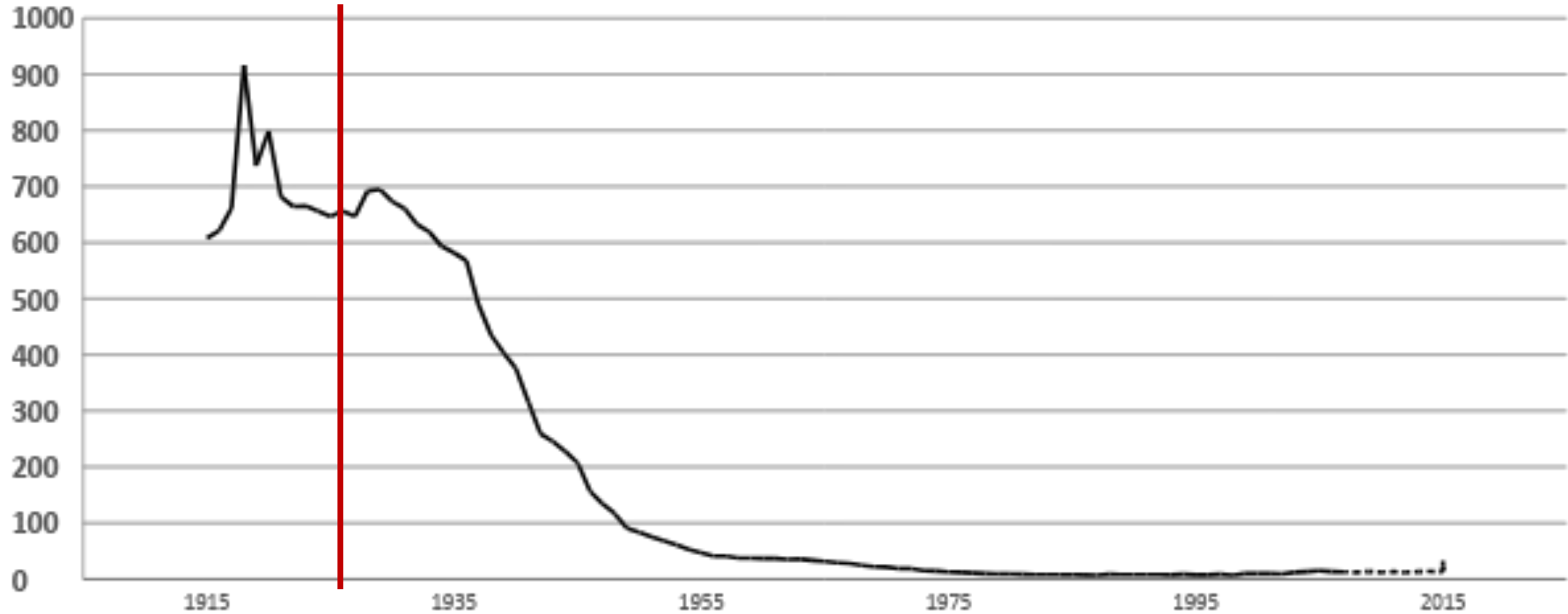
**Texas Maternal Mortality and Morbidity Review**  
Committee and Department of State Health Services Joint Biennial Report 2022

The cover has a white background with the title in blue text.

**Lack of consistency in how & if states report results**

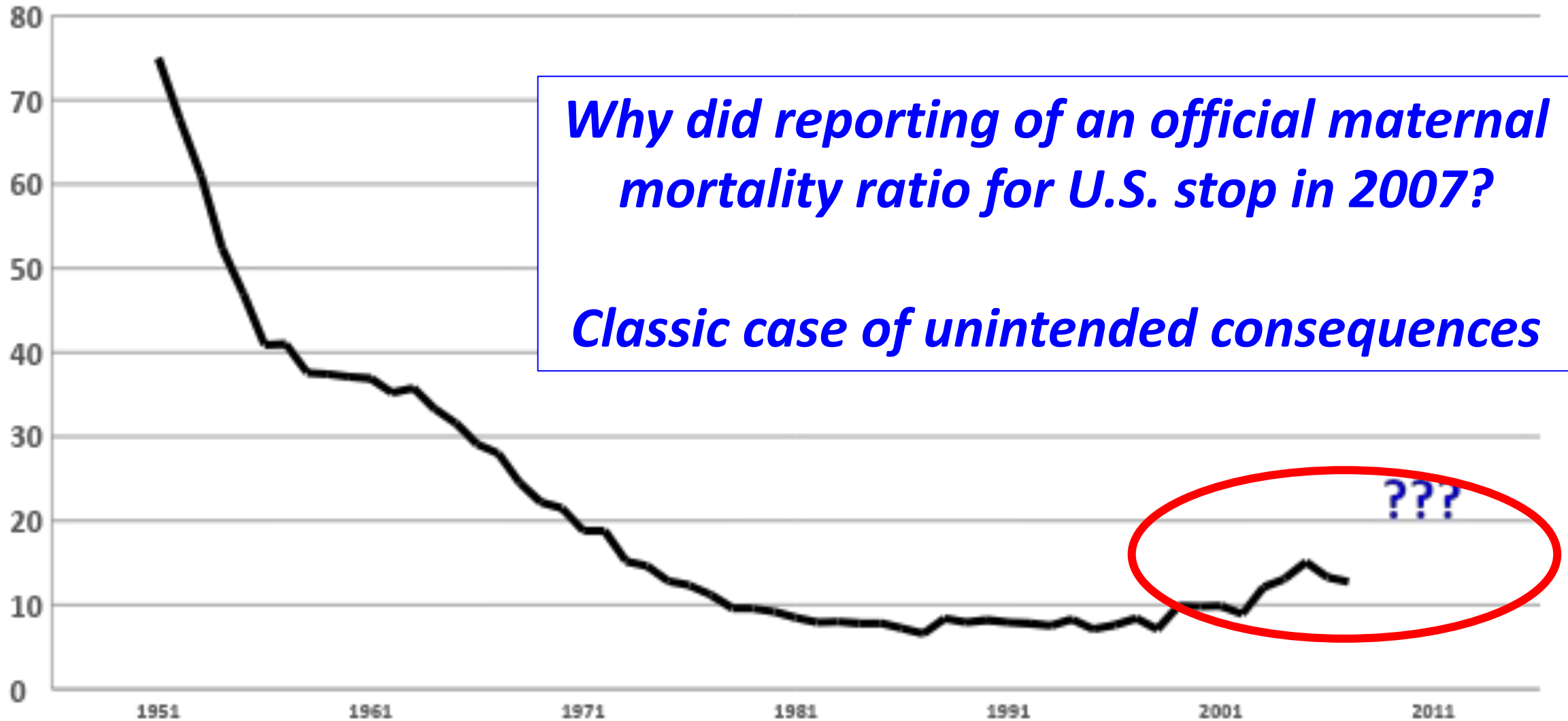
**How we got here**

# 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.

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



***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***

# 2003 death certificate revision: Pregnancy checkbox addition\*

## Checkbox format:

IF FEMALE:

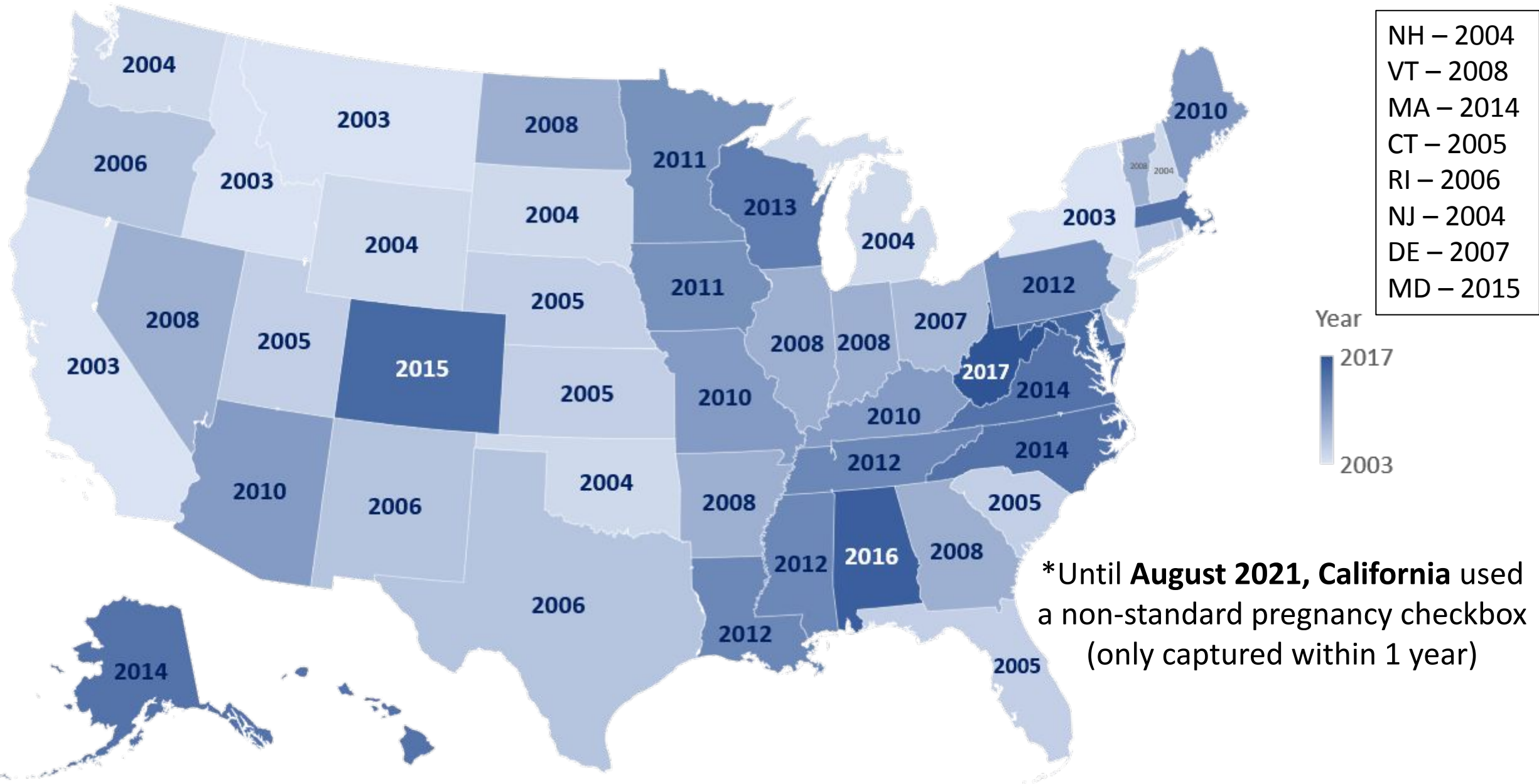
- Not pregnant within past year
- Pregnant at time of death
- Not pregnant, but pregnant within 42 days of death
- Not pregnant, but pregnant 43 days to 1 year before death
- Unknown if pregnant within the past year

