

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

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### Abstract

This report describes changes in how the National Center for Health Statistics (NCHS) will code, publish, and release maternal mortality data and presents official 2018 maternal mortality estimates using a new coding method. Due to the incremental implementation of the pregnancy status checkbox item on the 2003 revised U.S. Standard Certificate of Death, NCHS last published an official estimate of the U.S. maternal mortality rate in 2007. As of 2018, implementation of the revised certificate, including its pregnancy checkbox, is complete for all 50 states (noting that California implemented a different checkbox than that on the U.S. Standard Certificate of Death), allowing NCHS to resume the routine publication of maternal mortality statistics. However, an evaluation of data quality indicated some errors with the reporting of maternal deaths (deaths within 42 days of pregnancy) following adoption of the checkbox, including overreporting of maternal deaths among older women. Therefore, NCHS has adopted a new method (to be called the 2018 method) for coding maternal deaths to mitigate these probable errors. The 2018 method involves further restricting application of the pregnancy checkbox to decedents aged 10–44 years from the previous age group of 10–54. In addition, the 2018 method restricts assignment of maternal codes to the underlying cause alone when the checkbox is the only indication of pregnancy on the death certificate, and such coding would be applied only to decedents aged 10–44 based solely on the checkbox when no other pregnancy information is provided in the cause-of-death statement. Based on the new method, a total of 658 deaths were identified in 2018 as maternal deaths. The maternal mortality rate for 2018 was 17.4 deaths per 100,000 live births, and the rate for non-Hispanic black women (37.1) was 2.5 to 3.1 times the rates for non-Hispanic white (14.7) and Hispanic (11.8) women. Rates also increased with age. Maternal mortality rates calculated without using information obtained from the checkbox are also presented for 2002, 2015, 2016, 2017, and 2018 to provide comparisons over time using a comparable coding approach across all states.

**Keywords:** death certificate • pregnancy status checkbox • National Vital Statistics System

### Introduction

Maternal mortality is a high-profile health indicator used in domestic and international settings (1–3). In the United States, the National Center for Health Statistics' (NCHS) National Vital Statistics System (NVSS) is the source for official mortality statistics, including those on maternal mortality. NCHS uses the World Health Organization (WHO) definition for maternal mortality: deaths of women while pregnant or within 42 days of being pregnant, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes (i.e., neither caused nor complicated by the woman being pregnant at the time of or within 1 year of death). The classification of deaths involving pregnancy, childbirth and puerperium specifically excludes external causes (i.e., accidents, homicides, and suicides) as incidental. Late maternal deaths (occurring between 43 days and 1 year of death) are also not included as part of the WHO definition of maternal mortality.

NVSS has produced maternal mortality statistics for more than a century based on causes of death reported on death certificates. Over time, other data collection efforts emerged, such as the Pregnancy Mortality Surveillance System in 1986, and evidence demonstrated that the NVSS data underestimated maternal mortality (4–9). To address the underreporting of maternal deaths in vital statistics, a separate pregnancy checkbox item was added to the U.S. Standard Certificate of Death in 2003; see other reports that describe the checkbox implementation in more detail (10,11). NCHS initially paused publication of maternal mortality trends as states were transitioning to the checkbox format. However, as implementation of the standard checkbox took longer than expected, NCHS paused publication of annual maternal mortality rates as well. As a result, NCHS has not published an official estimate of the U.S. maternal mortality rate since 2007. Now that all states have implemented a checkbox as of the 2018 data year (noting that California implemented a different checkbox from that on the U.S. Standard Certificate of Death), NCHS is resuming publication of the maternal mortality rate starting with 2018 data.



Implementation of the pregnancy checkbox item accounts for a substantial increase in both the number of deaths identified as maternal and the resulting maternal mortality rates (10–12), with the impact varying by age, race and Hispanic origin, and state. When combining data for all states where the number of states adopting the checkbox increased differentially over time, the observed trend in maternal mortality appears to indicate an increase. However, it has been shown that this is mainly a reflection of the states' incremental implementation of the checkbox over a 14-year period. It could not be determined whether this effect is due to better ascertainment of true maternal deaths, or to increases in deaths coded as maternal in error, or some combination of both (11,13).

Coding procedures adopted with the checkbox implementation in 2003 and used through 2017 (referred to throughout this report as the 2003–2017 method) are based on causes of death reported on death certificates and information on pregnancy status reported in the checkbox item. The coding instructions specify assigning a maternal code from the *International Classification of Diseases, 10th Revision (ICD–10)* to all medical conditions reported if there is any indication of pregnancy on a death certificate. Such indications include when causes specific to pregnancy, delivery, or the puerperium are reported in the cause-of-death section of the death certificate; pregnancy is mentioned among the medical conditions reported on the death certificate; or a response in the checkbox item that indicates the woman had been pregnant at the time of death or in the preceding year. If the checkbox response is the only indication of a pregnancy in the past year on the death certificate, the term “checkbox-only” is used to refer to these deaths. The 2003–2017 method restricted application of the checkbox item to ages 10–54 years (see the next section on “Evidence and Effects of Checkbox Errors” for more details on reporting patterns for women aged 55 and over).

Based on research on the quality of maternal mortality data using information obtained from the checkbox (10,11), NCHS has adopted a new method for coding maternal deaths to mitigate some of the quality concerns identified by multiple evaluations of information on pregnancy status provided in the checkbox. NCHS has also adopted a new method for displaying the coded causes of death for maternal deaths in the mortality data file. This report describes the changes in how NCHS will code and release maternal mortality data and provides maternal mortality rates for 2018 using the new coding method. The 2018 maternal mortality rates using the new method are compared with rates calculated using the 2003–2017 method to highlight differences that result from applying the two coding methods. Maternal deaths for 2015–2018 were also recoded without using the information in the checkbox, as would have been the case before 2003. The rates for 2015–2018 were then compared with the rate for 2002 to provide comparable information on trends in maternal deaths. Considerations for assessing trends are also discussed.

## Evidence and Effects of Checkbox Errors

Recent research has demonstrated that errors are common in the reporting of pregnancy status using the checkbox. Rossen et al. reviewed the literature on reporting errors in the checkbox and reported a range of false-positive rates (i.e., indication of pregnancy or pregnancy in the past year when the decedent was not actually pregnant or pregnant in the last year) as high as 50% (11). An analysis conducted internally by NCHS that linked hospital records with death certificates for selected hospitals suggested potential false positive rates of 54% and 56% for the checkbox in 2014 and 2016, respectively. Note, however, that these results are not based on nationally representative data (see [Technical Notes](#), “Checkbox item analysis based on National Hospital Care Survey data linked to National Death Index,” for further information).

Davis et al. (12) examined patterns by age and discussed the likelihood of misclassification with increasing age. Subsequent research supported the thought that false positives resulting from errors in the checkbox item were concentrated among decedents in their 40s and 50s (14). Research on data from four states (Georgia, Louisiana, Michigan, and Ohio) found that a pregnancy indicated by the checkbox for those under age 40 was more likely to be corroborated, and a pregnancy for those aged 45 and over was more likely to not be corroborated—for example, 19% of decedents aged 45–49 with a positive checkbox response (i.e., pregnant or pregnant in the last year) had actual evidence of a pregnancy (14).

To evaluate the use of the checkbox for women aged 40 and over, checkbox entries were tabulated by age of decedent and compared with the number of births for these age groups. In the NVSS mortality data for 2013 (including all states except Alabama, Alaska, Colorado, Hawaii, Massachusetts, North Carolina, Virginia, and West Virginia, which did not use the standard checkbox in 2013), 797 deaths of women aged 40 and over had a checkbox entry indicating they were pregnant at the time of death or pregnant in the last year from any cause; 652 of these pregnancies were reported as occurring among those aged 45 and over; and 147 of these pregnancies were reported as occurring over age 85. The number of decedents reported as pregnant or pregnant in the last year is unrealistically large at older ages and, by ages 60–64, far surpasses the reported number of women giving birth in those age groups ([Table A](#)).

The exact cause of these errors is unclear. If the checkbox errors are random (i.e., certifiers are selecting the wrong checkbox item with the same regularity across all ages, or even with a lower error rate at the older ages), the absolute number of errors would be larger at the older ages simply because the volume of all deaths increases as age increases. To illustrate this, [Table B](#) uses data from before the checkbox was implemented to show the number of female deaths for decedents under age 25 through 54 from all causes, the number of maternal deaths identified from the cause-of-death section of the certificate, and the number of maternal deaths that potentially would be added assuming that the checkbox would have introduced a hypothetical constant error rate of 0.03%. The number of deaths potentially added in error increases with age. For those aged 45–54, an error rate in the checkbox item of 0.03% could result

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

[Deaths could include any cause (*International Classification of Diseases, 10th Revision* codes A00–Y89) but checkbox entry indicates pregnant at time of death, pregnant within 42 days of death, or pregnant between 43 days and 1 year of death]

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 and over .....	–	147

– Quantity zero.

