Maternal Mortality Part 2

The Mysterious Case of the Pregnancy Checkbox: *how solving one problem created a new one*

Gene Declercq, PhD

February, 2025

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***.

Why a Pregnancy Checkbox?

Building the case for a Pregnancy Checkbox

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. Berg, MD, MPH

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

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

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

Conclusions: The availability of pregnancy status information on death certificates is a simple and effective aid in ascertaining a pregnancy-related death, when no other indicators of

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

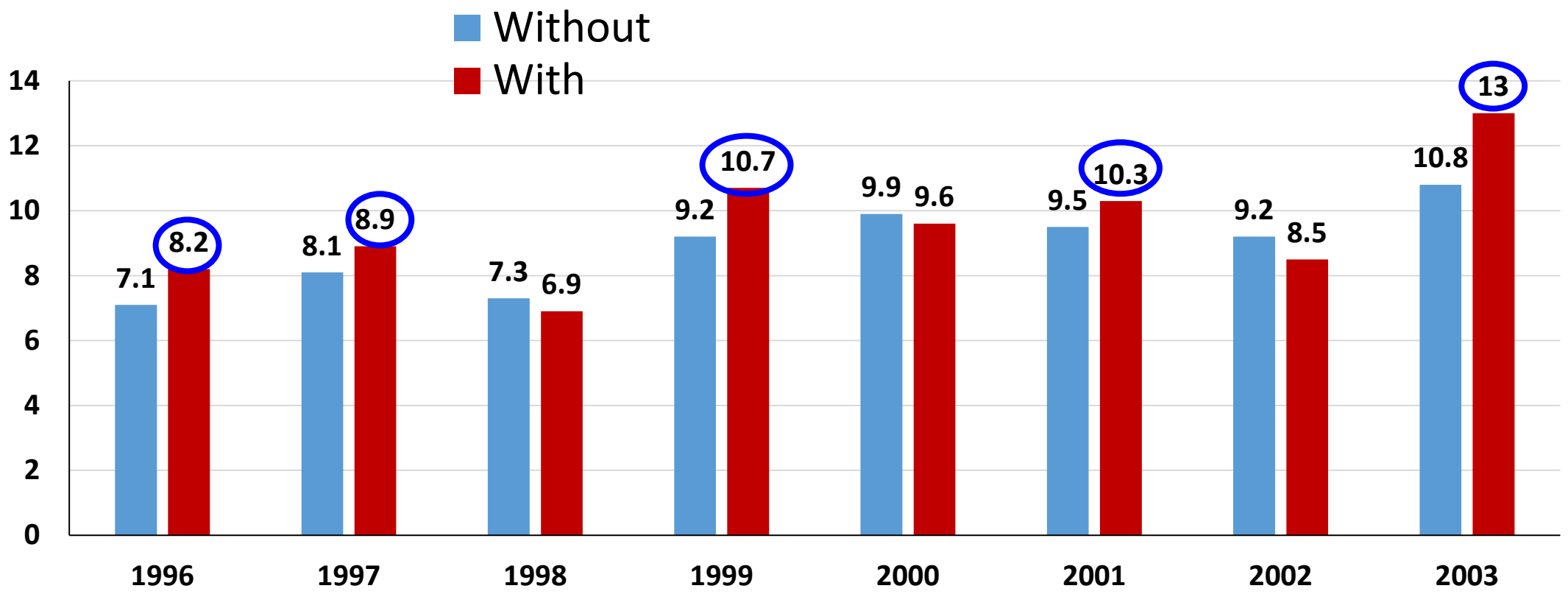
Wording of "Pregnancy Checkbox" in states prior to 2003

State	Wording
Alabama	Was there a pregnancy in last 42 days? (Specify Yes, No, or dk.)
California	If female, pregnant in last year? □ Yes □ No □ UNK
Florida	If female, was there a pregnancy in the past 3 months? Yes No
Idaho	If female aged 0–54: □ not preg win past yr □ preg at time of death □ not pregnant, but preg within 42 days of death □ not pregnant but preg 43 days to 1 yr before death □ unknown if preg w/in the past yr
Illinois	If female, was there a pregnancy in past three months? Yes □ No □
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? □ Yes □ No
Louisiana	If deceased was female 10–49, was she pregnant in the last 90 days? □ Yes □ No □ Unk
Maryland	If female: Was decedent pregnant in the past 12 months? □ Yes □ No □ 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? □ Yes □ No
Missouri	If deceased was female 10–49, was she pregnant in the last 90 days? □ Yes □ No □ Un
Montana	If female: □ not preg within past year □ not preg but preg within 42 days of death □ not preg but pregnant 43 days to 1 year before death □ pregnant at time of death □ unknown if preg within past year
New Jersey	If female, was she pregnant at death, or any time 90 days prior to death □ Yes □ No
New Mexico	Was decedent pregnant within last 6 weeks? □ Yes □ No
North Dakota	Was deceased pregnant within 18 months of death? □ Yes □ No
Nebraska	If female, was there a pregnancy in the past 3 months? Yes □ No □
Texas	Was decedent pregnant at time of death □ yes □ no □ UNK within last 12 MO □ yes □ no □ UN
Virginia	If female, was there a pregnancy in past 3 months? Yes □ No □ Unknown □

Time periods used:
42 days;
6 weeks;
3 months;
90 days;
12 mos;
"last year"

Source: Hoyert DL, *NVSR*; vol 69 no 1. Hyattsville, MD: NCHS. 2020.