- To improve ascertainment of pregnancy
- Reduce under-reporting of maternal deaths
- Recommendation by WHO to improve maternal death reporting from vital records

**\*WHO recommendation to improve maternal mortality ascertainment**

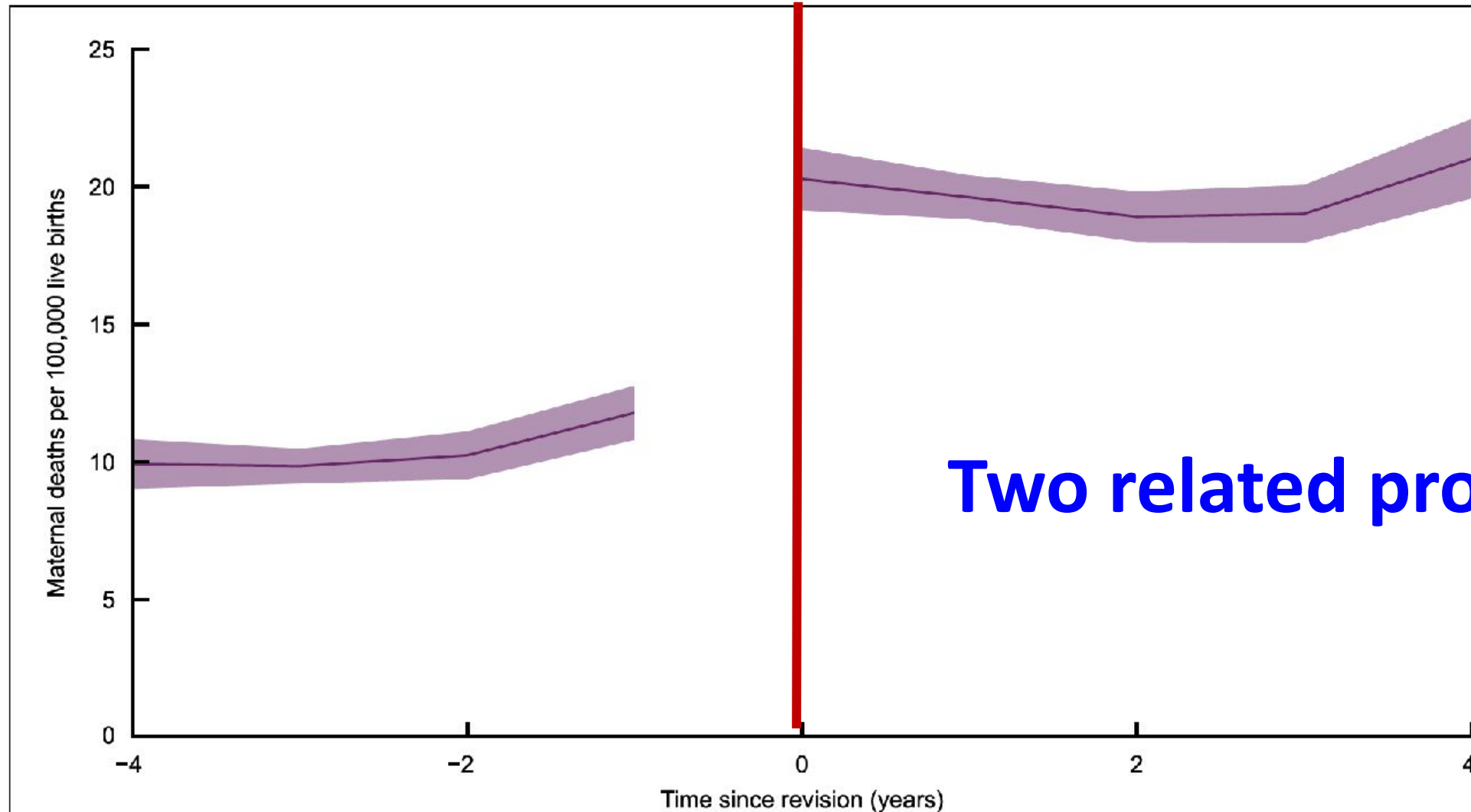
Source: Maternal mortality measurement: Guidance to improve national reporting, WHO, July 2022

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



# NCHS Analysis of the Impact of Checkbox

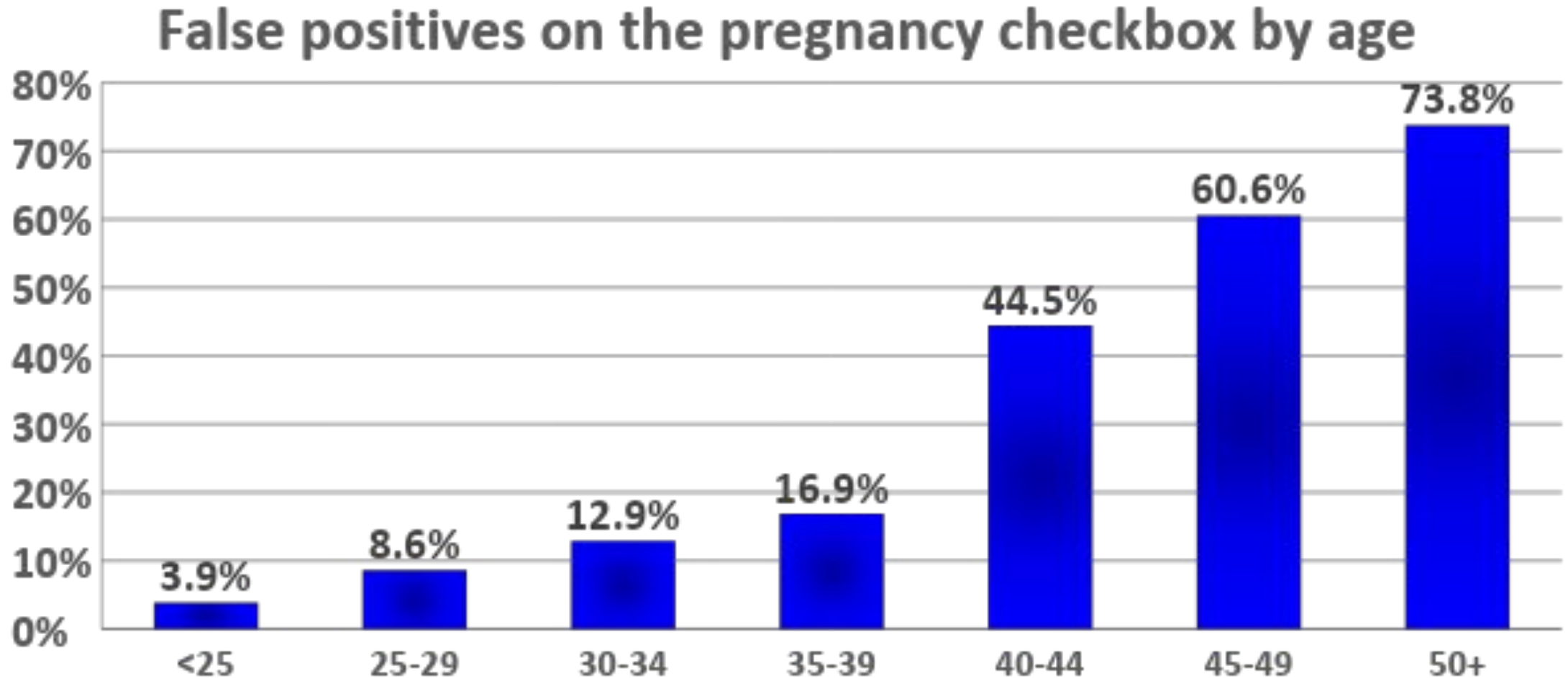
Figure 1. Average change in maternal mortality rates associated with the pregnancy checkbox implementation: United States, 2003–2017