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

SOURCE: NCHS, National Vital Statistics System.

in an additional 74 deaths, inflating the actual number of maternal deaths by 452%. For the data years used for [Table B](#) (1999–2002, before the checkbox was implemented), no maternal deaths were reported beyond age 54.

When information on pregnancy is found only in the checkbox with no mention of maternal causes in the cause-of-death section, the net result of errors in reporting pregnancy status is a substantial overreporting of maternal mortality, especially for older women (12,15,16). In the study by Catalano et al., ages 45 and over were identified as those for which a response in the pregnancy checkbox is more likely to be an error (14). The results from [Table B](#) align with this finding.

## New Approach for Coding Maternal Deaths: Description of 2018 Method

A new method (referred to as the 2018 method) for coding maternal deaths has been adopted to mitigate the effect of reporting errors in the checkbox item and to retain cause-of-death detail lost in the application of the 2003–2017 method.

This new method will be used for all jurisdictions (see [Technical Notes](#), “California data and coding methods”). Procedures will generally remain the same for records with reported terms or phrases indicating pregnancy and obstetric causes in the cause-of-death statement for all ages. The 2018 method introduces two changes to the 2003–2017 method in the coding of maternal deaths. The first change is that coding of maternal (and late maternal) deaths will further restrict application of the checkbox item to decedents aged 10–44 instead of 10–54 as is done with the 2003–2017 method. The checkbox will not be used for decedents aged 45 and over in light of the findings discussed above on the checkbox quality for women in this age group (14). The result is that for female decedents aged 45 and over, maternal codes will not be assigned if the only indication of a pregnancy was in the checkbox using the 2018 coding method. This change does not affect coding procedures for decedents aged 10–44.

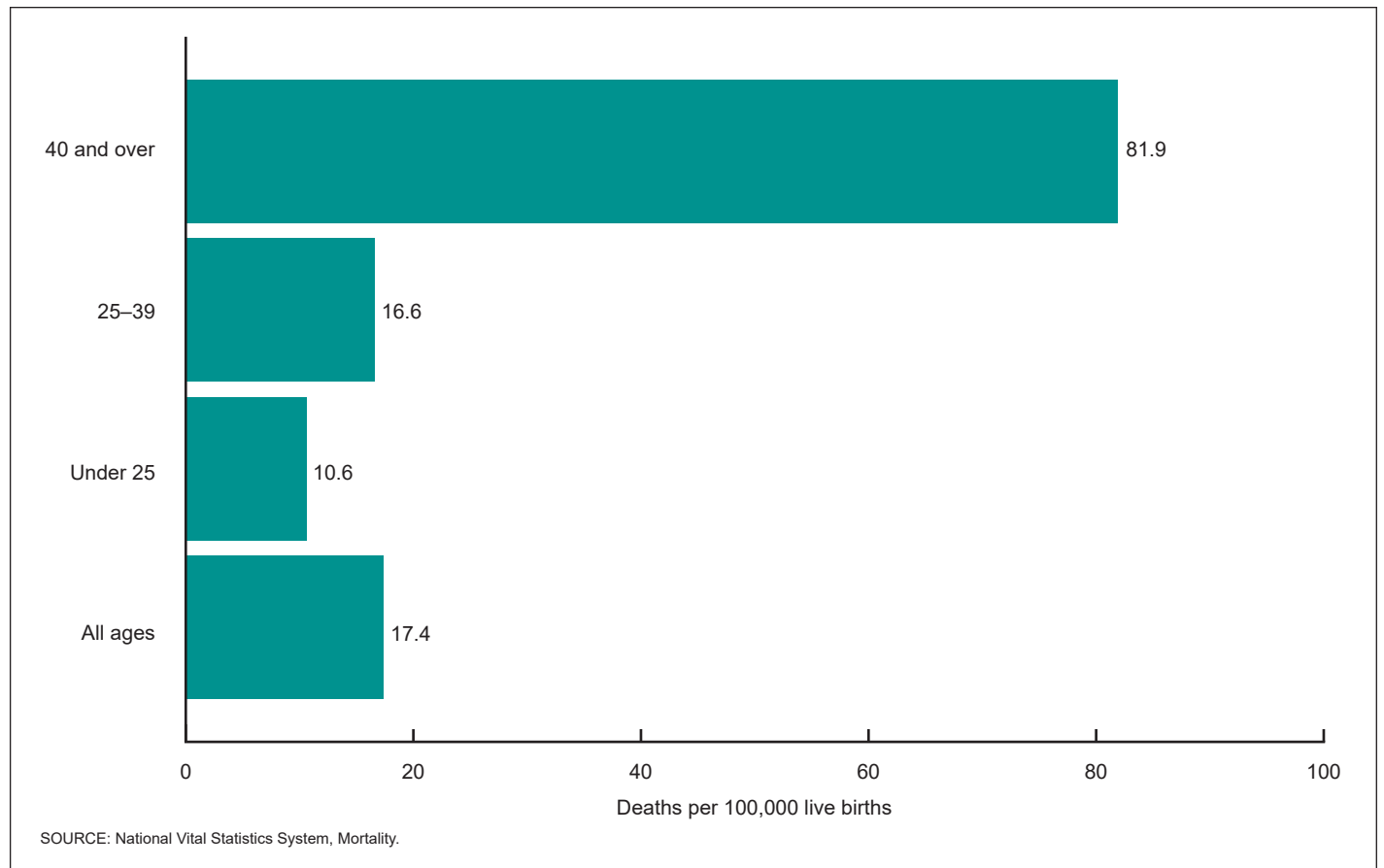
The second change involves how causes of death for maternal (and late maternal) deaths are reported on the mortality file. When the pregnancy checkbox item indicated that the decedent was pregnant or pregnant within the preceding year, application of the 2003–2017 method assigned all medical conditions reported on the death certificate for decedents aged 10–54 to maternal codes, rather than to nonmaternal codes for the causes listed on the certificate. However, doing so provided no means of identifying the record as a checkbox-only case without additional information beyond what is normally available in the standard data files (e.g., literal text), and no way to identify potential errors for specific records. In addition, for the checkbox-only records, the maternal codes assigned often retain less detail about the causes reported. The change implemented with the 2018 coding method for decedents aged 10–44 only codes the underlying cause of death to a maternal code when the checkbox is the only indicator of a pregnancy in the last year (i.e., only the underlying cause will be modified, except in cases where the underlying cause is an external or incidental cause, which is the practice regardless of method). The result of this change is that most of the original detail lost when applying the 2003–2017 method is retained, and the record better reflects what was actually reported on the death certificate. In addition, when using this new format, checkbox-only records will be flagged with an indicator on the mortality files.

**Table B. Number of deaths potentially added if 0.03% of certificates have a checkbox in error**

Age	All female deaths	Maternal deaths	Maternal mortality rate (deaths per 100,000 live 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 (deaths per 100,000 live 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

NOTES: Using counts from the National Vital Statistics System, mortality data for 1999–2002 for all female and maternal deaths for the ages are shown for illustration. These numbers were previously published according to how maternal deaths were determined before 2003. The error rate of 0.03% was selected based on the percentage of female decedents in 2013 aged 55 and over with a positive pregnancy checkbox.

SOURCE: NCHS, National Vital Statistics System, Mortality.



**Figure 1. Maternal mortality rates, by age: United States, 2018**

Generally, more information is reported on death certificates than is directly reflected in the underlying cause of death. This additional information is captured in multiple cause-of-death data that are available on the data files. Multiple cause-of-death data are retained in two forms: entity axis and record axis. The entity axis preserves details on where causes associated with the codes were reported on the death certificate. The record axis reflects some transformation of the entity axis codes to facilitate analysis, eliminates duplicate codes, and includes the underlying cause code. Record axis and entity axis generally would differ somewhat between coding methods (for examples, see [Technical Notes](#)). Using the 2018 method, for checkbox-only records, those aged 10–44 would have only one maternal code, which would appear in the record axis as the underlying cause. The entity axis would consist entirely of nonmaternal codes. Also using the 2018 method, checkbox-only records for those aged 45–54 would consist only of nonmaternal codes in both entity and record axis. For the records with terms or phrases related to pregnancy or obstetric conditions, in the cause-of-death section of the certificate, the multiple-cause data would be the same as before.