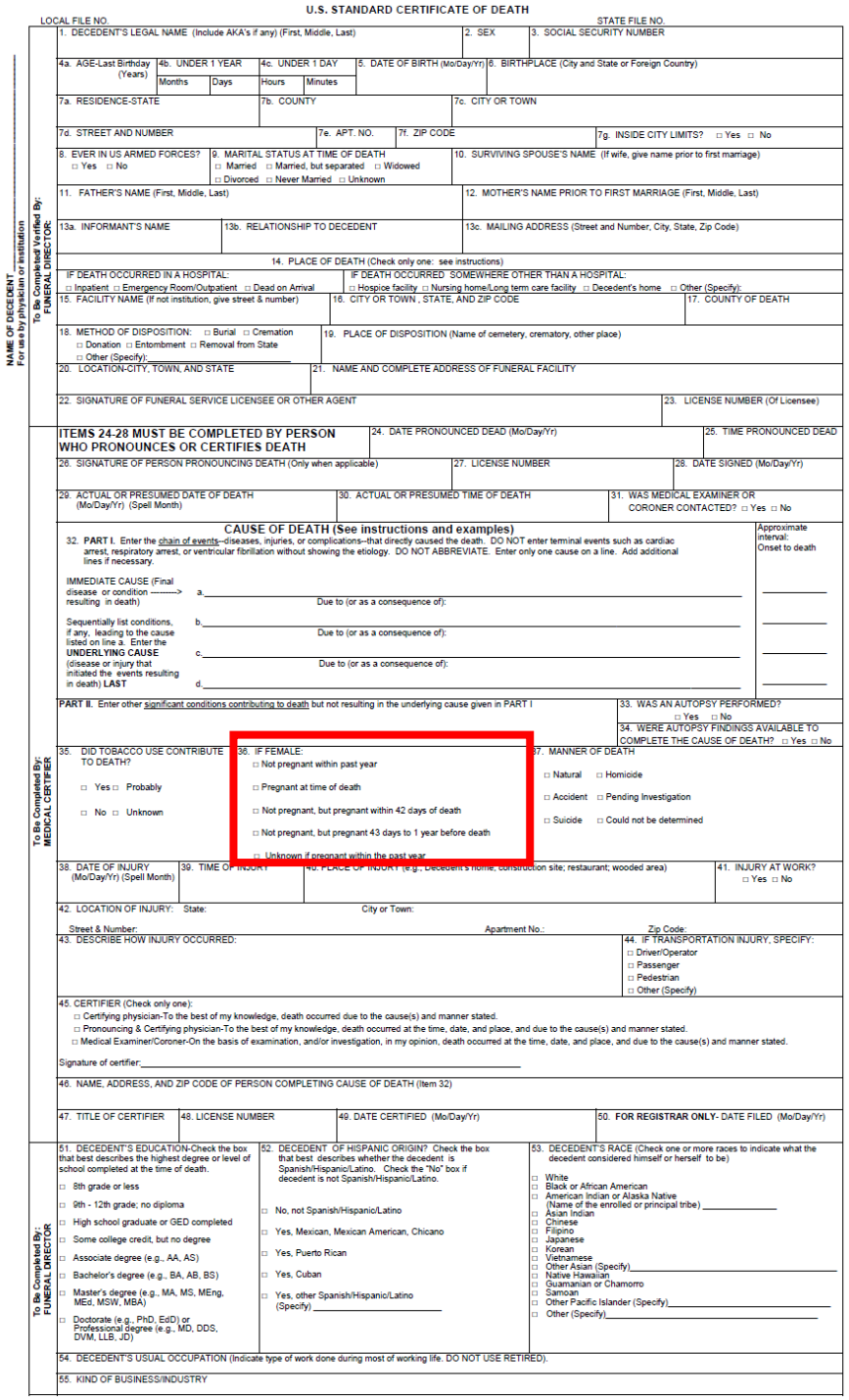
Maternal Mortality Rates (per 100,000) in States with & without a checkbox, 1996-2003



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

Source: Hoyert DL. *Maternal mortality and related concepts*. National Center for Health Statistics. Vital Health Stat 3(33). 2007.

www.birthbythenumbers.org



U.S. STANDARD CERTIFICATE OF DEATH

LOCAL FILE NO. STATE FILE NO.

NAME OF DECEDENT — For use by physician or institution — To Be Completed/Verified By: FUNERAL DIRECTOR:

1. DECEDENT'S LEGAL NAME (Include AKA's if any) (First, Middle, Last) | 2. SEX | 3. SOCIAL SECURITY NUMBER

4a. AGE-Last Birthday (Years) | 4b. UNDER 1 YEAR Months Days | 4c. UNDER 1 DAY Hours Minutes | 5. DATE OF BIRTH (Mo/Day/Yr) | 6. BIRTHPLACE (City and State or Foreign Country)

7a. RESIDENCE-STATE | 7b. COUNTY | 7c. CITY OR TOWN

7d. STREET AND NUMBER | 7e. APT. NO. | 7f. ZIP CODE | 7g. INSIDE CITY LIMITS? □ Yes □ No

8. EVER IN US ARMED FORCES? □ Yes □ No | 9. MARITAL STATUS AT TIME OF DEATH □ Married □ Married, but separated □ Widowed □ Divorced □ Never Married □ Unknown | 10. SURVIVING SPOUSE'S NAME (If wife, give name prior to first marriage)

11. FATHER'S NAME (First, Middle, Last) | 12. MOTHER'S NAME PRIOR TO FIRST MARRIAGE (First, Middle, Last)

13a. INFORMANT'S NAME | 13b. RELATIONSHIP TO DECEDENT | 13c. MAILING ADDRESS (Street and Number, City, State, Zip Code)

14. PLACE OF DEATH (Check only one: see instructions)

IF DEATH OCCURRED IN A HOSPITAL: □ Inpatient □ Emergency Room/Outpatient □ Dead on Arrival

IF DEATH OCCURRED SOMEWHERE OTHER THAN A HOSPITAL: □ Hospice facility □ Nursing home/Long term care facility □ Decedent's home □ Other (Specify):

15. FACILITY NAME (If not institution, give street & number) | 16. CITY OR TOWN , STATE, AND ZIP CODE | 17. COUNTY OF DEATH

18. METHOD OF DISPOSITION: □ Burial □ Cremation □ Donation □ Entombment □ Removal from State □ Other (Specify):_____ | 19. PLACE OF DISPOSITION (Name of cemetery, crematory, other place)

20. LOCATION-CITY, TOWN, AND STATE | 21. NAME AND COMPLETE ADDRESS OF FUNERAL FACILITY

22. SIGNATURE OF FUNERAL SERVICE LICENSEE OR OTHER AGENT | 23. LICENSE NUMBER (Of Licensee)

To Be Completed By: MEDICAL CERTIFIER

ITEMS 24-28 MUST BE COMPLETED BY PERSON WHO PRONOUNCES OR CERTIFIES DEATH | 24. DATE PRONOUNCED DEAD (Mo/Day/Yr) | 25. TIME PRONOUNCED DEAD

26. SIGNATURE OF PERSON PRONOUNCING DEATH (Only when applicable) | 27. LICENSE NUMBER | 28. DATE SIGNED (Mo/Day/Yr)

29. ACTUAL OR PRESUMED DATE OF DEATH (Mo/Day/Yr) (Spell Month) | 30. ACTUAL OR PRESUMED TIME OF DEATH | 31. WAS MEDICAL EXAMINER OR CORONER CONTACTED? □ Yes □ No