**Two related problems**

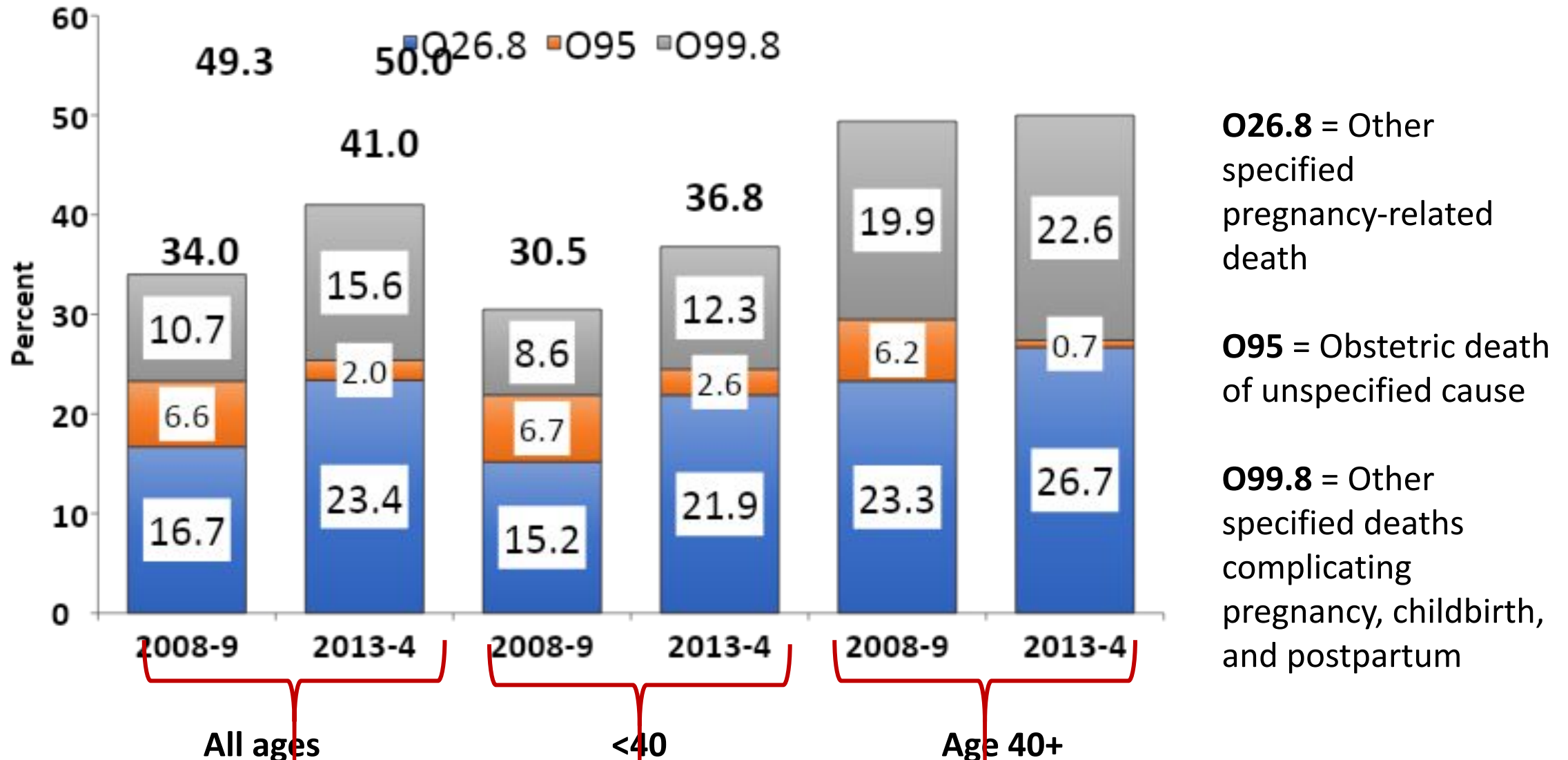


# 1) Over-ascertainment maternal deaths



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

## 2) Increase in “other” non-specific causes of death



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

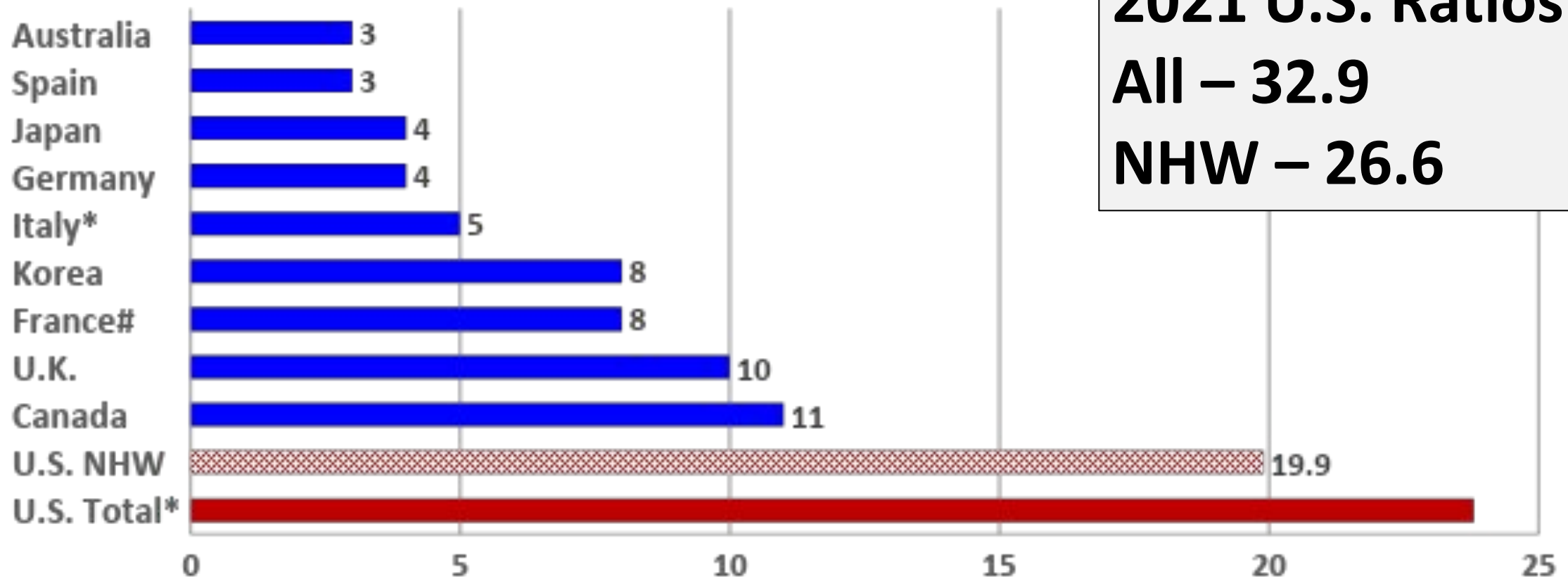
*Among the 1691 records originally coded as maternal deaths, 735 (43.5%) were originally coded to ill-defined or non-specific causes (O26.8, O95, O99.8). We were able to recode 694 (94.4%) of these cases to more specific causes of death as more specific information was available from the cause-of-death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

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

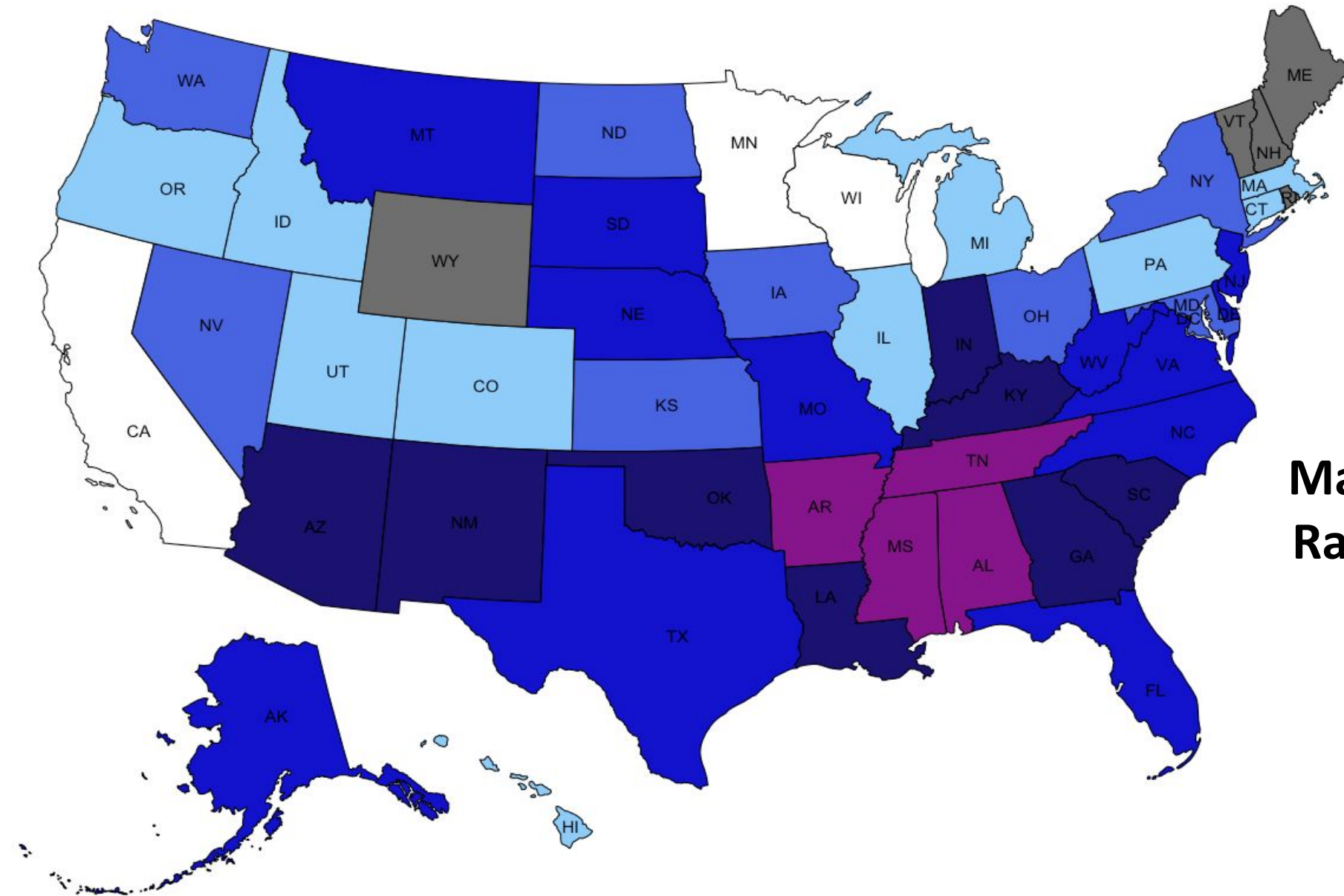
- While the checkbox contributed to errors, a Four MMRC Committee study showed that the *checkbox also improved identification of pregnancy-related deaths. **Without the pregnancy checkbox, states would have missed approximately:***
  - *50% of pregnancy-related deaths that occurred during pregnancy*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

# **U.S. Maternal Mortality in Context**

# 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, U.S. States\*, 2018-21

Source: CDC Wonder



\* States with < 10 maternal deaths, 2018-2020, are excluded from reporting

# Covid and Maternal Deaths

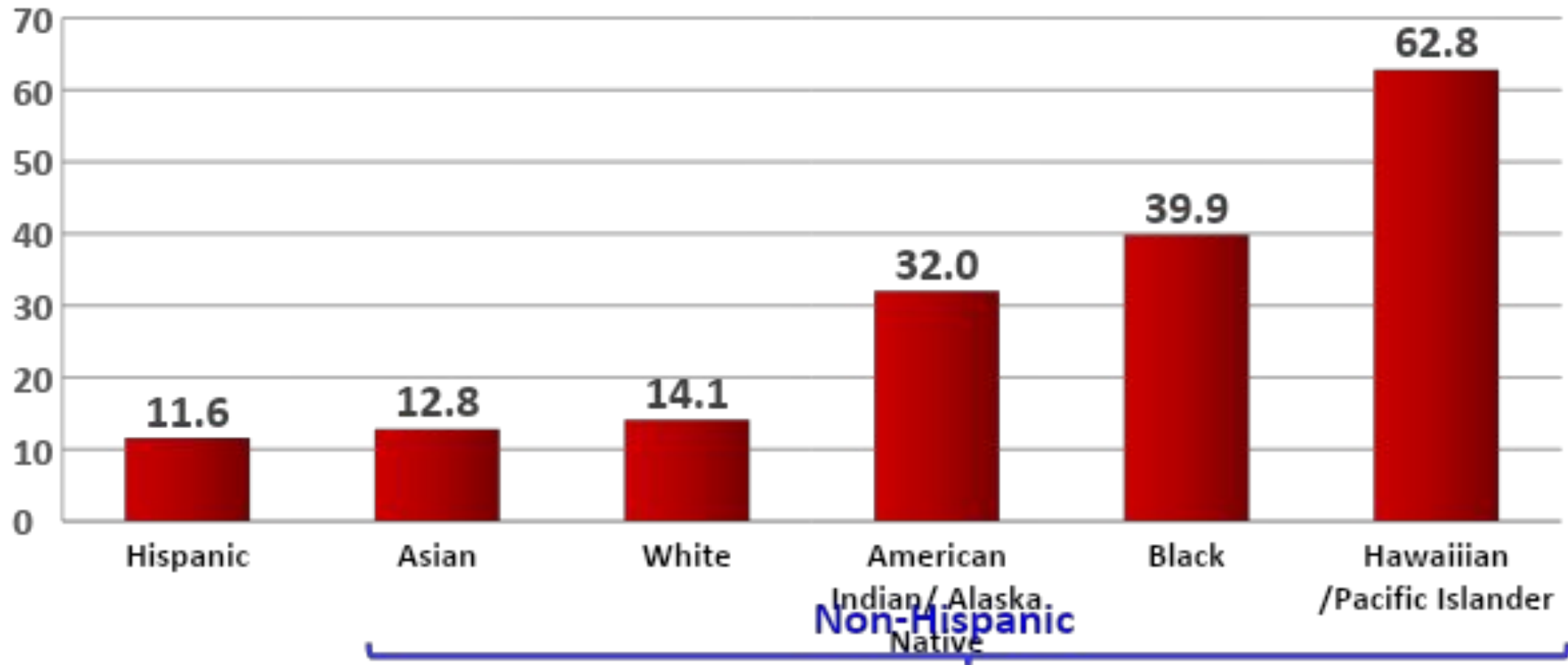
Backdrop of pregnancy-related mortality pre-pandemic