The changes incorporated with the 2018 method (see [Technical Notes](#) for examples) are summarized as:

- Coding of maternal deaths will restrict application of the checkbox item to decedents aged 10–44. The checkbox will not be applied in the coding of cause of death for decedents

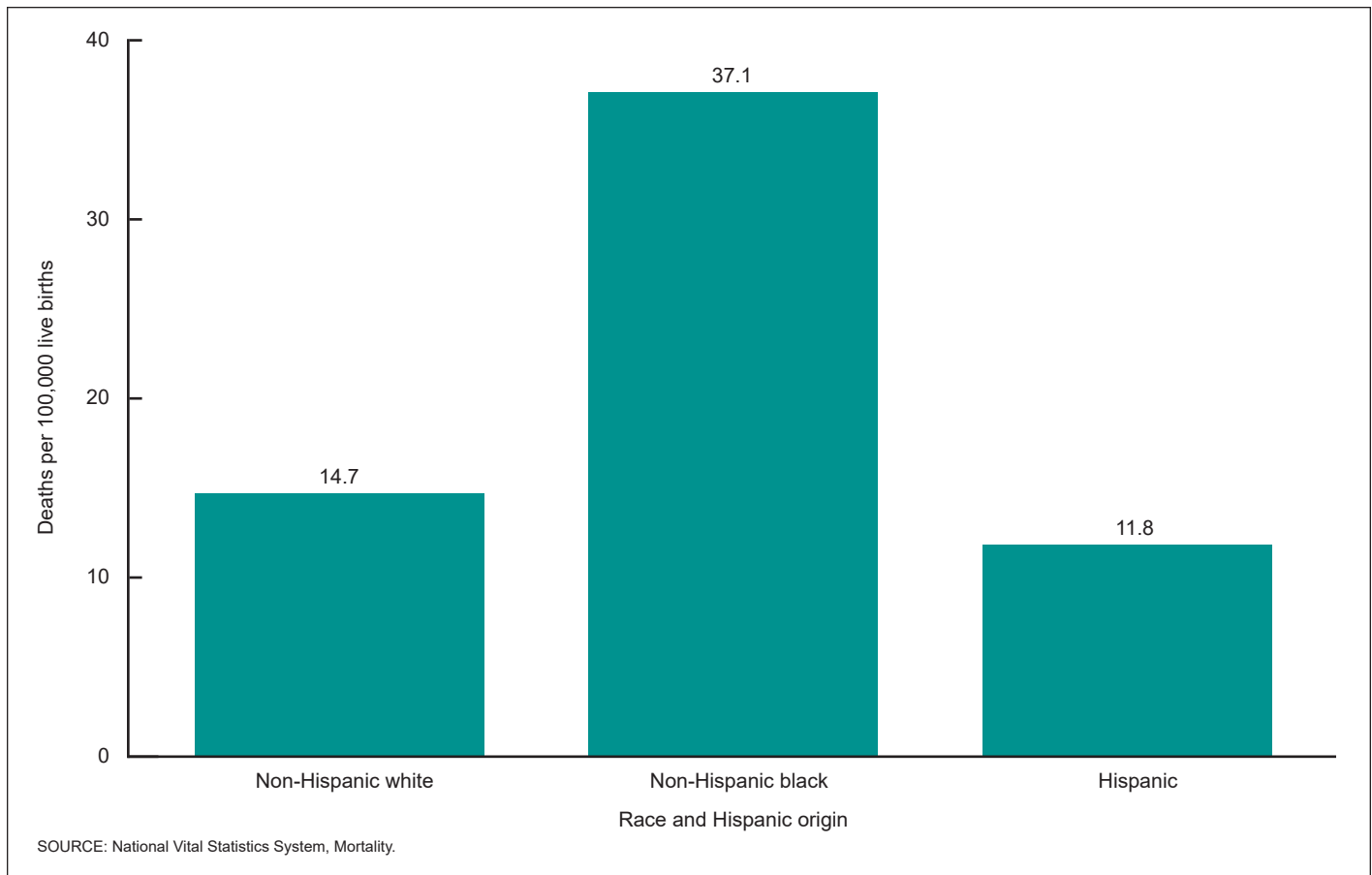
aged 45 and over when no other cause-of-death information related to pregnancy is indicated on the certificate; however, the original checkbox entries will be retained on the file for this age group.

- If the checkbox is the only indication of a pregnancy for female decedents aged 10–44, a maternal code will be assigned as the underlying cause, except in cases where the underlying cause is an external or incidental cause, which would not be coded as maternal regardless of coding method. A maternal code will be assigned only to the underlying cause and not to other conditions reported on the certificate. The other original causes will be retained on the record.

Cases in which a pregnancy or obstetric condition is reported in the cause-of-death section will continue to be coded as maternal deaths regardless of age.

## Maternal Mortality in 2018

In 2018, a total of 658 women were identified as having died of maternal causes in the United States ([Table 1](#)) using the 2018 coding method. The maternal mortality rate for 2018 was 17.4 deaths per 100,000 live births. The maternal mortality rate increases with successively older age groups ([Figure 1](#)), with the rate for women aged 40 and over (81.9) equal to 7.7 times that for women under age 25 (10.6).



**Figure 2. Maternal mortality rates, by single race and Hispanic origin: United States, 2018**

As shown in [Figure 2](#), the maternal mortality rate for non-Hispanic black women (37.1 deaths per 100,000 live births) was 2.5 times the rate for non-Hispanic white (14.7) and 3.1 times the rate for Hispanic women (11.8) (Note: Rates are shown by single race group; see [Technical Notes](#) for information on bridged-race results and more information on the differences between single and bridged race). In 2018, the ratio for non-Hispanic white women to Hispanic women was 1.2.

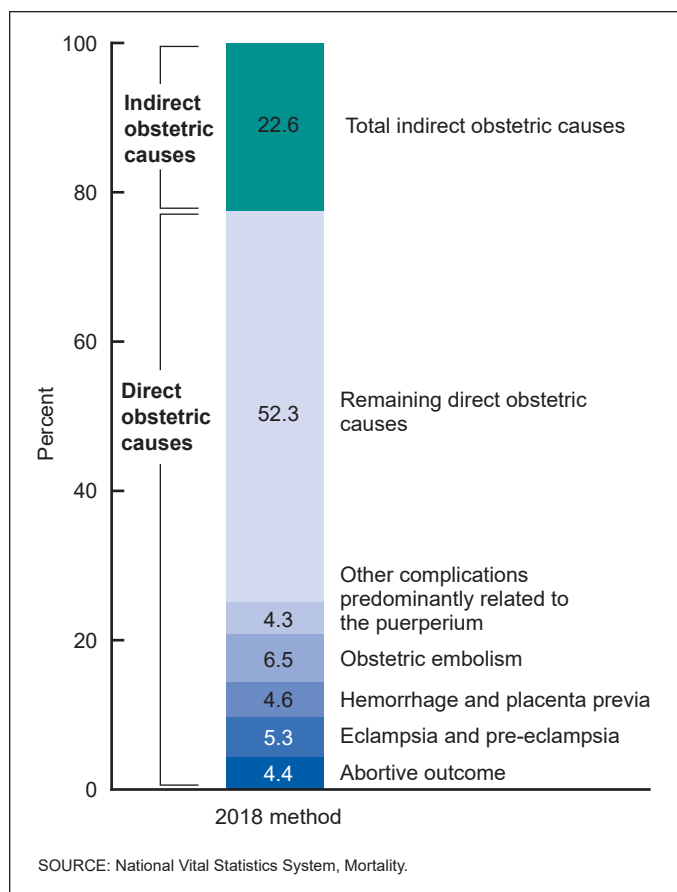
Maternal deaths may be viewed using more detailed causes of death, which are broadly divided into direct and indirect obstetric causes ([Table 2](#); note that some of the more detailed cause categories have vague titles or small numbers). Using the 2018 method, more deaths were classified to direct obstetric causes (A34, 000–095) (77%) than to indirect obstetric causes (O98–O99) (23%) in 2018. [Figure 3](#) shows the percent distribution of selected maternal death causes (which each account for 4%–6% of maternal deaths), a category for indirect causes (accounts for 23% of deaths), and the category “Remaining direct obstetric causes,” which encompasses many codes (e.g., O10, O12, O21–O43, O47–O66, O68–O71, O73–O75, and O95) and accounts for about one-half of the deaths. Described in terms of maternal mortality rates, Abortive outcomes, which primarily are ectopic pregnancies, and Hemorrhage of pregnancy and childbirth and placenta previa both occurred at a rate of 0.8 deaths per 100,000 live births in 2018. The rate for Eclampsia and pre-eclampsia was 0.9 deaths per 100,000 live births, and

the rate for Obstetric embolism was 1.1 deaths per 100,000 live births.

Not included in [Figures 1–3](#) are the 277 deaths that were reported as occurring more than 42 days but less than 1 year after delivery in 2018, for a late maternal mortality rate of 7.3 deaths per 100,000 live births. Late maternal deaths are not included as part of the official maternal mortality rate (see [Technical Notes](#), “Late maternal deaths”).