CAUSE OF DEATH (See instructions and examples)

32. PART I. 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.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition resulting in death) ——> a._____ Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST

b._____ Due to (or as a consequence of):

c._____ Due to (or as a consequence of):

d._____

PART II. Enter other significant conditions contributing to death but not resulting in the underlying cause given in PART I | 33. WAS AN AUTOPSY PERFORMED? □ Yes □ No | 34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? □ Yes □ No

35. DID TOBACCO USE CONTRIBUTE TO DEATH? □ Yes □ Probably □ No □ Unknown

36. 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

37. MANNER OF DEATH □ Natural □ Homicide □ Accident □ Pending Investigation □ Suicide □ Could not be determined

38. DATE OF INJURY (Mo/Day/Yr) (Spell Month) | 39. TIME OF INJURY | 40. PLACE OF INJURY (e.g., Decedent's home; construction site; restaurant; wooded area) | 41. INJURY AT WORK? □ Yes □ No

42. LOCATION OF INJURY: State: City or Town: Street & Number: Apartment No.: Zip Code:

43. DESCRIBE HOW INJURY OCCURRED: | 44. IF TRANSPORTATION INJURY, SPECIFY: □ Driver/Operator □ Passenger □ Pedestrian □ Other (Specify)

45. CERTIFIER (Check only one):
□ Certifying physician-To the best of my knowledge, death occurred due to the cause(s) and manner stated.
□ Pronouncing & Certifying physician-To the best of my knowledge, death occurred at the time, date, and place, and due to the cause(s) and manner stated.
□ Medical Examiner/Coroner-On the basis of examination, and/or investigation, in my opinion, death occurred at the time, date, and place, and due to the cause(s) and manner stated.

Signature of certifier:_____

46. NAME, ADDRESS, AND ZIP CODE OF PERSON COMPLETING CAUSE OF DEATH (Item 32)

47. TITLE OF CERTIFIER | 48. LICENSE NUMBER | 49. DATE CERTIFIED (Mo/Day/Yr) | 50. FOR REGISTRAR ONLY- DATE FILED (Mo/Day/Yr)

To Be Completed By: FUNERAL DIRECTOR

51. DECEDENT'S EDUCATION-Check the box that best describes the highest degree or level of school completed at the time of death.
□ 8th grade or less
□ 9th - 12th grade; no diploma
□ High school graduate or GED completed
□ Some college credit, but no degree
□ Associate degree (e.g., AA, AS)
□ Bachelor's degree (e.g., BA, AB, BS)
□ Master's degree (e.g., MA, MS, MEng, MEd, MSW, MBA)
□ Doctorate (e.g., PhD, EdD) or Professional degree (e.g., MD, DDS, DVM, LLB, JD)

52. DECEDENT OF HISPANIC ORIGIN? Check the box that best describes whether the decedent is Spanish/Hispanic/Latino. Check the "No" box if decedent is not Spanish/Hispanic/Latino.
□ No, not Spanish/Hispanic/Latino
□ Yes, Mexican, Mexican American, Chicano
□ Yes, Puerto Rican
□ Yes, Cuban
□ Yes, other Spanish/Hispanic/Latino (Specify) _____

53. DECEDENT'S RACE (Check one or more races to indicate what the decedent considered himself or herself to be)
□ White
□ Black or African American
□ American Indian or Alaska Native (Name of the enrolled or principal tribe) _____
□ Asian Indian
□ Chinese
□ Filipino
□ Japanese
□ Korean
□ Vietnamese
□ Other Asian (Specify)_____
□ Native Hawaiian
□ Guamanian or Chamorro
□ Samoan
□ Other Pacific Islander (Specify)_____
□ Other (Specify)_____

54. DECEDENT'S USUAL OCCUPATION (Indicate type of work done during most of working life. DO NOT USE RETIRED).

55. KIND OF BUSINESS/INDUSTRY

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

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.

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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

	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

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

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

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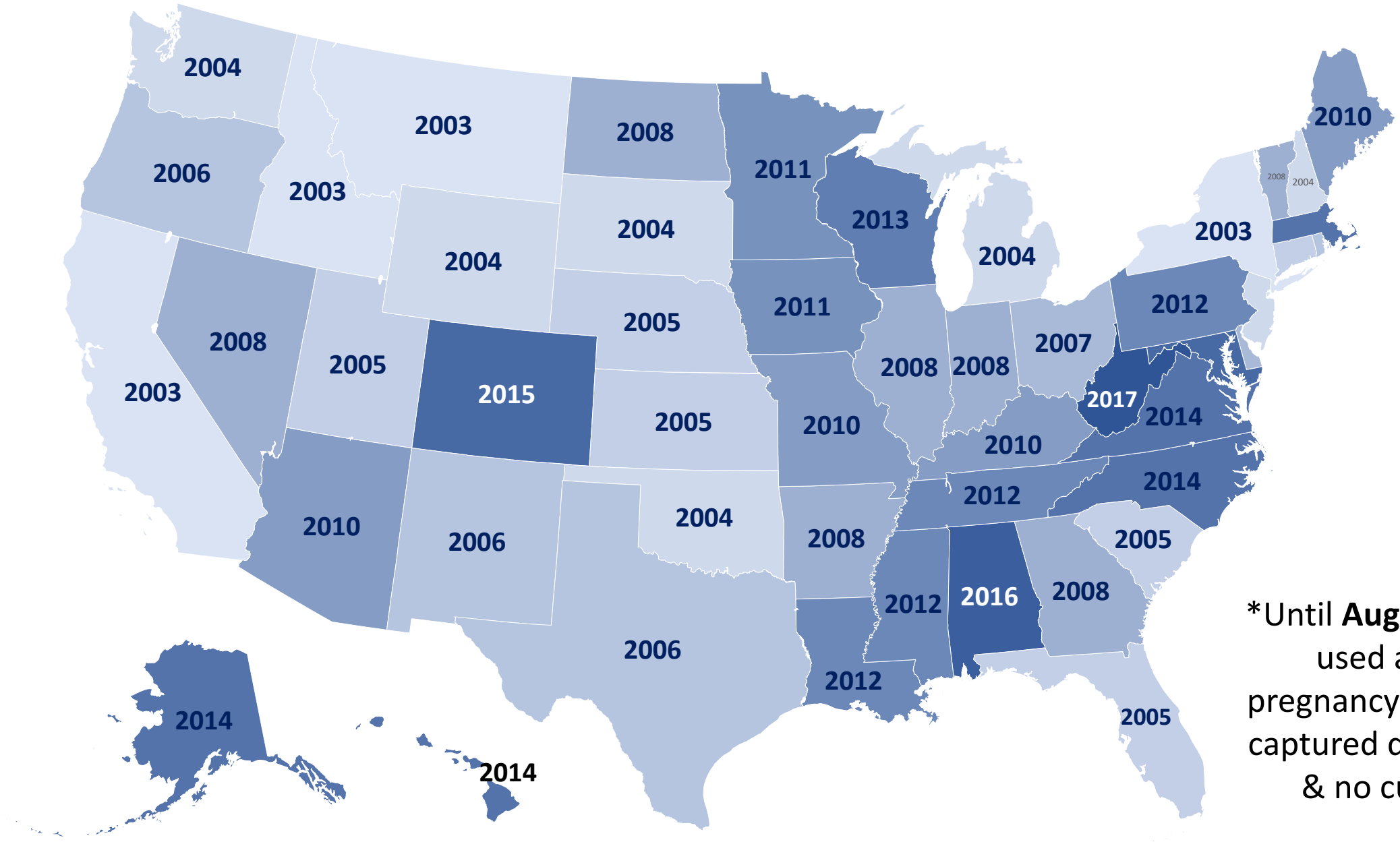
Staggered adoption of 2003 revisions by states (2003-17)