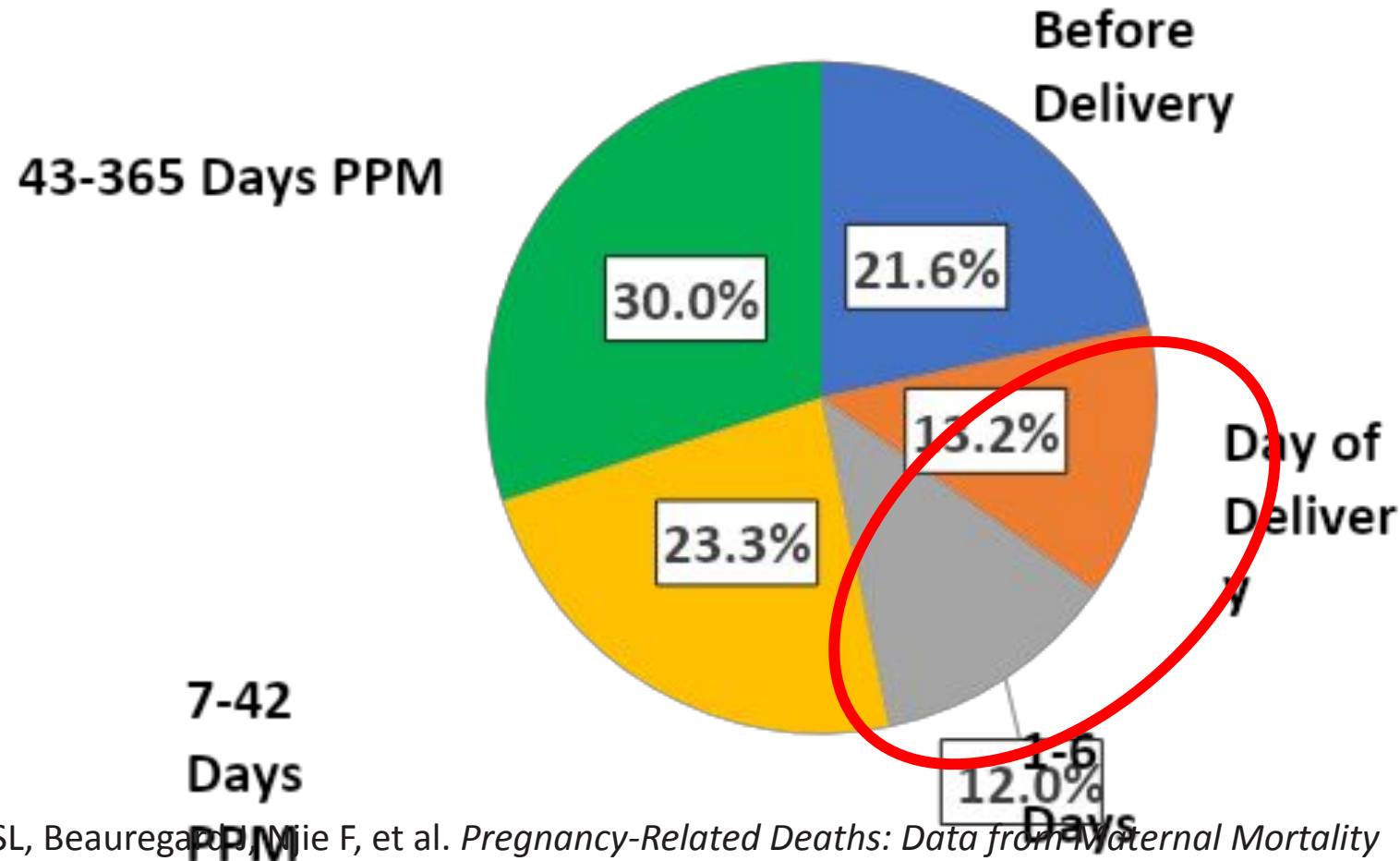
# The Context for COVID and Maternal Deaths

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



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

# Timing of Pregnancy-related deaths (2017-19)



Source: Trost SL, Beauregard J, Mijie 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 in the Time of COVID-19

2020

2021



Research Letter | Public Health

# All-Cause Maternal Mortality in the US Before vs During the COVID-19 Pandemic

Marie E. Thoma, PhD; Eugene R. Declercq, PhD

## Introduction

The National Center for Health Statistics (NCHS) reported an 18.4% increase in US maternal mortality (ie, death during pregnancy or within 42 days of pregnancy) between 2019 and 2020. The relative increase was 44.4% among Hispanic, 25.7% among non-Hispanic Black, and 6.1% among non-Hispanic White women.<sup>1</sup> Given a 16.8% increase in overall US mortality in 2020, largely attributed to the COVID-19 pandemic,<sup>2</sup> we examined the pandemic's role in 2020 maternal death rates.

+ Supplemental

Author affiliations listed at the end of the article.



? About this Attention Score

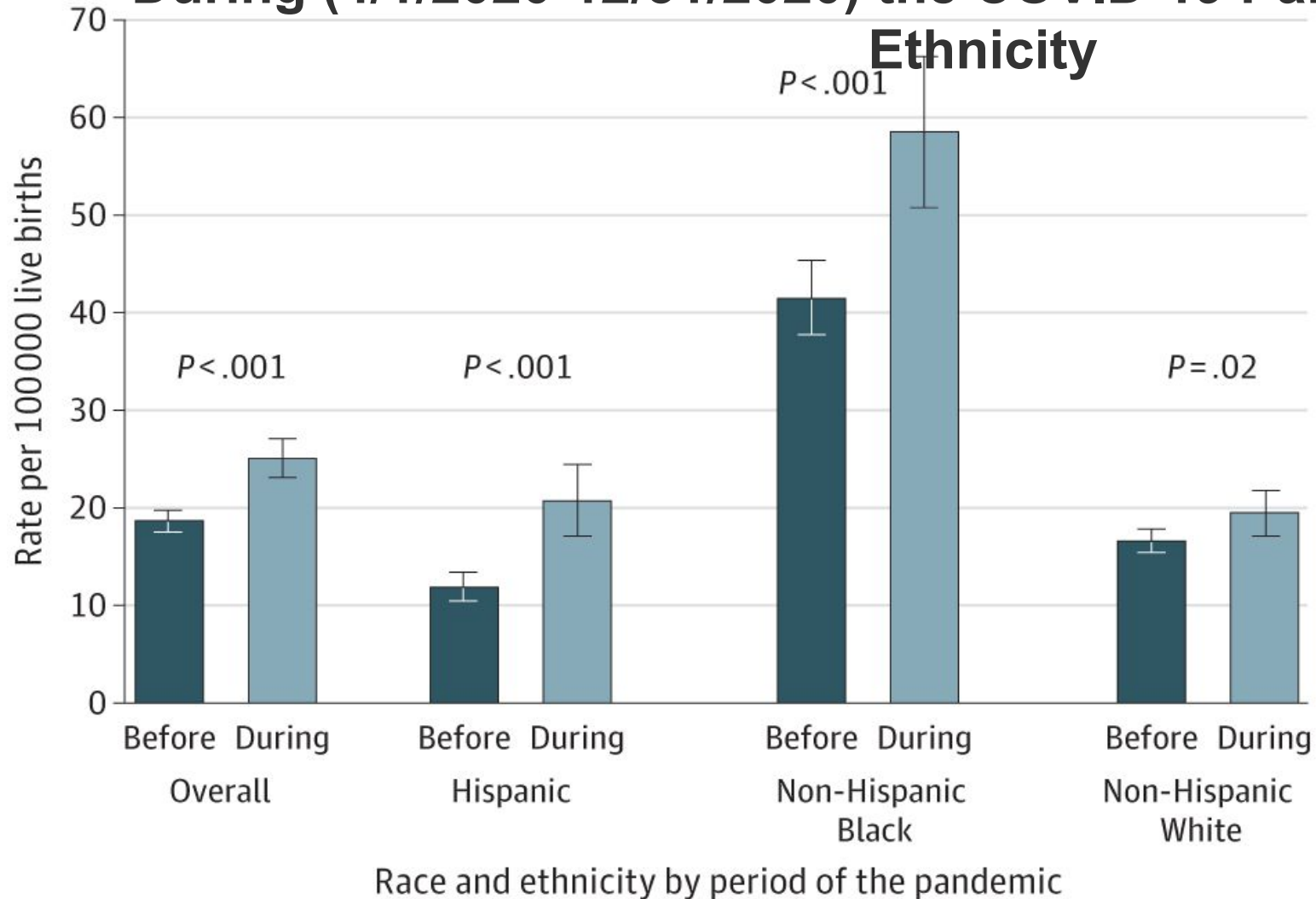
In the top 5% of all research outputs scored by Altmetric

# Methods

- **Data source:** U.S. Vital Records, multiple cause mortality data
- **Population**
  - All deaths in which the underlying cause was a maternal death (ICD-10: A34, O00-O-95, O98-O99) or late maternal death (ICD-10: O96)
  - **Maternal death:** “Death of a women while pregnant or within 42 days of the end of a pregnancy...from any cause related to or aggravated by the pregnancy or its management...”
  - **Late maternal death:** pregnancy-related death from 43 days to 1 years
- **Analysis**
  - Examined changes before (2018-March 2020) and during (April-Dec. 2020) the pandemic
    - specific causes of death based on ICD-10
    - the proportion of death with a secondary cause of COVID-19 (ICD-10: U07.1)
  - Examined differences in maternal mortality rates and % of maternal deaths with COVID-19 as a secondary cause by race/ethnicity
  - **For all maternal deaths, COVID-19 is listed is a contributory cause rather than the underlying, or main cause of death (per WHO/NCHS coding processes)**

# The impact of the pandemic on maternal mortality

US Maternal Mortality Rates (95% CI) Before (1/1/2018-3/31/2020) and During (4/1/2020-12/31/2020) the COVID-19 Pandemic by Race and Ethnicity