## Results From 2018 Method Compared With 2003–2017 Method

[Tables 1](#) and [C](#) show maternal mortality rates for 2018 calculated based on both the 2003–2017 method and the 2018 method. Given that the change in use of the checkbox with the 2018 method is applied to women aged 45–54, the maternal mortality rates are the same for age groups under 25, 25–39, and 40–44 for both methods ([Table 1](#)). The ratio of the maternal mortality rates for those aged 40 and over to under age 25 ([Table C](#)) is 16.6 when using the 2003–2017 method and 7.7 when using the 2018 method, reflecting the higher error rate in identifying maternal deaths at older ages in the 2003–2017 method and the decision to restrict the use of the checkbox to those under age 45. For women aged 45 and over, there are only seven deaths when using the 2018 method’s expanded



**Figure 3. Percent distribution of maternal deaths, by cause of death: United States, 2018**

restriction on age, which results in a rate that does not meet NCHS standards of reliability (73.1). Using the 2003–2017 checkbox method, the ratio of the maternal mortality rates among those aged 45 and over to those under age 25 is 124.1, and 6.9 when using the 2018 method, but these again are based on rates that are statistically unreliable.

**Table C. Maternal mortality rates and ratio of maternal mortality rates, by coding method and maternal age: United States, 2018**

[Rates are per 100,000 live births. Ratio of maternal mortality rates is for specified maternal age to those under age 25]

Age	With checkbox (2003–2017 coding method)		With checkbox for ages 44 and under; without checkbox for 45 and over (2018 coding method)	
	Rate	Ratio	Rate	Ratio
Under 25.....	10.6	1.0	10.6	1.0
25–39.....	16.6	1.6	16.6	1.6
40 and over.....	175.7	16.6	81.9	7.7
40–44.....	82.6	7.8	82.6	7.8
45 and over.....	1,315.9	124.1	*73.1	*6.9

\* Figure does not meet NCHS standards of reliability.  
SOURCE: NCHS, National Vital Statistics System.

**Table D. Maternal mortality rates and ratio of maternal mortality rates, by coding method and single race and Hispanic origin: United States, 2018**

[Rates are per 100,000 live births. Ratio of maternal mortality rates is for non-Hispanic black women compared with non-Hispanic white and Hispanic women]

Race and Hispanic origin	With checkbox (2003–2017 coding method)		With checkbox for ages 44 and under; without checkbox for 45 and over (2018 coding method)	
	Rate	Ratio	Rate	Ratio
Non-Hispanic white.....	18.0	2.4	14.7	2.5
Non-Hispanic black.....	43.3	1.0	37.1	1.0
Hispanic.....	13.7	3.2	11.8	3.1

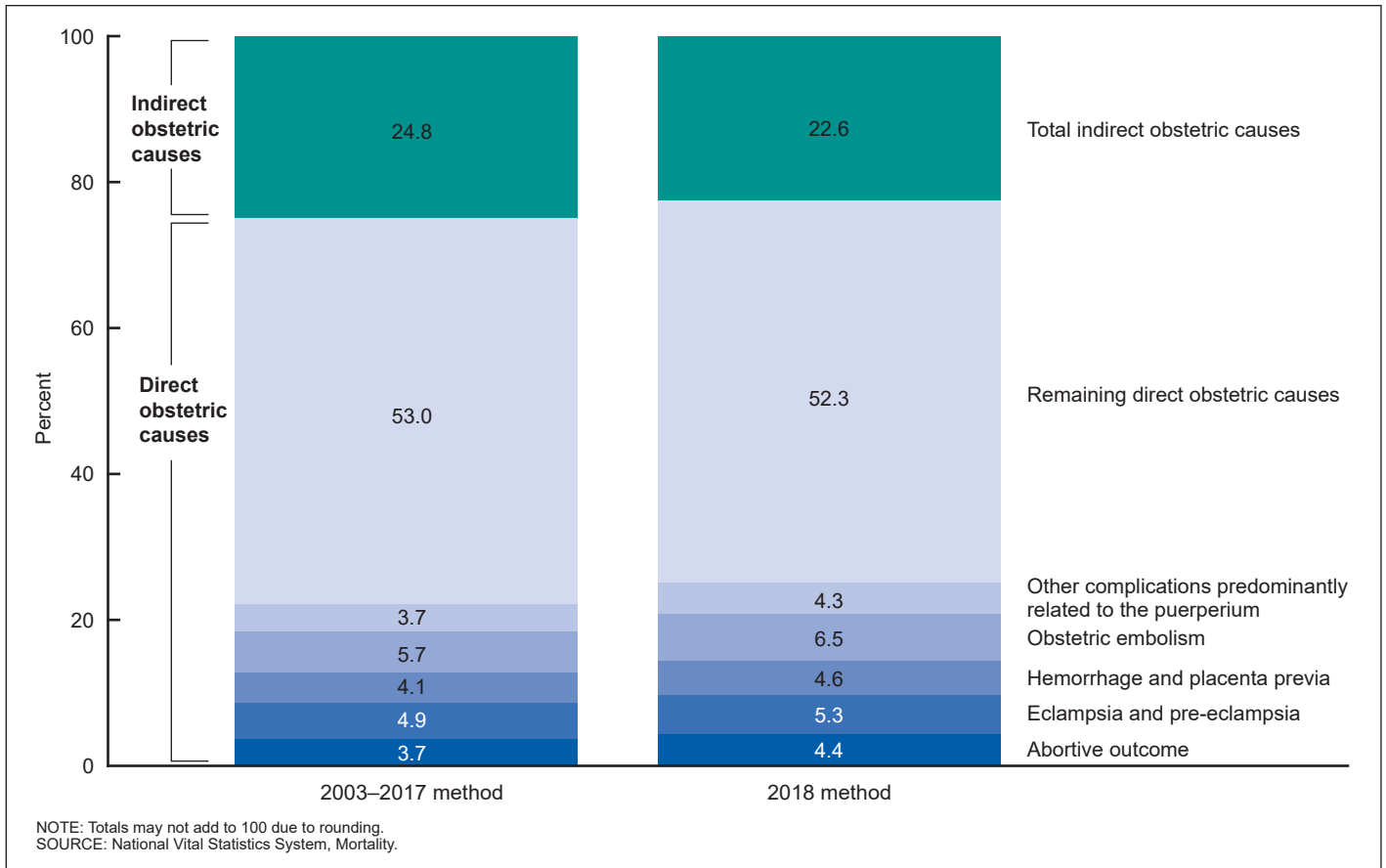
SOURCE: NCHS, National Vital Statistics System.

Maternal mortality rates for non-Hispanic black women (Tables 1 and D) were consistently higher than for non-Hispanic white (Note: Rates are shown by single race group; see Technical Notes for information on bridged-race results and more information on the differences between single and bridged race) and Hispanic women based on both methods. The ratio of the rates for non-Hispanic black women to non-Hispanic white women was 2.4 with the 2003–2017 method and 2.5 with the 2018 method. The ratio for non-Hispanic black to Hispanic women was 3.2 using the 2003–2017 method and 3.1 using the 2018 method.

Table 2 shows numbers and maternal mortality rates by cause based on the different coding methods. The distribution of the causes of death is similar for these two methods (Figure 4). In 2018, the maternal mortality rate for indirect obstetric causes was 5.1 deaths per 100,000 live births using the 2003–2017 method, whereas when using the 2018 method, the rate was 3.9. For direct obstetric causes, the rate was 15.4 deaths per 100,000 live births using the 2003–2017 method, compared with 13.4 when using the 2018 method. Within the direct causes, rates were 0.8 deaths per 100,000 live births for Other complications predominantly related to the puerperium using the 2003–2017 method, and 0.7 using the 2018 method; 1.0 for Eclampsia and pre-eclampsia using the 2003–2017 method, and 0.9 using the 2018 method; and 1.2 for Obstetric embolism using the 2003–2017 method, and 1.1 using the 2018 method. Maternal mortality rates increase with increasing age for the different causes of death regardless of method.

## Comparison of Rates With Those of Pre-checkbox Era

NCHS last published information on the U.S. maternal mortality trend in 2002. It is not appropriate to compare maternal mortality for 2018 with previous years when the checkbox had not been adopted by all states and the number of states adopting the checkbox increased each year. Observed changes in the rate reflect the increasing number of states adopting the checkbox rather than a change in the risk of maternal death. The maternal



**Figure 4. Percent distribution of maternal deaths, by cause of death using two coding methods: United States, 2018**

mortality rate calculated without using the checkbox, as would have been done before 2003 (referred to as the pre-2003 method), provides statistics calculated in the most equivalent way possible (i.e., without the checkbox) for the entire United States over time (10). These comparisons are provided in this report to show comparisons using the most recent data and as many recent time points as possible. As of this report, data have been recoded without using the checkbox for only the 2015–2018 data years.