NH – 2004
VT – 2008
MA – 2014
CT – 2005
RI – 2006
NJ – 2004
DE – 2007
MD – 2015

Year

2017

2003

*Until **August 2021, California** used a non-standard pregnancy checkbox. Cal. only captured deaths within 1 year & no cutoff at 42 days.

Here's where we come in

Original Research

***OBSTETRICS & GYNECOLOGY* 2016;128:447-455.**

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.

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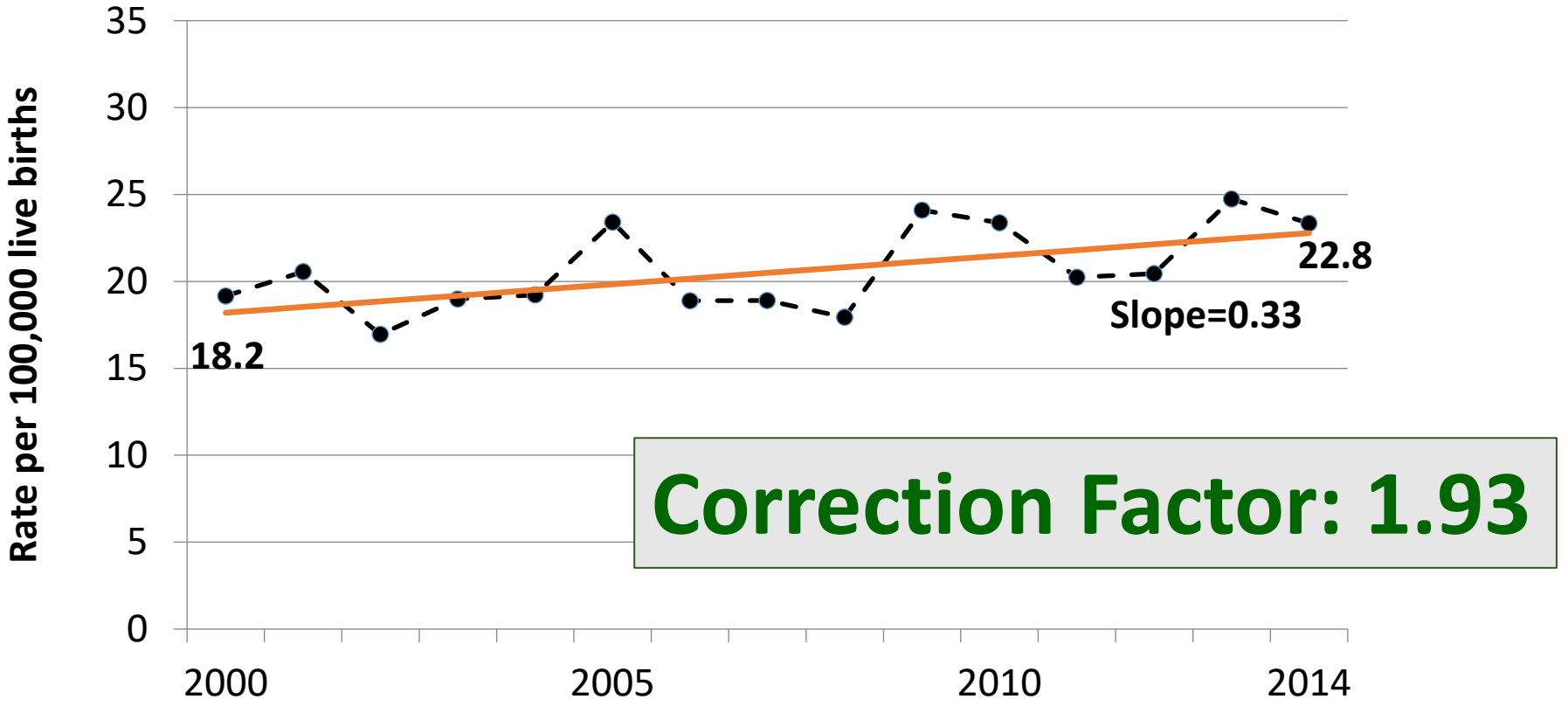
Correcting for Impact of Adding Pregnancy Box