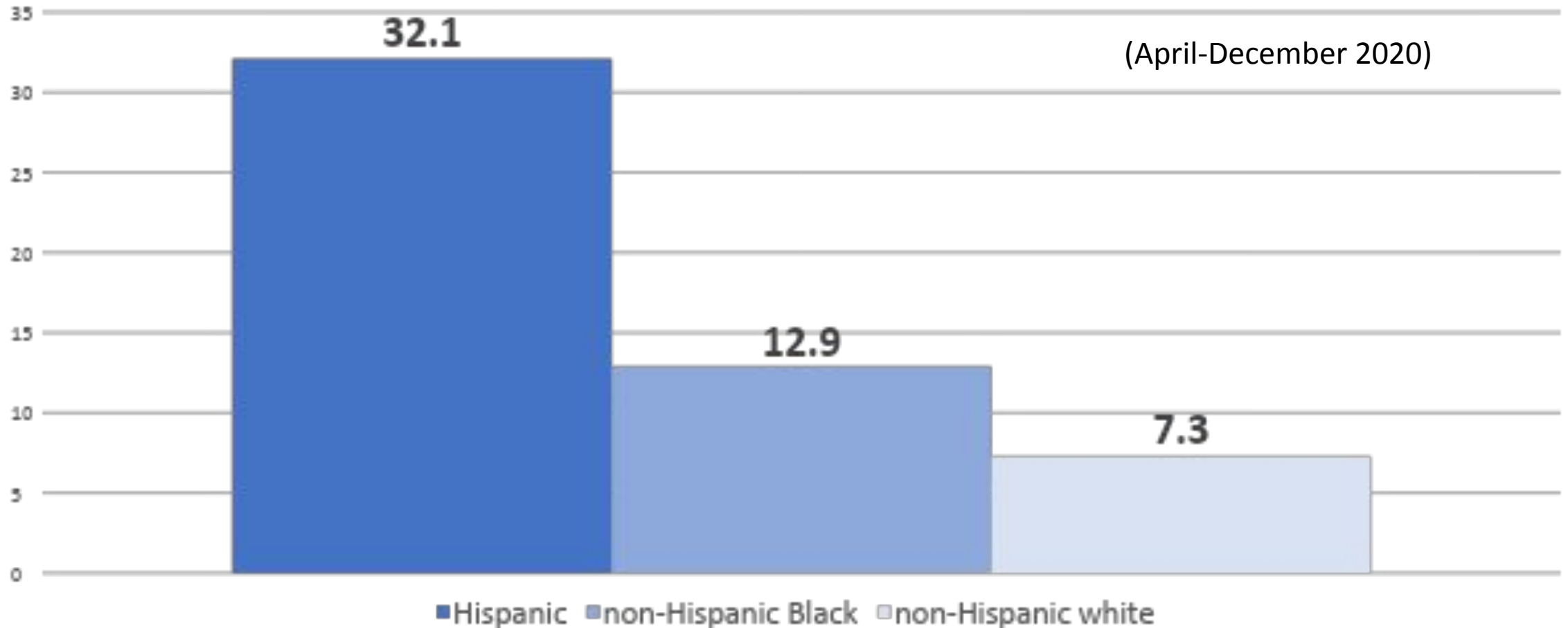
Late maternal deaths increased from:

8.2 to 11.6 deaths per 100,000 live births (41% relative change)

## Figure Legend:

US Maternal Mortality Rates (95% CI) Before and During the COVID-19 Pandemic by Race and Ethnicity All rates met standards of reliability (numerator >16 deaths), which corresponded to SEs that were below 25% of the rate under the assumption of a Poisson distribution. P values were based on z test of proportions comparing the period during the pandemic (April-December 2020) with the period before the pandemic (2018, 2019, and January-March 2020).

# What % of maternal deaths by race/ethnicity also listed COVID-19 as a contributory cause?



# Causes of maternal death that had the largest relative increase before vs. during the pandemic

- **Respiratory conditions** during pregnancy
  - Viral diseases (2374.7% relative change, 100% with COVID-19 code)\*
  - Disease of the respiratory system (117.7% relative change, 58% with COVID-19 code)
- **Cardiovascular/Metabolic** conditions during pregnancy
  - Diabetes (95.9% relative change, 21% COVID-19 code)
  - Hypertensive disorders (39% relative change, 9.9% COVID-19 code)
  - Diseases of the circulatory system (72.1% relative change, 1.4% COVID-19 code)
- **Other pregnancy-related condition** (O26.8) (48% relative change)
  - 22.6% COVID-19 code

\*pre-pandemic rates based on small, less reliable #s



*Original Research*

# Changes in Pregnancy-Related Mortality Associated With the Coronavirus Disease 2019 (COVID-19) Pandemic in the United States

*Marie E. Thoma, PhD, MHS, and Eugene R. Declercq, PhD*

**OBJECTIVE:** To examine pregnancy-related mortality ratios before (January 2019–March 2020) and during (April 2020–December 2020 and 2021) the coronavirus disease 2019 (COVID-19) pandemic overall, by race and ethnicity, and by rural–urban classifications using vital records data.

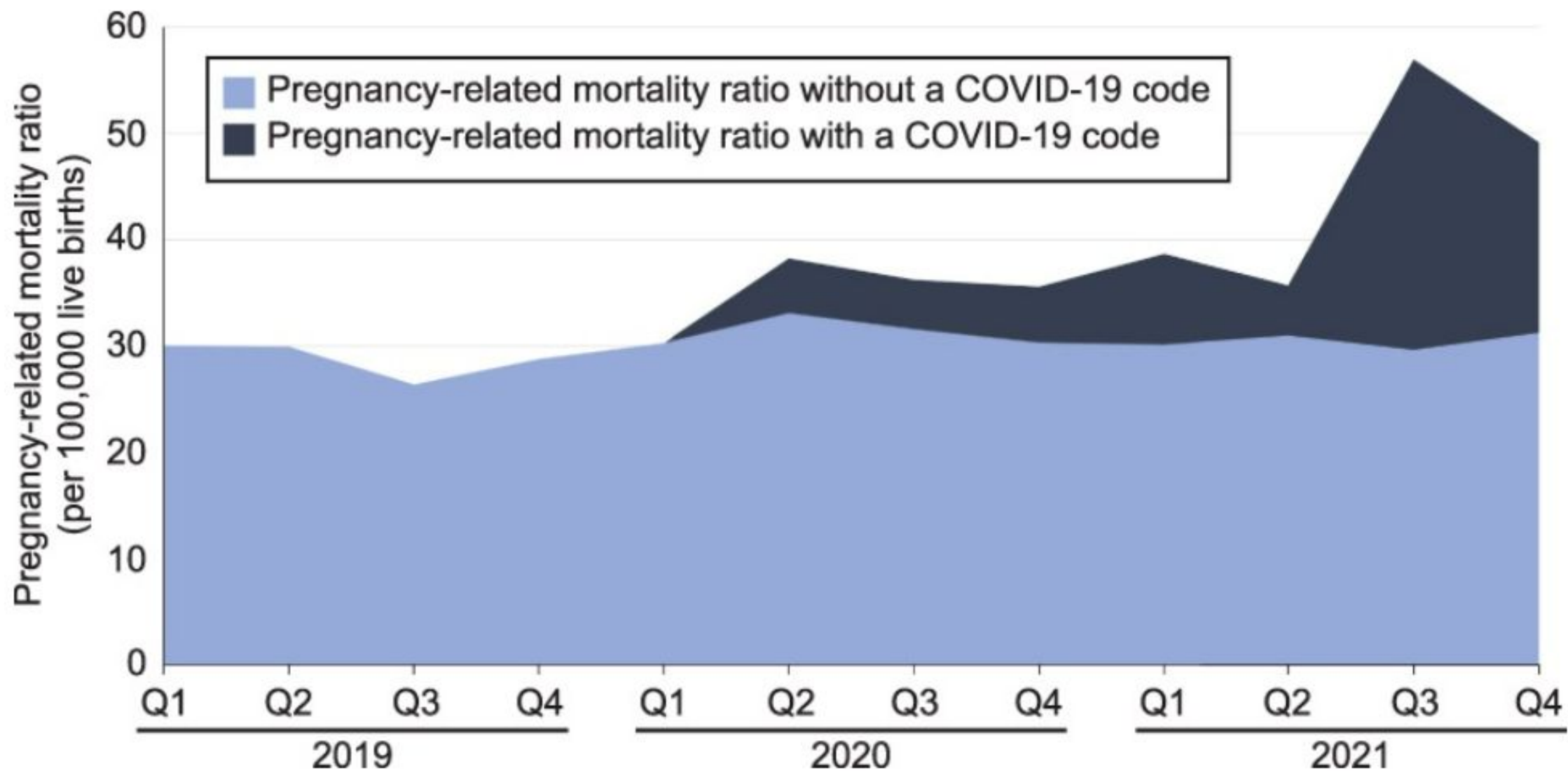
during (April 2020–December 2020 and 2021) the COVID-19 pandemic.

**RESULTS:** Pregnancy-related mortality was significantly higher in 2021 (45.5/100,000 live births) compared with during the pandemic in 2020 (36.7/100,000 live births) and before the pandemic (29.0/100,000 live births).