Table E shows maternal mortality rates for 2002 (8.9), 2015 (8.7), 2016 (8.7), 2017 (11.5), and 2018 (8.7). Except for 2017 (11.5), the rates were not statistically different from the rate in 2002 (8.9). These results are similar to the other reports previously mentioned, which also demonstrate that the maternal mortality rate did not increase significantly either after accounting for the staggered implementation of the checkbox by states (using the modeled approach) (11) or as if the checkbox had never been implemented (10). It is possible that recoding cause of death without using the checkbox can miss some deaths that would have been identified had the checkbox not been present, such as if the certifier did not list a maternal cause in the cause-of-death section of the death certificate because pregnancy was indicated in the checkbox.

## Maternal Mortality Data Release Moving Forward

Starting with the 2018 data year, the 2018 method will be incorporated as part of NCHS’ standard production of the public-use mortality data. The 2018 mortality data are being released at the same time as this report and will include maternal deaths coded according to the 2018 method. All official statistics on maternal mortality from 2018 and subsequent years will be based on the 2018 method.

Starting with the 2018 data file, the underlying-cause and multiple-cause (both entity axis and record axis) fields will be the same as originally coded for the records reporting terms and phrases indicating pregnancy or obstetric conditions

**Table E. Maternal mortality rates using the pre-2003 method: United States, 2002 and 2015–2018**

[Rates are per 100,000 live births]

Year	Number of deaths	Rate
2002	357	8.9
2015	345	8.7
2016	345	8.7
2017	442	11.5
2018	331	8.7

NOTE: Data for 2002 are included for comparison with the 2015–2018 values.

SOURCE: NCHS, National Vital Statistics System.

for decedents of all ages. For checkbox-only records, not all conditions on the record will be assigned maternal codes as was previously done. Instead, only the underlying cause will be modified. Entity axis fields will not be modified. In addition, in the record axis fields, the nonmaternal code that would have been selected as the underlying cause if no checkbox item had been available will be flagged (see data documentation for the 2018 mortality file for details). For decedents aged 45–54 with a positive checkbox item and no reported information related to pregnancy in the cause-of-death section, the underlying-cause and multiple-cause fields will reflect coding done without using the checkbox item; see [Technical Notes](#) for an illustration with a couple of examples. The checkbox value will still be available in the mortality files as a separate field.

For the data files that have been released previously (2003–2017), maternal records are being recoded without using the checkbox item (pre-2003 method) and will also be recoded according to the 2018 method. These data, along with the original coding (2003–2017 method) and the pregnancy checkbox item, will be incorporated into an additional, separate restricted-use data file that will be available to researchers through the NCHS Research Data Center. The official data files for 2003–2017 already released will not be changed. Reclassified data for 2015–2017 are being released along with this report. Data for 2003–2014 will be added to this file as the recoding for each year is completed. These data will provide researchers with access to cause-of-death codes using alternate coding methods and provide maximum flexibility for analysis using different methods and assumptions. As addressed earlier, the pre-2003 method underestimated maternal deaths, the 2003–2017 method overestimated maternal deaths for older women, and the 2018 method is designed to lessen the effect of likely errors in the checkbox. Trend analyses for data pre-2018 using either the 2003–2017 or 2018 method are limited by the incremental implementation of the checkbox.

## Implications Related to Use of 2018 Method

The checkbox item was added to correct for underestimation, and initial results showed an increase in reporting of maternal deaths. With time, however, questions arose about whether the increase stemmed from an unknown mixture of improved measurement and increased misclassification (12,13,15). The 2018 method is intended to mitigate errors (14) in the pregnancy checkbox item and provide an improved estimate of maternal mortality. However, it does not correct all errors, nor does it address all issues with the data. The 2018 method may result in an underestimate of maternal mortality at ages 45 and over and may still overestimate maternal mortality for ages 10–44. If certifiers alter what they report in the cause-of-death statement because of the availability of the checkbox, that might affect the adequacy of the 2018 method. The 2018 method will not have an impact on records where pregnancy may have contributed to death but the certifier failed to report it in either the cause-of-death statement or the checkbox item. Other modifications—such as changes in ways certifiers completed cause-of-death

information on the death certificate, changes in guidance provided to certifiers, shifts in completing death certification on paper compared with electronic death registration, or changes in outreach to query the quality of the information over time—may be other factors that could potentially have influenced the balance between improvement and misclassification captured in the checkbox item but cannot be easily quantified. With the exception of external causes, the 2018 coding method also does not address cases in which the cause of death was incidental to pregnancy (i.e., the decedent was pregnant in the last year, but pregnancy was not a factor contributing to death). The expectation is that more deaths are identified as maternal deaths than appropriate in this scenario, because information on the death certificate is typically insufficient to exclude causes that may, in fact, be incidental.

Additional efforts will be needed to identify and correct errors and improve reporting. Linking deaths for women of reproductive age to birth and fetal death records as part of routine vital statistics reporting in NVSS can help detect cases that fail to report pregnancies in the past year as well as help investigate checkbox-only cases that do not seem to have corroborating indications of a pregnancy in the past year. Guidance on death certificate reporting for certifiers can be effective, especially for certifiers who are not familiar with the task of completing a death certificate. A key step in any effective improvement is to ensure that the accuracy and quality of information is incorporated into vital statistics data as it is originally recorded.

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## List of Detailed Tables

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**Table 1. Maternal mortality rates and number of maternal deaths, by race and Hispanic origin and age: United States, 2018**

[Maternal causes are those assigned to categories of the *International Classification of Diseases, 10th Revision*, 1992. Maternal deaths occur while pregnant or within 42 days of being pregnant. Race values are not bridged. Rates are per 100,000 live births]

Race and Hispanic origin and age	Maternal mortality (A34, 000–095, 098–099)		Late maternal mortality (096)	
	With checkbox <sup>1</sup> (2003–2017 coding method)	With checkbox for ages 44 and under <sup>1</sup> ; without checkbox for 45 and over (2018 coding method)	With checkbox <sup>1</sup> (2003–2017 coding method)	With checkbox for ages 44 and under <sup>1</sup> ; without checkbox for 45 and over (2018 coding method)
			Rate	
All persons <sup>2</sup> . . . . .	20.5	17.4	7.9	7.3
Under 25 . . . . .	10.6	10.6	5.6	5.6
25–39 . . . . .	16.6	16.6	7.0	7.0
40 and over . . . . .	175.7	81.9	44.1	25.2
40–44 . . . . .	82.6	82.6	26.4	26.4
45 and over . . . . .	1,315.9	*	261.1	*
Non-Hispanic white . . . . .	18.0	14.7	8.0	7.2
Under 25 . . . . .	10.2	10.2	5.6	5.6
25–39 . . . . .	13.7	13.7	6.8	6.8
40 and over . . . . .	179.2	68.7	53.6	*
40–44 . . . . .	66.8	66.8	*	*
45 and over . . . . .	1,635.9	*	*	*
Non-Hispanic black . . . . .	43.3	37.1	14.5	13.9
Under 25 . . . . .	15.3	15.3	*	*
25–39 . . . . .	38.0	38.0	14.5	14.5
40 and over . . . . .	434.0	239.9	*	*
40–44 . . . . .	243.9	243.9	*	*
45 and over . . . . .	2,431.0	*	*	*
Hispanic . . . . .	13.7	11.8	5.1	4.5
Under 25 . . . . .	7.6	7.6	*	*
25–39 . . . . .	12.4	12.4	4.5	4.5
40 and over . . . . .	90.0	*	*	*
40–44 . . . . .	*	*	*	*
45 and over . . . . .	*	*	*	*
			Number	
All persons <sup>2</sup> . . . . .	777	658	301	277
Under 25 . . . . .	96	96	51	51
25–39 . . . . .	458	458	194	194
40 and over . . . . .	223	104	56	32
40–44 . . . . .	97	97	31	31
45 and over . . . . .	126	7	25	1
Non-Hispanic white . . . . .	353	287	156	141
Under 25 . . . . .	40	40	22	22
25–39 . . . . .	206	206	102	102
40 and over . . . . .	107	41	32	17
40–44 . . . . .	37	37	16	16
45 and over . . . . .	70	4	16	1
Non-Hispanic black . . . . .	239	205	80	77
Under 25 . . . . .	27	27	15	15
25–39 . . . . .	136	136	52	52
40 and over . . . . .	76	42	13	10
40–44 . . . . .	39	39	10	10
45 and over . . . . .	37	3	3	–
Hispanic . . . . .	121	105	45	40
Under 25 . . . . .	21	21	11	11
25–39 . . . . .	72	72	26	26
40 and over . . . . .	28	12	8	3
40–44 . . . . .	12	12	3	3
45 and over . . . . .	16	–	5	–

\* Rate does not meet NCHS standards of reliability.