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

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

Impact on 24 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

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

Analytical and Epidemiological Studies

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

www.birthbythenumbers.org

Objectives of NVSS 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***

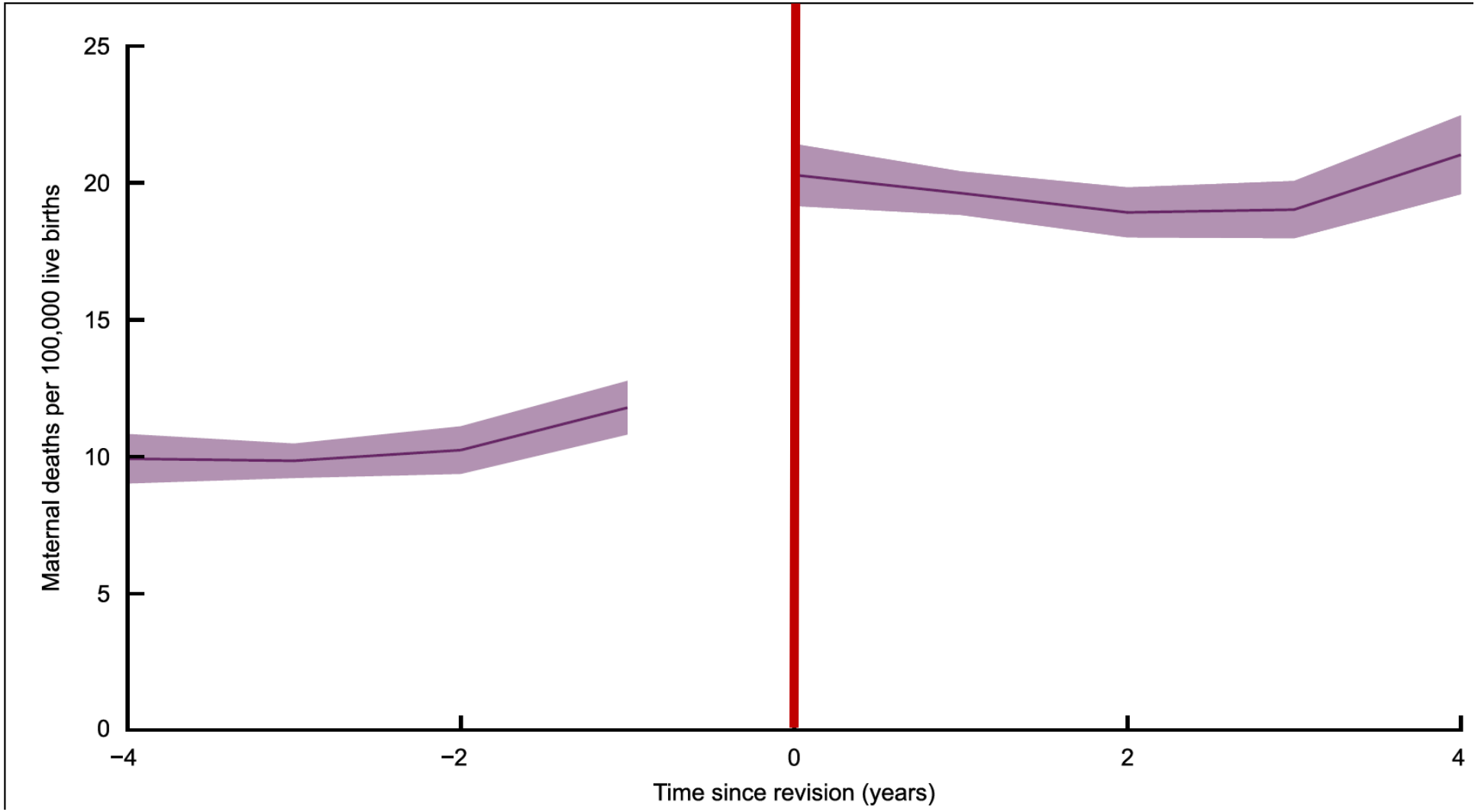
Two key problems raised by the checkbox

1. **Over ascertainment** – as described above. While finding more real cases, are there now also more false positives?

2 **“Other” causes** – Loss of precision in identifying causes of maternal death leading to the rise of “other” causes of death.

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, etal. *The impact of the pregnancy checkbox, 1999–2017*. NCHS. Vital Health Stat 3(44). 2020.

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

State	Change in maternal mortality rate (95% CI)
Alabama	29.0 (18.4 – 39.7)
Alaska	4.0 (–8.7 – 16.7)
Arizona	10.2 (2.2 – 18.1)
Arkansas	15.7 (1.0 – 30.4)
California	9.9 (5.2 – 14.7)
Colorado	2.0 (–4.8 – 8.8)
Connecticut	5.7 (–0.6 – 12.0)
Delaware	19.0 (–15.5 – 53.5)
District of Columbia	2.3 (–9.9 – 14.6)
Florida	9.3 (4.8 – 13.7)
Georgia	3.2 (–2.4 – 8.7)
Hawaii	–6.4 (–22.3 – 9.5)
Idaho	23.9 (4.7 – 43.2)
Illinois	17.9 (10.6 – 25.1)
Indiana	20.4 (14.3 – 26.5)
Iowa	9.5 (–1.7 – 20.7)
Kansas	14.0 (4.3 – 23.8)
Kentucky	11.6 (0.6 – 22.7)
Louisiana	38.2 (28.4 – 48.0)
Maine	6.9 (–13.5 – 27.3)
Maryland	–7.8 (–13.3 – –2.4)
Massachusetts	2.4 (–1.6 – 6.5)
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)
New Jersey	16.1 (11.0 – 21.1)
New Mexico	15.7 (–5.9 – 37.2)
New York City	9.3 (2.7 – 15.9)
New York State[1]	6.6 (1.8 – 11.3)
North Carolina	9.5 (5.0 – 14.1)
North Dakota	25.3 (–14.3 – 64.9)
Ohio	19.6 (12.7 – 26.4)
Oklahoma	29.9 (16.0 – 43.8)
Oregon	5.1 (–3.7 – 13.9)
Pennsylvania	– 2.4 (–8.4 – 3.6)
Rhode Island	–0.8 (–13.5 – 11.8)
South Carolina	18.3 (9.8 – 26.7)
South Dakota	14.8 (–7.1 – 36.7)
Tennessee	18.8 (11.2 – 26.3)
Texas	12.5 (8.8 – 16.1)
Utah	10.9 (0.1 – 21.6)
Vermont	4.4 (–16.6 – 25.4)
Virginia	7.4 (2.5 – 12.3)
Washington	3.7 (–2.3 – 9.6)
West Virginia	4.6 (–17.4 – 26.6)
Wisconsin	–4.8 (–12.9 – 3.2)
Wyoming	84.4 (–22.5 – 191.3)