March 2023

# Methods

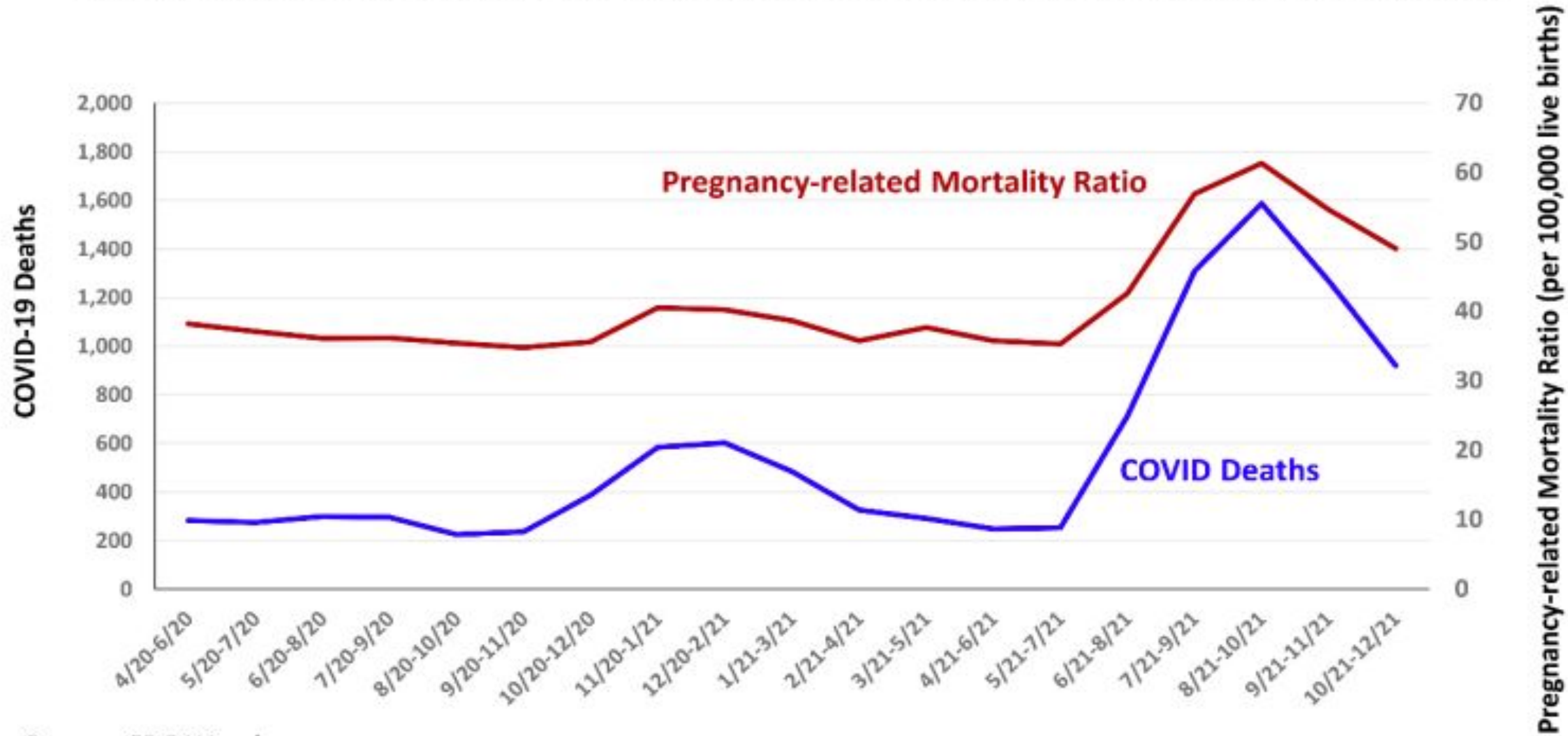
- **Data source:** U.S. Vital Records, multiple cause mortality data (CDC Wonder)
- **Population**
  - **Pregnancy related deaths:** All deaths in which the underlying cause was a maternal death (ICD-10: A34, O00-O96, O98-O99) or late maternal death (ICD-10: O96)
- **Analysis**
  - Overall pregnancy-related mortality ratios were partitioned by whether COVID-19 was listed as a contributory cause
    - Quarterly estimates were compared between 2019 and 2021.
  - Pregnancy-related mortality ratios before (2019–March 2020) and during (April 2020–December 2020 and 2021) the COVID-19 pandemic were compared by:
    - More detailed race and ethnicity groups
    - rural–urban residence



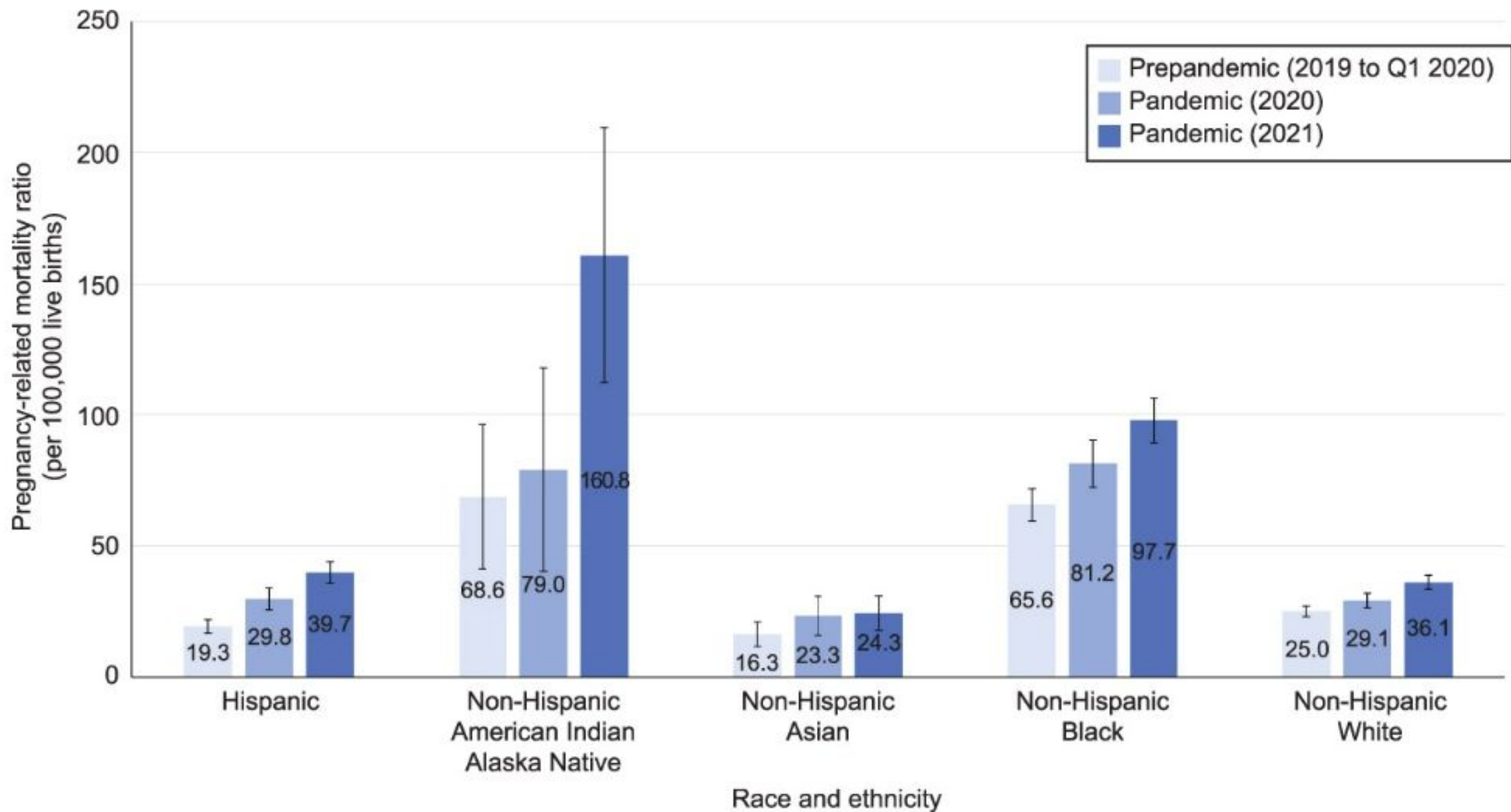
Quarterly pregnancy-related mortality ratios by coronavirus disease 2019 (COVID-19) contributory cause, 2019–2021, United States. Q, quarter.

Pregnancy-related = maternal + late maternal deaths

# 3-Month Moving Averages for COVID-19 Deaths (Females 15-44) and Pregnancy-related Mortality Ratios (per 100,000 live births), United States, April 2020-December 2021