– Quantity zero.

<sup>1</sup>California did not have the standard checkbox item.

<sup>2</sup>Total includes more race and Hispanic groups than shown, including more than one race.

SOURCE: NCHS, National Vital Statistics System, Mortality.

**Table 2. Maternal mortality rates and number of maternal deaths by coding method for selected causes, by age: United States, 2018**

[Maternal causes are those assigned to categories of the *International Classification of Diseases, 10th Revision (ICD-10)*, 1992. Maternal deaths occur while pregnant or within 42 days of being pregnant]

Cause of death (based on ICD-10)	With checkbox <sup>1</sup> (2003–2017 coding method)						With checkbox for ages 44 and under <sup>1</sup> ; without checkbox for 45 and over (2018 coding method)					
	All persons	Under 25	25–39	40 and over			All persons	Under 25	25–39	40 and over		
				Total	40–44	45 and over				Total	40–44	45 and over
	Rate per 100,000 live births											
Maternal causes . . . . . (A34,000–095,098–099)	20.5	10.6	16.6	175.7	82.6	1,315.9	17.4	10.6	16.6	81.9	82.6	*
Direct obstetric causes . . . . . (A34, 000–095)	15.4	7.6	12.8	126.8	68.2	846.0	13.4	7.6	12.8	67.7	68.2	*
Pregnancy with abortive outcome . . . . . (000–007)	0.8	*	0.8	*	*	*	0.8	*	0.8	*	*	*
Ectopic pregnancy . . . . . (000)	0.6	*	*	*	*	*	0.6	*	*	*	*	*
Spontaneous abortion . . . . . (003)	*	*	*	*	*	*	*	*	*	*	*	*
Medical abortion . . . . . (004)	*	*	*	*	*	*	*	*	*	*	*	*
Other abortion . . . . . (005)	*	*	*	*	*	*	*	*	*	*	*	*
Other and unspecified pregnancy with abortive outcome . . . . . (001–002,006–007)	*	*	*	*	*	*	*	*	*	*	*	*
Other direct obstetric causes . . . . . (A34,010–092)	14.1	6.6	11.7	119.7	60.5	846.0	12.1	6.6	11.7	60.7	60.5	*
Eclampsia and pre-eclampsia . . . . . (O11,013–016)	1.0	*	1.0	*	*	*	0.9	*	1.0	*	*	*
Hemorrhage of pregnancy and childbirth and placenta previa . . . . . (O20,044–046,067,072)	0.8	*	0.9	*	*	*	0.8	*	0.9	*	*	*
Complications predominantly related to the puerperium . . . . . (A34,085–092)	1.9	*	1.9	*	*	*	1.9	*	1.9	*	*	*
Obstetrical tetanus . . . . . (A34)	*	*	*	*	*	*	*	*	*	*	*	*
Obstetric embolism . . . . . (O88)	1.2	*	1.2	*	*	*	1.1	*	1.2	*	*	*
Other complications predominantly related to the puerperium . . . . . (O85–O87,089–092)	0.8	*	0.7	*	*	*	0.7	*	0.7	*	*	*
All other direct obstetric causes . . . . . (O10,012,021–043,047–066,068–071,073–075)	10.3	5.1	7.9	99.2	46.9	741.5	8.5	5.1	7.9	45.7	46.9	*
Obstetric death of unspecified cause . . . . . (O95)	0.6	*	*	*	*	*	0.6	*	*	*	*	*
Indirect obstetric causes . . . . . (O98–099)	5.1	3.0	3.8	48.8	*	470.0	3.9	3.0	3.8	*	*	*
Death from any obstetric cause occurring more than 42 days but less than 1 year after delivery . . . . . (O96) <sup>2</sup>	7.9	5.6	7.0	44.1	26.4	261.1	7.3	5.6	7.0	25.2	26.4	*

See footnotes at end of table.

**Table 2. Maternal mortality rates and number of maternal deaths by coding method for selected causes, by age: United States, 2018—Con.**

[Maternal causes are those assigned to categories of the *International Classification of Diseases, 10th Revision* (ICD-10), 1992. Maternal deaths occur while pregnant or within 42 days of being pregnant]

Cause of death (based on ICD-10)	With checkbox <sup>1</sup> (2003–2017 coding method)						With checkbox for ages 44 and under <sup>1</sup> ; without checkbox for 45 and over (2018 coding method)					
	All persons	Under 25	25–39	40 and over			All persons	Under 25	25–39	40 and over		
				Total	40–44	45 and over				Total	40–44	45 and over
	Number											
Maternal causes . . . . . (A34,000–095,098–099)	777	96	458	223	97	126	658	96	458	104	97	7
Direct obstetric causes . . . . . (A34, 000–095)	584	69	354	161	80	81	509	69	354	86	80	6
Pregnancy with abortive outcome . . . . . (000–007)	29	3	21	5	5	–	29	3	21	5	5	–
Ectopic pregnancy . . . . . (000)	24	3	19	2	2	–	24	3	19	2	2	–
Spontaneous abortion . . . . . (003)	2	–	1	1	1	–	2	–	1	1	1	–
Medical abortion . . . . . (004)	–	–	–	–	–	–	–	–	–	–	–	–
Other abortion . . . . . (005)	1	–	–	1	1	–	1	–	–	1	1	–
Other and unspecified pregnancy with abortive outcome . . . . . (001–002,006–007)	2	–	1	1	1	–	2	–	1	1	1	–
Other direct obstetric causes . . . . . (A34,010–092)	534	60	322	152	71	81	459	60	322	77	71	6
Eclampsia and pre-eclampsia . . . . . (011,013–016)	38	2	27	9	5	4	35	2	27	6	5	1
Hemorrhage of pregnancy and childbirth and placenta previa . . . . . (020,044–046,067,072)	32	2	24	6	3	3	30	2	24	4	3	1
Complications predominantly related to the puerperium . . . . . (A34,085–092)	73	10	52	11	8	3	71	10	52	9	8	1
Obstetrical tetanus . . . . . (A34)	–	–	–	–	–	–	–	–	–	–	–	–
Obstetric embolism . . . . . (088)	44	5	33	6	5	1	43	5	33	5	5	–
Other complications predominantly related to the puerperium . . . . . (085–087,089–092)	29	5	19	5	3	2	28	5	19	4	3	1
All other direct obstetric causes . . . . . (010,012,021–043,047–066,068–071,073–075)	391	46	219	126	55	71	323	46	219	58	55	3
Obstetric death of unspecified cause . . . . . (095)	21	6	11	4	4	–	21	6	11	4	4	–
Indirect obstetric causes . . . . . (098–099)	193	27	104	62	17	45	149	27	104	18	17	1
Death from any obstetric cause occurring more than 42 days but less than 1 year after delivery . . . . . (096) <sup>2</sup>	301	51	194	56	31	25	277	51	194	32	31	1

\* Rate does not meet NCHS standards of reliability.

– Quantity zero.

<sup>1</sup>California did not have the standard checkbox item.

<sup>2</sup>Late maternal death.

SOURCE: NCHS, National Vital Statistics System, Mortality.

## Technical Notes

Tabulations of cause-of-death statistics in this report are based solely on the underlying cause of death. The underlying cause is defined by the World Health Organization as “the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury.” The underlying cause is selected from the conditions entered by the medical certifier in the cause-of-death section of the death certificate. When more than one cause or condition is entered by the medical certifier, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the *International Classification of Diseases* (ICD), and associated selection rules and modifications. Generally, more medical information is reported on death certificates than is directly reflected in the underlying cause of death. This is captured in National Center for Health Statistics’ (NCHS) multiple cause-of-death data as entity axis and record axis data.

For the years for which data has already been released, [Figures I](#) and [II](#) provide some examples of how the recoded data would be presented on a data file.

### Checkbox item analysis based on National Hospital Care Survey data linked to National Death Index

The National Hospital Care Survey (NHCS) data linked to the National Death Index (NDI) were analyzed by NCHS as a case study to explore the potential accuracy of use of the pregnancy checkbox item according to maternal mortality coding procedures in U.S. death certificates. This analysis sought to determine potential false positive (overuse) or false negative (underuse) uses of the pregnancy checkbox. The linked NHCS–NDI data contain information about hospital visits (inpatient and emergency department encounters) in the year before death for those patients who died. The analysis was based on the premise that for a decedent currently pregnant or pregnant in the year before death, the pregnancy checkbox would be used as it was intended to indicate that the decedent was currently pregnant (checkbox value of 2), pregnant within 42 days (value of 3), or pregnant within 43 days to 1 year (value of 4). Assuming that the person responsible for filling out the death certificate is aware of the decedent’s recent medical history, including pregnancy, then the expectation is that the checkbox would be correctly used. If no evidence existed of a current pregnancy or pregnancy within the year prior to death, or no information about pregnancy is available, the expectation is that the checkbox would not be used, and a value of 1 (not pregnant), 7 (not on certificate), 8 (not applicable), or 9 (unknown if pregnant within the past year) would be used accordingly.