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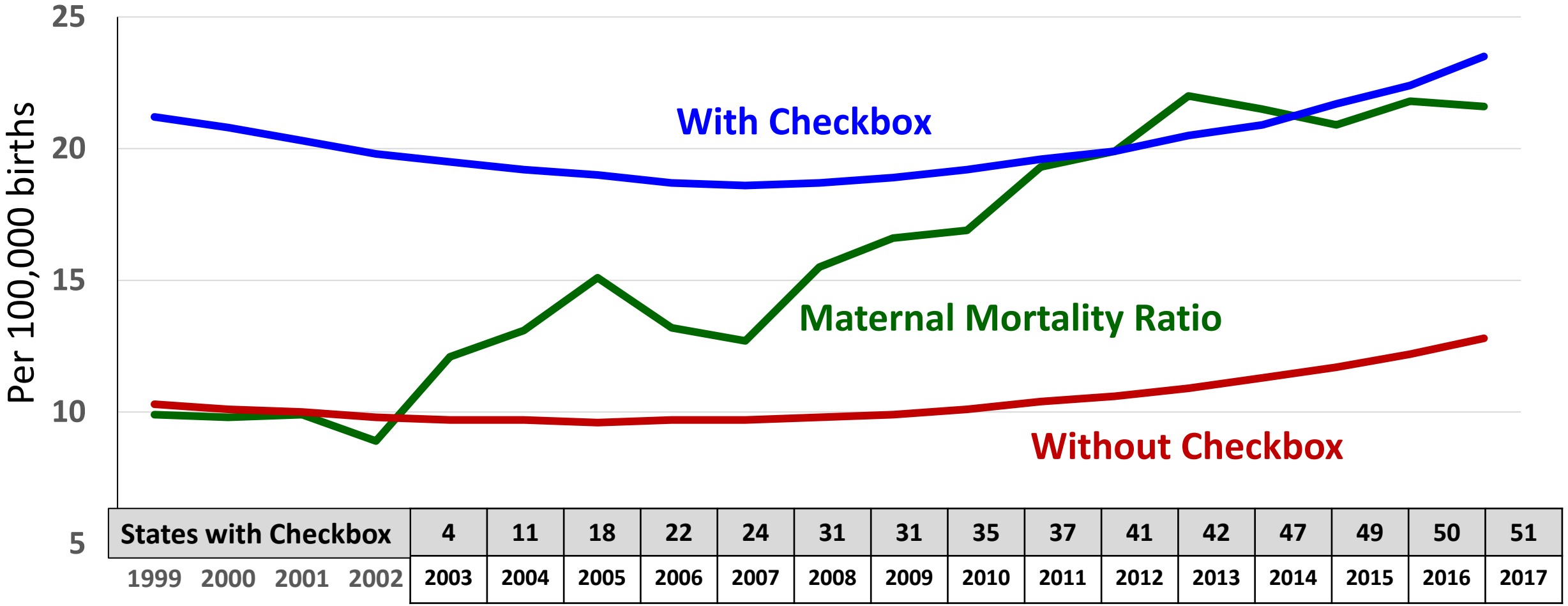
Source: Rossen LM, etal. *The impact of the pregnancy checkbox, 1999–2017*. NCHS. Vital Health Stat 3(44). 2020.

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



States with Checkbox	4	11	18	22	24	31	31	35	37	41	42	47	49	50	51
1999 2000 2001 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017

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

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Ratio of pregnancy associated deaths assigned using the checkbox as maternal deaths & those assigned without using the checkbox 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.

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

Age	Births	Pregnancy Associated 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.

Source: Hoyert & Miniño. *Maternal mortality in the United States, 2018*. NVSR; vol 69 no 2. Hyattsville, MD: NCHS. 2020

Number of deaths potentially added if 0.03% of certificates have a checkbox with a random error

Age	All female deaths	Maternal Deaths	Maternal Mortality Rate (per 100K births)	Number of deaths potentially added if 0.03% of certificates have a checkbox in error	Maternal mortality rate including those potentially added in error (per 100 k births
Under 25	39,796	384	6.5	12	6.7
25-39	102,796	1,018	10.4	31	10.7
40-54	324,934	141	37.0	97	62.4
40-44	79,796	120	33.2	24	39.8
45-54	245,138	21	107.6	74	486.6

Source: Hoyert & Miniño. *Maternal mortality in the United States, 2018*. NVSR; vol 69 no 2. Hyattsville, MD: NCHS. 2020