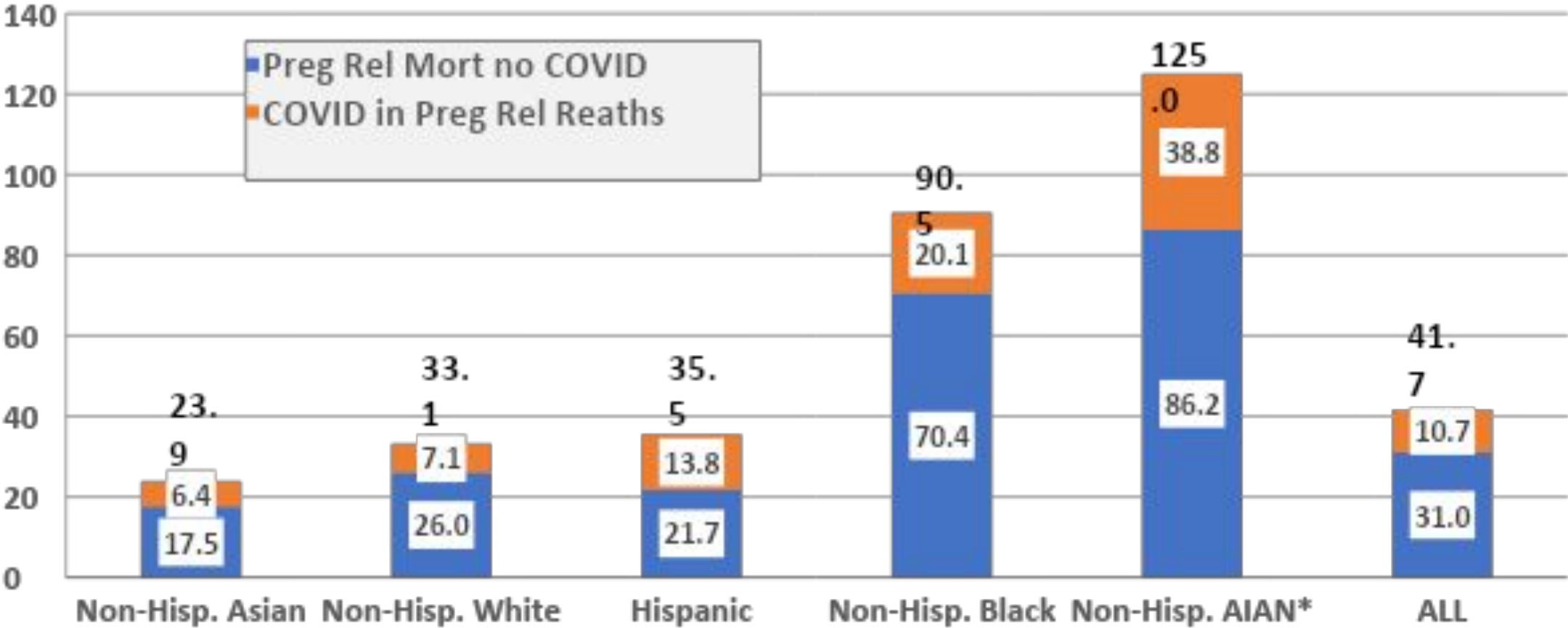
Source: CDC Wonder



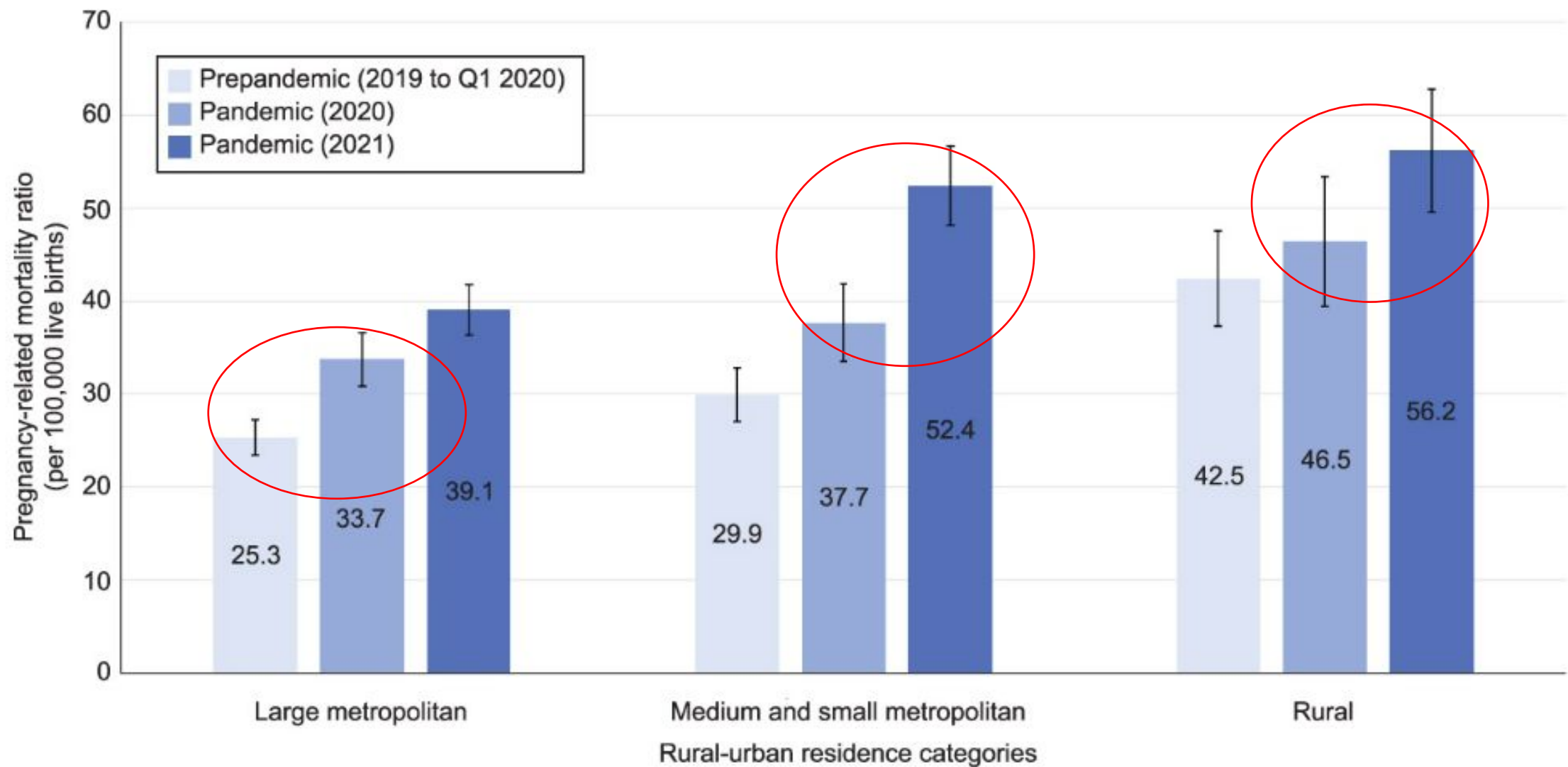
Pregnancy-related mortality ratios by race and ethnicity during vs before the coronavirus disease 2019 (COVID-19) pandemic, 2019–2021, United States. Race and ethnicity categories are single-race categories. All race categories are non-Hispanic origin. Hispanic origin includes all races.

# Pregnancy Related # Death Ratios with & without a COVID Code by Race-Ethnicity, 4/2020 – 12/2021

Pregnancy Related Mortality per 100,000 Births



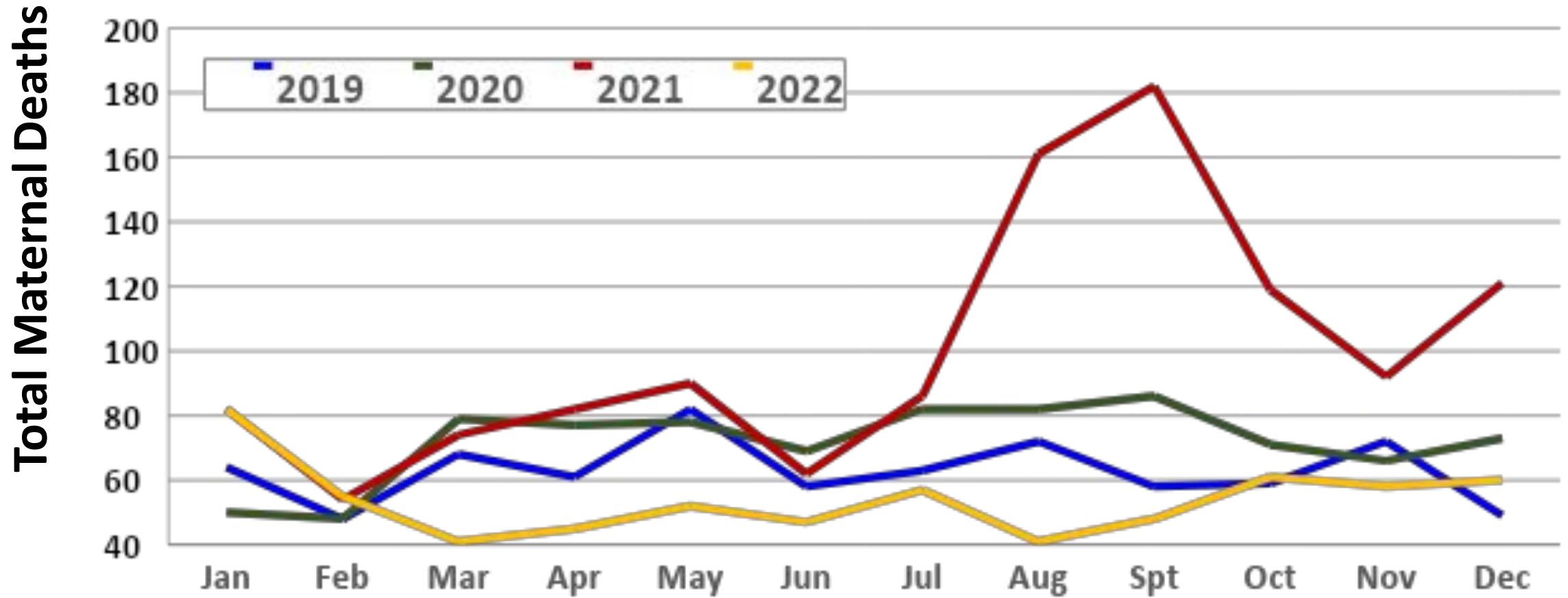
# Deaths during pregnancy and up to 1 year after delivery;  
 \*AIAN – American Indian Alaskan Native



Pregnancy-related mortality ratios by rural-urban residence during vs before the coronavirus disease 2019 (COVID-19) pandemic, 2019–2021, United States. Six rural-urban residence categories were collapsed to three to ensure reliable estimates: large urban (large central, large fringe metropolitan), medium and small urban (medium, small metropolitan), and rural (micropolitan, noncore areas).

# Preview of 2022:

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





# Summary

- **Maternal deaths** have a high impact on society. These are **largely preventable** deaths of women/pregnant people in the prime of life, often with families and other small children needing care.
  - Accurate measurement of maternal mortality is an essential first step in prevention efforts
- Data efforts on maternal mortality have improved in recent years, particularly since 2018
- The COVID-19 pandemic may have **directly AND indirectly**
  - Increased maternal mortality
  - Exacerbated existing disparities (NH Black, AIAN) and created new ones (Hispanic)
  - AIAN women and Med/small metro and rural areas saw the largest rise in MMR in 2021
- While the pandemic effects may be lessening, maternal mortality in the U.S. **still remains far higher than other high-income countries**

# Data and Programmatic Implications

# Data Considerations

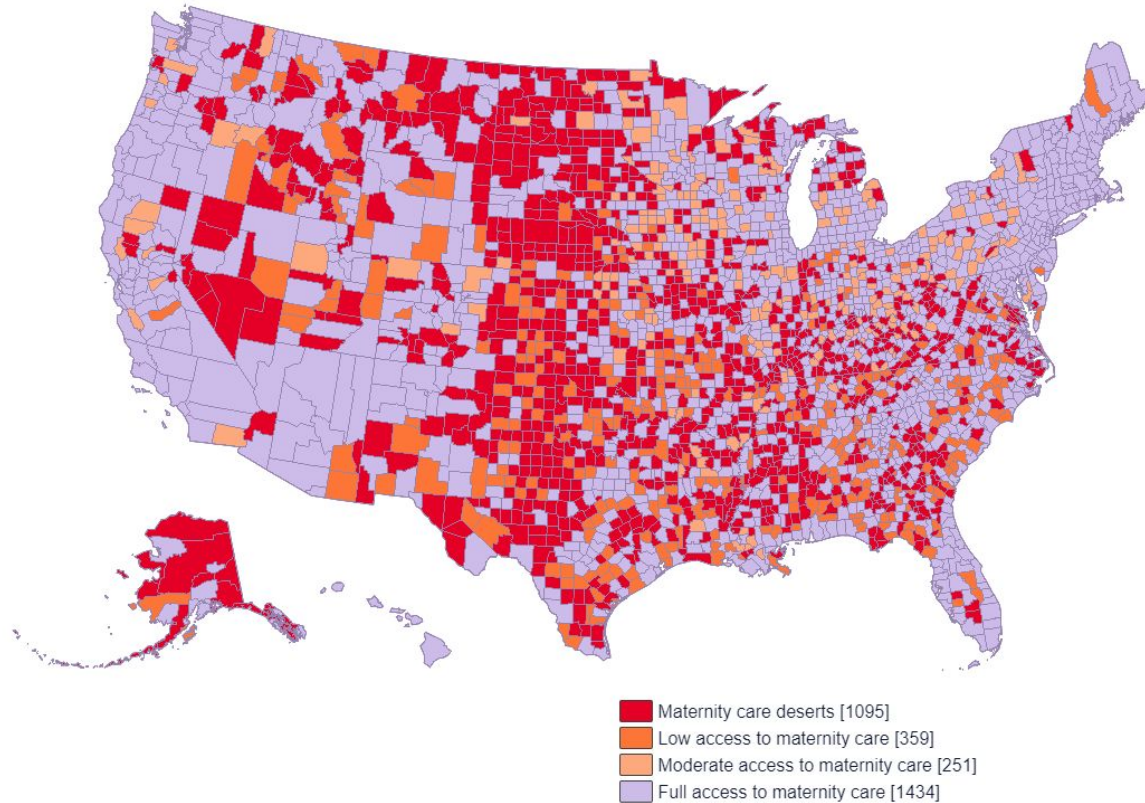
- The pandemic showed us the need for timely (and accurate) mortality data
  - Vital statistics are the most timely and publicly available
  - MMRCs are becoming more applicable nationally as data from states are added
- Enhance **quality improvement efforts** in every state to improve data quality for the pregnancy checkbox item.
- Include more **training** for persons who complete death certificates
  - Procedures to confirm pregnancy-status
- Improve surveillance pregnancy-associated mortality