This analysis assessed whether overuse or underuse of the checkbox occurred, using this unique source of linked hospital care and death data. Overuse was assessed by first identifying all death records in the linked file that had a pregnancy checkbox value indication of 2, 3, or 4. Given that these decedents were linked to hospitalization data in the previous year, the goal

I a) Rupture ectopic pregnancy	O00.9	Pregnancy checkbox = Pregnant at time of death
b)		
c)		
II		
<b>Underlying cause</b>		<b>O00.9</b>
<ul style="list-style-type: none"> <li>Entity axis codes—First two positions indicate where the condition was reported (i.e., which line and where on the line) 11O009</li> <li>Record axis codes—Underlying cause is listed first, followed by other codes listed alphanumerically O009</li> </ul>		
<small>NOTES: For this example, the record would be coded the same with or without the checkbox. The entity and record axis codes would be the same for both the 2003–2017 and 2018 methods. SOURCE: NCHS, National Vital Statistics System, Mortality.</small>		

**Figure I. Example of record with checkbox and mention of pregnancy or obstetric condition in cause-of-death statement**

<b>Coding using 2018 method</b>		
I a) Brain stem herniation	R58	Pregnancy checkbox =
b) Intracerebral hemorrhage	I71.0	Pregnant at time of death
c) Brain arteriovenous malformation	I70.9	
II		
<b>Underlying cause</b>		<b>I71.0 → O99.4 (Diseases of the circulatory system complicating pregnancy, childbirth and the puerperium)</b>
<ul style="list-style-type: none"> <li>Entity axis codes—First two positions indicate where the condition was reported (i.e., which line and where on the line) 11R58 21I710 31I709</li> <li>Record axis codes—Underlying cause is listed first, followed by code that would have been the underlying cause without the checkbox, followed by other codes listed alphanumerically O994 I7101<sup>1</sup> I709 R58</li> </ul>		
<small><sup>1</sup>The numeral 1 in the fifth position indicated the code that would be the underlying cause without the checkbox.</small>		
<b>Coding using 2003–2017 method</b>		
I a) Brain stem herniation	O99.3	Pregnancy checkbox =
b) Intracerebral hemorrhage	O99.4	Pregnant at time of death
c) Brain arteriovenous malformation	O99.8	
II		
<b>Underlying cause</b>		<b>O99.8 (Other specified diseases and conditions complicating pregnancy, childbirth and the puerperium)</b>
<ul style="list-style-type: none"> <li>Entity axis codes—First two positions indicate where the condition was reported (i.e., which line and where on the line) 11O993 21O994 31O998</li> <li>Record axis codes—Underlying cause is listed first, followed by other codes listed alphanumerically O998 O993 O994</li> </ul>		
<small>NOTES: For this example, the record would be coded differently with or without the checkbox. Using the 2003–2017 method, all of the codes are O codes, whereas with the 2018 method, only the underlying cause is converted to an O code. SOURCE: NCHS, National Vital Statistics System, Mortality.</small>		

**Figure II. Example of checkbox-only record for decedent aged 10–44**

was to see if the records would have some indication of a pregnancy-related hospital encounter, including delivery, or that a pregnancy would be noted in their record of care for a given inpatient or emergency department visit. Pregnancy-related hospital encounters were defined based on any diagnosis codes using *International Classification of Diseases, Ninth Revision or 10th Revision, Clinical Modification* (ICD-9-CM or ICD-10-CM) or SNOMED for that encounter. If no indication of a pregnancy-related diagnosis in the previous year was listed for these decedents, then these records would be considered a potential overuse of the pregnancy indication on the checkbox, or a false positive use of the checkbox (i.e., the checkbox indicated pregnancy when it should not have).

Underuse of the pregnancy indication on the checkbox was assessed by first identifying all records of pregnancy-related hospitalizations for persons who died within the year of their hospitalization and then determining those records with a pregnancy checkbox value of 1, 7, 8, or 9. Given that these decedents had a record of a pregnancy-related hospitalization in the previous year, the expectation is that the checkbox value would indicate a current or recent pregnancy. Otherwise, if no value indicating current or recent pregnancy existed in the checkbox item, these records were considered an underuse of the pregnancy indication of the checkbox, or a false negative use of the checkbox (i.e., the checkbox should have indicated a pregnancy when it did not).

The 2014 NHCS data were linked to the 2014–2015 NDI, and 2016 NHCS data were linked to the 2016–2017 NDI, to allow for an assessment of mortality at intervals of interest (e.g., death at 30, 60, or 90 days postdischarge or 1-year survival postdischarge). The linkage process has been detailed elsewhere: [https://www.cdc.gov/nchs/data/datalinkage/NHCS14\\_NDI14\\_15\\_Methodology\\_Analytic\\_Consider.pdf](https://www.cdc.gov/nchs/data/datalinkage/NHCS14_NDI14_15_Methodology_Analytic_Consider.pdf) and [https://www.cdc.gov/nchs/data/datalinkage/NHCS16\\_NDI16\\_17\\_Methodology\\_Analytic\\_Consider.pdf](https://www.cdc.gov/nchs/data/datalinkage/NHCS16_NDI16_17_Methodology_Analytic_Consider.pdf).

Note that NHCS data for both 2014 and 2016 are based only on the relatively small percentage of hospitals that responded to the survey (16% in 2014 and 27% in 2016) and are not nationally representative. Therefore, this case study is not intended to be a nationally representative assessment of checkbox usage. In addition, this analysis only includes visits that occurred at sampled hospitals, and the possibility exists that the patient may have been seen primarily at a nonsampled hospital during the year before birth or that the mention of a pregnancy was omitted from the record. Lastly, this analysis may miss cases of pregnancies for which no event occurred necessitating a hospitalization or emergency department visit (e.g., abortive outcomes).

### Potential overuse of checkbox—false positives

To create the analytic sample to assess overuse of the pregnancy checkbox, 150 women in the 2014 linked NHCS–NDI and 220 women in the 2016 linked NHCS–NDI file were identified with a checkbox value of 2, 3, or 4. In the 2014 NHCS, 81 of the 150 decedents who were identified as pregnant within the year before death by the checkbox (values 2, 3, or 4) had no pregnancy-related hospital encounter within 1 year of death,

including no record of delivery. Of these 81 decedents, 32 were under age 30, 15 were aged 30–39, and 34 were aged 40 and over. Based on this analysis, 54% of records with a pregnancy checkbox value indicating a current or recent pregnancy had no pregnancy-related hospitalization nor any mention of pregnancy in the hospitalization record in the previous year and were considered false positives.

In the 2016 linked NHCS–NDI data, 124 of the 220 decedents who were identified as pregnant within the year before death by the pregnancy checkbox (values 2, 3, or 4) had no pregnancy-related hospital encounter within 1 year of death. Of the 124 decedents, 47 were aged under 30, 36 were aged 30–39, and 41 were aged 40 and over. Based on this analysis, 56% of records with a pregnancy checkbox value indicating a current or recent pregnancy had no pregnancy-related hospitalization nor mention of pregnancy in the record of hospitalization in the previous year and were considered false positives.

### Potential underuse of checkbox—false negatives

In the 2014 NHCS, 236 decedents with a pregnancy-related hospitalization in the previous year were identified. Of these, 157 decedents had both a pregnancy-related hospital encounter within 1 year of death and a pregnancy checkbox value of 1, 7, 8, or 9 (not indicating pregnancy). Of the 157 decedents, 62 were aged under 30, 62 were aged 30–39, and 33 were aged 40 and over. Based on this analysis, 67% of 236 records of a pregnancy-related hospitalization in the previous year did not have current or recent pregnancy indicated by the pregnancy checkbox on the death certificate and were considered false negatives.

In the 2016 NHCS, 253 decedents with a pregnancy-related hospitalization in the previous year were identified. Of these, 158 had both a pregnancy-related encounter within 1 year of death and a pregnancy checkbox value of 1, 7, 8, or 9. Of the 158 decedents, 64 were under age 30, 62 were aged 30–39, and 32 were aged 40 and over. Based on this analysis, 62% of 236 records with a pregnancy-related hospitalization in the previous year did not have current or recent pregnancy indicated by the pregnancy checkbox and were considered false negatives.