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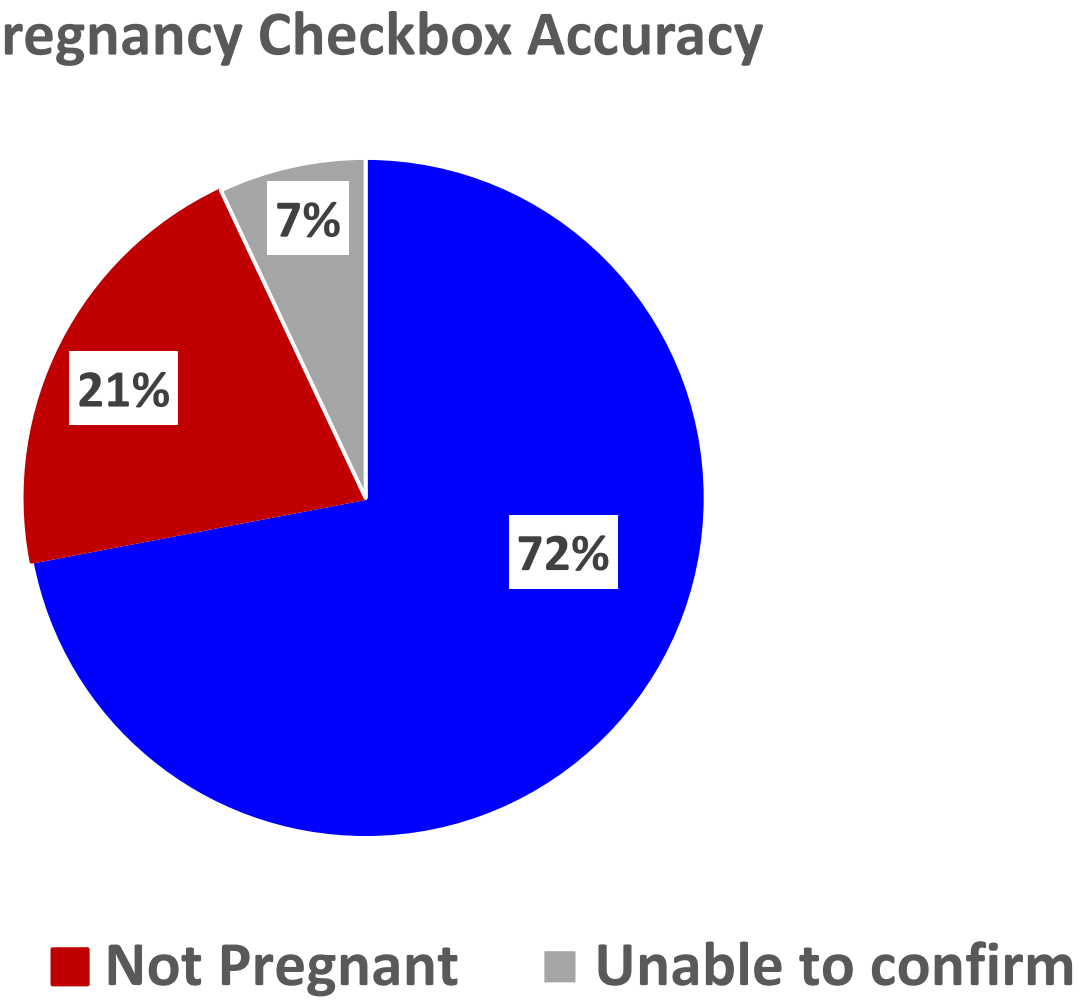
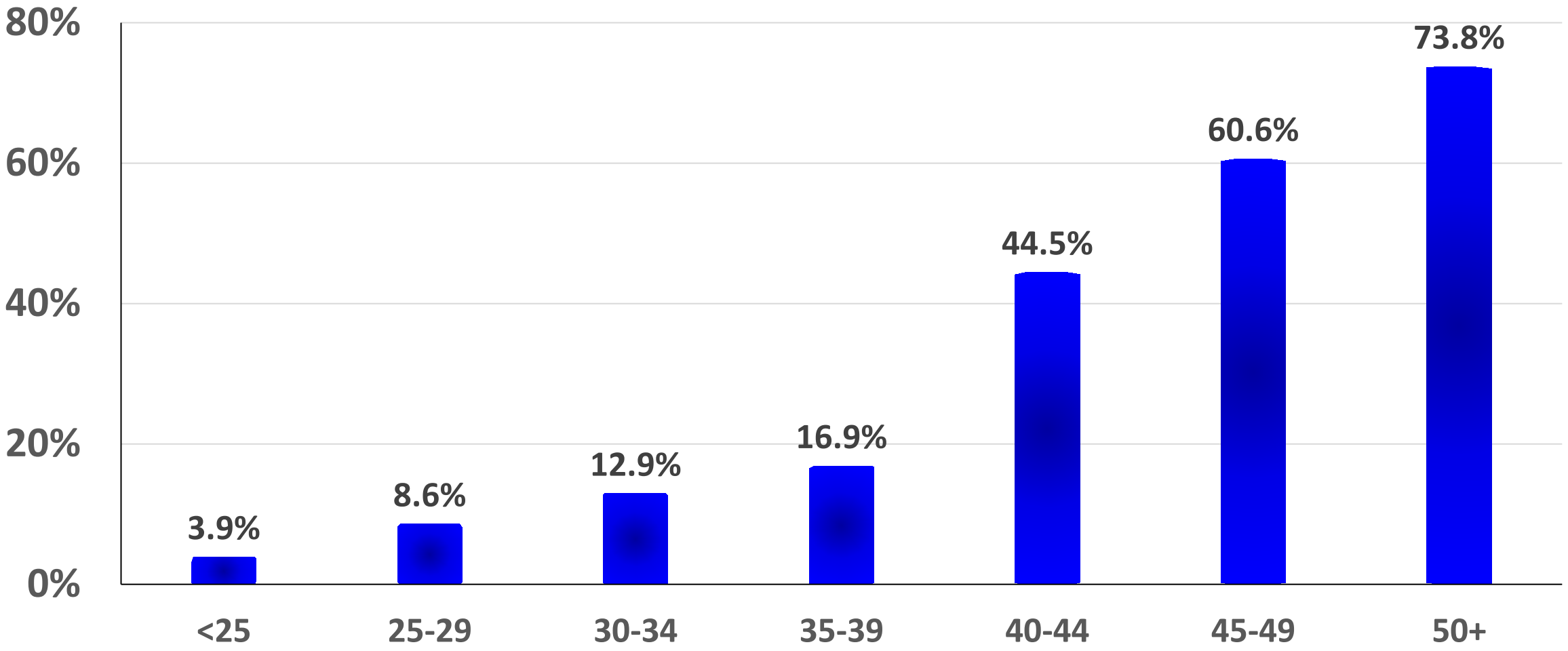
Over-ascertainment: Results of a 4 state study (Georgia, Louisiana, Michigan, and Ohio)

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



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.

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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

Source: MacDormanM. Trends in Mat. Mort. By Socioeconomic Characteristics. OBGYN.2017;129:811

ICD Codes for 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)

Source: MacDormanM. *OBGYN*.2017;129:811

Maternal Death ICD-10 Codes

The Problem with 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)

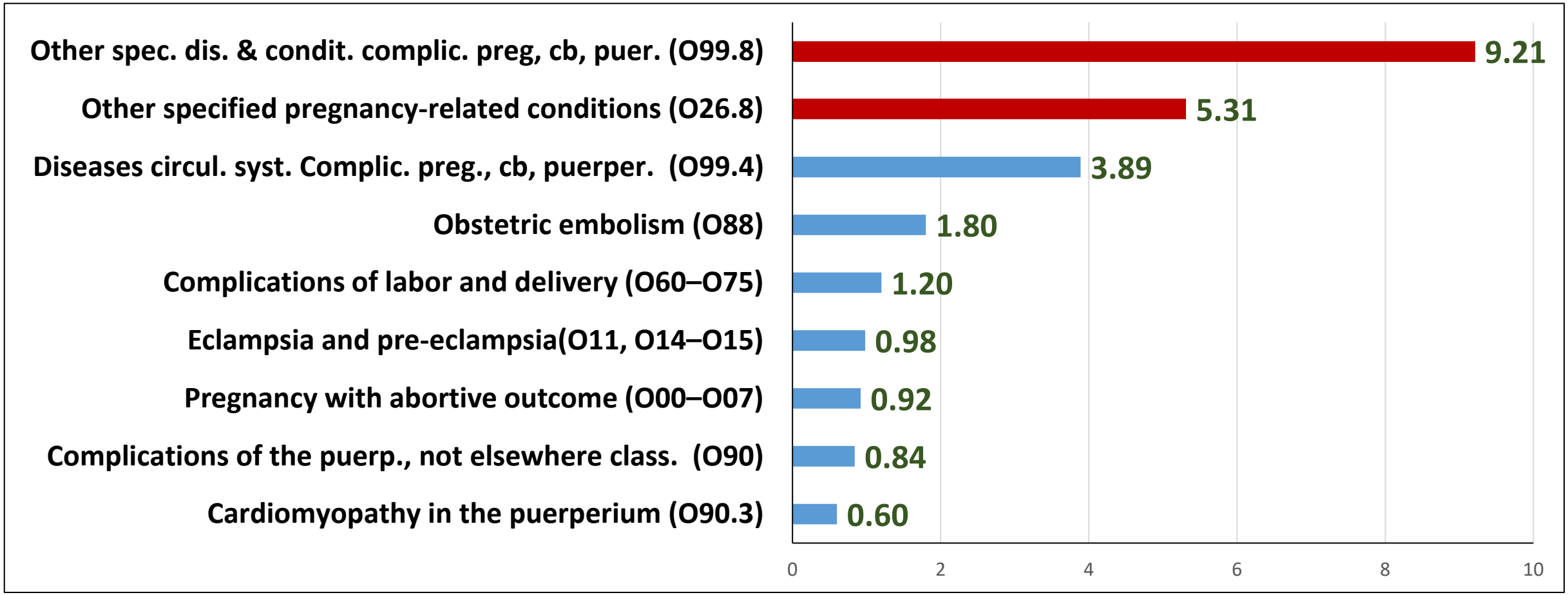
Source: MacDorman M et al. *OBGYN*.2017;129:811