# Direct impacts of COVID-19

- Increased susceptibility during pregnancy
  - Immunological changes (suppress immune system to accommodate the fetus) that increase risks from respiratory viruses
  - Cardiovascular output is increased to produce more blood to sustain the placenta – SARS-CoV-2 binds to tissues in the cardiovascular system
  - As fetus gets larger, it pushes against the diaphragm making it harder to clear lungs (increased risk of pneumonia)
  - Co-morbidities are a risk factor for more severe COVID-19
    - Diabetes, hypertension

# Obstetric services became even harder to reach

## Maternity Care Deserts



## Compounded by the pandemic



VOX.COM

**Maternity wards are shuttering across the US during the pandemic**

<https://www.vox.com/22923432/maternity-wards-hospitals-covid-19-pandemic>

# Barriers to receiving prenatal care and support during labor and delivery

Journal of Law and the Biosciences, 1–17  
doi:10.1093/jlb/ljaa079  
Essay



## Going solo: the law and ethics of childbirth during the COVID-19 pandemic

Nofar Yakovi Gan-Or\*

Columbia Law School, New York, NY 10027, USA  
Corresponding author. E-mail: ny2248@columbia.edu

<https://academic.oup.com/jlb/article/7/1/ljaa079/5918380>

Morbidity and Mortality Weekly Report

## Delay or Avoidance of Medical Care Because of COVID-19–Related Concerns — United States, June 2020

Mark É. Czeisler<sup>1,2</sup>; Kristy Marynak, MPP<sup>3,4</sup>; Kristie E.N. Clarke, MD<sup>3</sup>; Zainab Salah, MPH<sup>3</sup>; Iju Shakya, MPH<sup>3</sup>; JoAnn M. Thierry, PhD<sup>3</sup>; Nida Ali, PhD<sup>3</sup>; Hannah McMillan, MPH<sup>3</sup>; Joshua F. Wiley, PhD<sup>1</sup>; Matthew D. Weaver, PhD<sup>1,5,6</sup>; Charles A. Czeisler, PhD, MD<sup>1,5,6</sup>; Shantha M.W. Rajaratnam, PhD<sup>1,2,5,6</sup>; Mark E. Howard, MBBS, PhD<sup>1,2,7</sup>

Temporary disruptions in routine and nonemergency medical care access and delivery have been observed during periods of considerable community transmission of SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19) (1). However, medical care delay or avoidance might increase morbidity and

18–24 years versus adults aged 25–44 years (aPR = 1.5); and persons with disabilities<sup>§</sup> versus those without disabilities (aPR = 1.3). Given this widespread reporting of medical care avoidance because of COVID-19 concerns, especially among persons at increased risk for severe COVID-19, urgent efforts are warranted to

<https://www.cdc.gov/mmwr/volumes/69/wr/mm6936a4.htm>

# Vaccine hesitancy in pregnancy

## Sources of Vaccine Hesitancy: Pregnancy, Infertility, Minority Concerns, and Gene

Albert L. Hsu,<sup>1</sup> Traci Johnson,<sup>2</sup> Lynelle Phillips,<sup>3</sup> and Taylor B. Nelson<sup>4</sup>

<sup>1</sup>Reproductive Medicine and Fertility Center, Department of Obstetrics, Gynecology and Women's Health, University of Missouri–Kansas City, Kansas City, Missouri, USA, <sup>2</sup>Department of Obstetrics and Gynecology, University of Missouri–Kansas City, Kansas City, Missouri, USA, <sup>3</sup>Department of Obstetrics and Gynecology, University of Missouri–Columbia, Missouri, USA, and <sup>4</sup>Division of Infectious Diseases, Department of Medicine, University of Missouri–Columbia, Missouri, USA

The coronavirus disease 2019 (COVID-19) epidemic continues to be noted over the past months. The limited data and evolving recommendations led to some understandable hesitancy among pregnant individuals. COVID-19 vaccines to infertility are widespread, leading to vaccine hesitancy. The disproportionate impact of COVID-19 on communities of color and African Americans by the biomedical research community in the United States has led to vaccine hesitancy among some of our most vulnerable. The complex nature of vaccine hesitancy, influenced by demographic, political, age, geographical, and socioeconomic factors, requires individualized approaches to each patient.

**Keywords.** COVID-19 pandemic; COVID-19 vaccines; vaccine hesitancy

<https://academic.oup.com/ofid/article/9/3/ofad009>

## Researchers debate inclusion of pregnant, chestfeeding people in clinical trials

Caitlin VanOverbergh | Mar 15, 2023

f in t e + MORE



fuels fears surrounding

Centers for Disease Control and Prevention recommend that pregnant women get vaccinated as soon as possible, to protect both

<https://www.cdc.gov/media/releases/2021/s0401-covid-vaccine-pregnancy-misinformation.html>

# Impacts on mental health during and after pregnancy

## A third of new moms had postpartum depression during early COVID

*People who delivered babies during the pandemic also reported more distress and anxiety.*



Justine Ross, Michigan Medicine

For many, having a baby during the pandemic era may have been a more isolating experience than usual. Masks during delivery. Birthing without a partner in the room. Skipping traditional baby showers. Fewer visits from family and friends.

<https://labblog.uofmhealth.org/rounds/a-third-of-new-moms-had-postpartum-depression-during-early-covid>



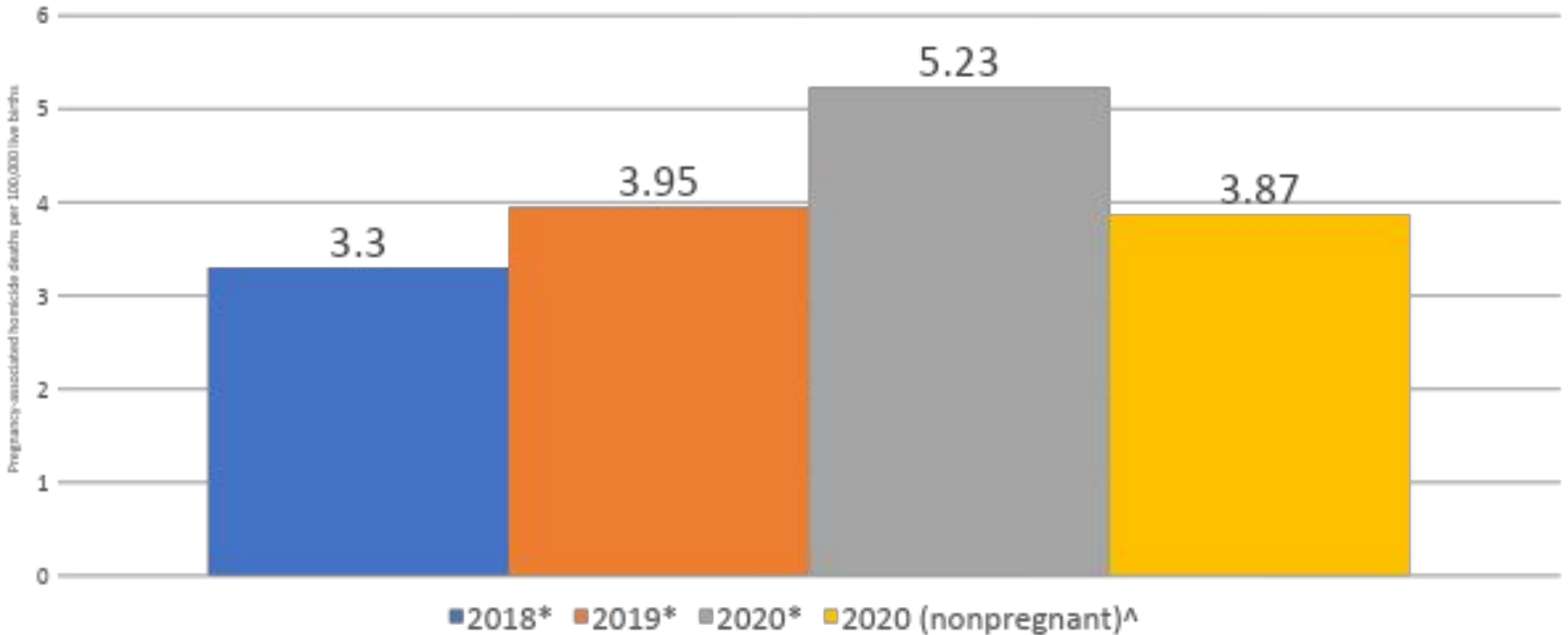
UAB.EDU

**The pandemic is increasing intimate partner violence. Here is how health care providers can help.**

<https://www.uab.edu/news/health/item/12390-the-pandemic-is-increasing-intimate-partner-violence-here-is-how-health-care-providers-can-help>



# Rise in pregnancy-associated homicide deaths in 2020



Pregnancy-associated homicide rates

# The pandemic also came with innovation in the delivery of prenatal care

## Prenatal Care May Look Very Different After Coronavirus

The shift from in-person visits to telehealth appointments could be here to stay.



Michelle Mildenberg

By Emily Goligoski

Published April 28, 2020 Updated May 1, 2020

<https://www.nytimes.com/2020/04/28/parenting/pregnancy/coronavirus-prenatal-care.html>



PERMANENTE.ORG

**Kaiser Permanente plans to offer remote blood pressure monitoring for all pregnancies - Permanente Medicine**

The new model for perinatal care features:

- **Blended model of care**, an intentionally sequenced set of in-person and virtual clinical care appropriate for low-risk patients.
- **Remote monitoring**, with Bluetooth-connected weight scales and blood pressure monitors provided to each patient that shares readings with their electronic health record via a mobile app, as well as a doppler device to check fetal heart tones.
- **Single digital home**, with seamlessly connected digital capabilities to support Kaiser Permanente members during their pregnancies.

# Policy Considerations

FOR IMMEDIATE RELEASE

April 1, 2022

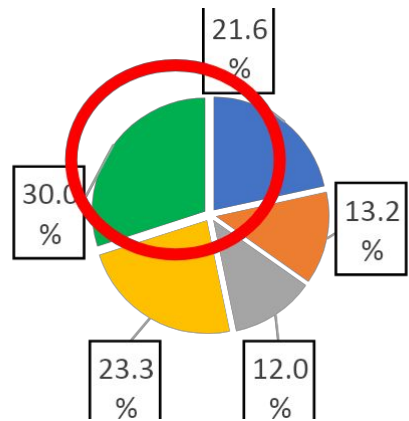
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## Thousands More People with Medicaid and CHIP Coverage Now Eligible to Access Critical Postpartum Coverage Thanks to the American Rescue Plan

*Louisiana is the first state to partner with the Biden-Harris Administration to extend Medicaid and CHIP postpartum coverage for a full 12 months under its state plan, and additional states are seeking to extend coverage under the American Rescue Plan*



***If 30% of deaths occur after 42 ppm, why are we dropping people from coverage?***

## WHITE HOUSE BLUEPRINT FOR ADDRESSING THE MATERNAL HEALTH CRISIS

JUNE 2022



# Questions