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**
Total Maternal	20.6	25.4	**23.3**
Ill-defined "other" causes	7.0	10.4	**47.9**
Total maternal minus ill defined	13.5	15.0	**10.6**
Total Direct Obstetric	13.9	16.6	**19.7**
Other spec. pregnancy related cond.	3.4	5.9	**73.0**
Total direct obstetric minus ill defined	10.5	10.7	**2.3**
Total indirect causes	5.3	8.2	**54.4**
Other specified dis. & conditions	2.2	3.9	**75.9**
Total indirect minus ill defined	3.1	4.3	**38.7**

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, etal. *Evaluation of the pregnancy status checkbox on the identification of maternal deaths*. NVSR; vol 69 no 1. Hyattsville, MD: NCHS. 2020.

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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***

Source: CDC. *Report from MMRCs: a view into their critical role.*

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*

PBS. Frontline. PostMortem.(2/1/2011) https://www.pbs.org/wgbh/pages/frontline/post-mortem/things-to-kno

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

Source: McGivernL. *PubHlthRep*. 2017; 132(6):669-675.

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.

Source: *PLoS One*. 2022. 17(5):e0268566.

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."

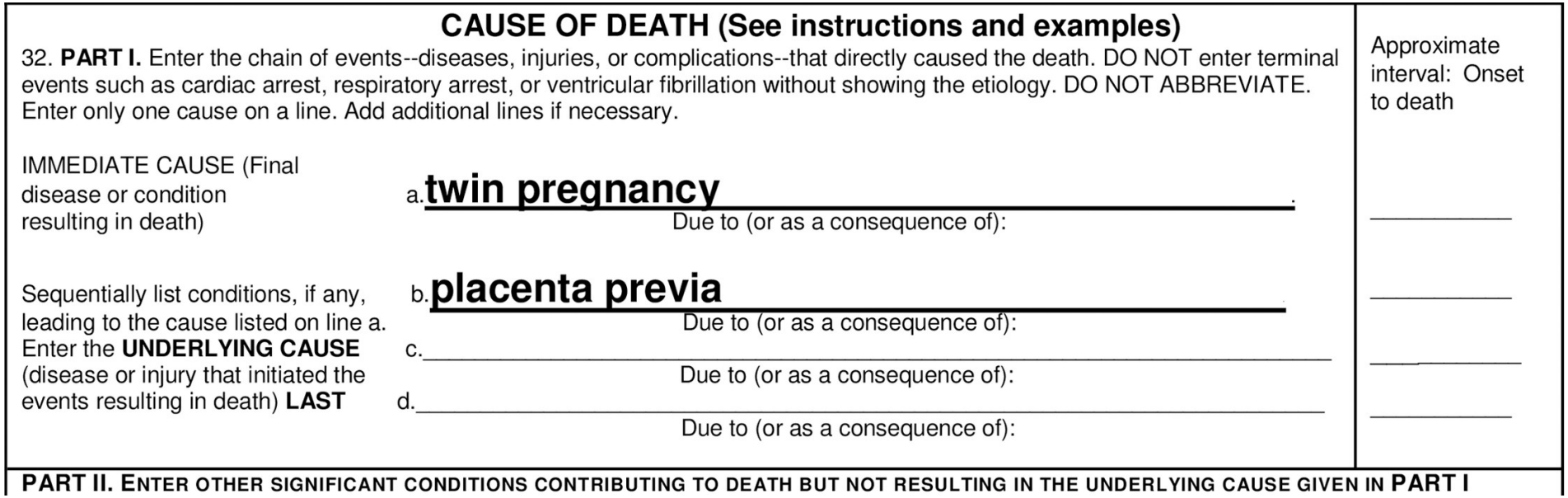
Obtain more information

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

Source: *PLoS One*. 2022. 17(5):e0268566.

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)

32. **PART I.** 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.

Approximate interval: Onset to death

IMMEDIATE CAUSE (Final disease or condition resulting in death)
a. twin pregnancy
Due to (or as a consequence of):

Sequentially list conditions, if any, leading to the cause listed on line a. Enter the **UNDERLYING CAUSE** (disease or injury that initiated the events resulting in death) **LAST**
b. placenta previa
Due to (or as a consequence of):
c.
Due to (or as a consequence of):
d.
Due to (or as a consequence of):

PART II. ENTER OTHER SIGNIFICANT CONDITIONS CONTRIBUTING TO DEATH BUT NOT RESULTING IN THE UNDERLYING CAUSE GIVEN IN **PART I**

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

Source: MacDorman MF, et al. (2020) *PLoS ONE* 15(10): e0240701. https://doi.org/10.1371/journal.pone.0240701

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.*

Source: MacDorman MF, et al. (2020) *PLoS ONE* 15(10): e0240701. https://doi.org/10.1371/journal.pone.0240701

The Checkbox Problem

- The adoption of the checkbox was understandable but has clearly led to a rise in false positives and an overestimation of maternal deaths. ***However***, it has also identified cases during pregnancy that wouldn't otherwise be found.

- May be best to consider the NVSS data involving the checkbox as the **first look** at maternal mortality in the US since their data is much more timely than other systems.

- For a more accurate assessment of the state of maternal mortality, we should look at the CDC Pregnancy Mortality Surveillance System for national data and state Maternal Mortality Review Committees for state rates. ***However***, they tend to be much slower (~2 years) in reporting.