### Summary

This analysis attempts to discern use of the pregnancy checkbox from a data source linking hospitalization encounters and deaths among patients. The purpose was to assess the use of the checkbox according to whether a record of pregnancy in a hospitalization event occurred in the period of time defined by the checkbox (i.e., within 1 year). For both the 2014 and 2016 linked files, approximately 53% of records were false positive cases of pregnancy indication on the checkbox, while approximately 65% of records were false negative cases of pregnancy indication on the checkbox. The ability to examine use of the pregnancy checkbox on the death certificate linked with hospitalization data predating death provided a unique way to examine and highlight potential misreporting of the checkbox, which may, in turn, affect estimates of maternal mortality.

## Late maternal deaths

Late maternal deaths (occurring between 43 days and 1 year of death) are not included in the calculation of the official maternal mortality rates, which are based on maternal deaths occurring while pregnant or within 42 days of being pregnant. Late maternal deaths are included in other maternal death measures, such as in the calculation of pregnancy-related deaths, defined as the death of a woman while pregnant or within 1 year of the end of a pregnancy, as measured by the Centers for Disease Control and Prevention's Pregnancy Mortality Surveillance System (4). In the National Vital Statistics System, identification of late maternal deaths is similar to that for maternal deaths, in that the coding procedures are based on causes of death reported on death certificates and information on pregnancy status reported in the checkbox item. Therefore, late maternal deaths are also affected by the change in the coding methods.

Some late maternal deaths are identified via checkbox-only records. In this situation, the checkbox is the only indication of pregnancy, and the checkbox indicates that the pregnancy occurred between 43 days and 1 year of death. In the 2018 coding method, coding of late maternal deaths will restrict application of the checkbox item to decedents aged 10–44 years. The checkbox will not be applied in coding cause of death for decedents aged 45 and over. If the checkbox is the only indication of a pregnancy for female decedents aged 10–44, a late maternal code will be assigned as the underlying cause. However, a late maternal code will be assigned only to the underlying cause and not to other conditions reported on the certificate.

## California data and coding methods

California has included a checkbox on the death certificate since 2003, but it is not the one used on the U.S. Standard Certificate of Death. The pregnancy checkbox used by California asks only if a pregnancy occurred within the year of death and does not differentiate timing of pregnancy. Under the 2003–2017 coding method, a positive response to this nonstandard category without further specification of timing in the cause-of-death statement was treated as if the pregnancy occurred between 43 days and 1 year before death (i.e., a late maternal death), and, therefore, these deaths would not be coded as maternal deaths or included in the calculation of the maternal mortality rate (10). This could overestimate the number of deaths identified as late maternal deaths and underestimate the maternal mortality rate in California.

Application of the 2018 coding method will differ for California compared with the rest of the jurisdictions. For checkbox-only cases, no difference will exist between California and the other states for women aged 45 and over, because these cases will not be coded as maternal deaths under the 2018 coding rules. However, checkbox-only records in California among women aged 10–44 will also not be coded as maternal deaths, whereas they would be so coded in the other states where the checkbox indicates a pregnancy before 43 days. Checkbox-only deaths in California for those aged 10–44 will instead be coded as late maternal deaths. For California and the rest of the states, all deaths with cause-of-death information in addition to

the checkbox have the potential to be coded as maternal deaths depending on the information included in the cause-of-death section. The coding of the cause will follow usual coding and use information from the checkbox, if available, to determine timing. Quantifying the impact of coding all California checkbox-only deaths as late maternal deaths on the maternal mortality rate is difficult, but it is plausible that the national maternal mortality rate may be somewhat underestimated. California will begin using the standard checkbox in 2020, and changes in the national maternal mortality rate as a result of this changeover will be evaluated upon release of the 2020 data.

## Race and Hispanic origin

The 2003 revision of the U.S. Standard Certificate of Death allows the reporting of more than one race (multiple races), in accordance with the revised standards issued by the Office of Management and Budget in 1997. Information on this change is presented elsewhere (17). The number of states reporting multiple races increased over time, so that by midyear 2017, all were reporting multiple races. To provide uniformity and comparability of the data before all areas have data in multiple-race format, the responses of those for whom more than one race was reported (multiple races) were bridged to a single race. The bridging procedure for multiple-race women is similar to the procedure used to bridge the multiple-race population estimates. Information detailing the processing and tabulation of data by race is presented elsewhere (see [https://www.cdc.gov/nchs/data/dvs/Multiple\\_race\\_documentation\\_5-10-04.pdf](https://www.cdc.gov/nchs/data/dvs/Multiple_race_documentation_5-10-04.pdf)).

Race and Hispanic origin are two distinct attributes and are reported separately on the death certificate. Data shown for Hispanic women include women of any race. Hispanic origin is not imputed if it is not reported.

This report presents data by single-race group when only one race was reported. A separate report (10) on maternal mortality presented data for earlier years and showed data by bridged race. The following Table is similar to Table 1 but presents the information using bridged data.

## Random variation

Mortality data are not subject to sampling error but may be affected by random variation. That is, the number of deaths that actually occurred may be considered as one of a large series of possible results that could have arisen under the same circumstances; see Technical Notes (17) for more complete discussion of random variation, confidence intervals, and statistical tests for rates.

*Suppression of unreliable rates*—An asterisk is shown in place of a mortality rate based on fewer than 20 deaths, the equivalent of a relative standard error of 23% or more. The minimum of 20 deaths is the current standard for NCHS' Division of Vital Statistics, below which rates are considered to be too statistically unreliable for presentation.

**Table. Maternal mortality rates and maternal deaths, by bridged race and Hispanic origin and age: United States, 2018**

[Maternal causes are those assigned to categories of the *International Classification of Diseases, 10th Revision*, 1992. Maternal deaths occur while pregnant or within 42 days of being pregnant. Race values are bridged. Rates are per 100,000 live births]

Race and Hispanic origin and age	Maternal mortality (A34, 000–095, 098–099)		Late maternal mortality (096)	
	With checkbox <sup>1</sup> (2003–2017 coding method)	With checkbox for ages 44 and under <sup>1</sup> ; without checkbox for 45 and over (2018 coding method)	With checkbox <sup>1</sup> (2003–2017 coding method)	With checkbox for ages 44 and under <sup>1</sup> ; without checkbox for 45 and over (2018 coding method)
			Rate	
All persons <sup>2</sup> . . . . .	20.5	17.4	7.9	7.3
Under 25 . . . . .	10.6	10.6	5.6	5.6
25–39 . . . . .	16.6	16.6	7.0	7.0
40 and over . . . . .	175.7	81.9	44.1	25.2
40–44 . . . . .	82.6	82.6	26.4	26.4
45 and over . . . . .	1,315.9	*	261.1	*
Non-Hispanic white . . . . .	18.1	14.8	7.9	7.2
Under 25 . . . . .	10.4	10.4	5.4	5.4
25–39 . . . . .	13.7	13.7	6.8	6.8
40 and over . . . . .	179.6	70.8	52.7	*
40–44 . . . . .	69.2	69.2	*	*
45 and over . . . . .	1,609.6	*	*	*
Non-Hispanic black . . . . .	42.1	36.3	14.0	13.5
Under 25 . . . . .	14.9	14.9	*	*
25–39 . . . . .	37.5	37.5	14.2	14.2
40 and over . . . . .	421.1	232.7	*	*
40–44 . . . . .	236.6	236.6	*	*
45 and over . . . . .	2,368.8	*	*	*
Hispanic . . . . .	13.7	11.8	5.1	4.5
Under 25 . . . . .	7.6	7.6	*	*
25–39 . . . . .	12.4	12.4	4.5	4.5
40 and over . . . . .	90.0	*	*	*
40–44 . . . . .	*	*	*	*
45 and over . . . . .	*	*	*	*
			Number	
All persons <sup>2</sup> . . . . .	777	658	301	277
Under 25 . . . . .	96	96	51	51
25–39 . . . . .	458	458	194	194
40 and over . . . . .	223	104	56	32
40–44 . . . . .	97	97	31	31
45 and over . . . . .	126	7	25	1
Non-Hispanic white . . . . .	361	295	158	143
Under 25 . . . . .	42	42	22	22
25–39 . . . . .	210	210	104	104
40 and over . . . . .	109	43	32	17
40–44 . . . . .	39	39	16	16
45 and over . . . . .	70	4	16	1
Non-Hispanic black . . . . .	244	210	81	78
Under 25 . . . . .	28	28	15	15
25–39 . . . . .	140	140	53	53
40 and over . . . . .	76	42	13	10
40–44 . . . . .	39	39	10	10
45 and over . . . . .	37	3	3	–
Hispanic . . . . .	121	105	45	40
Under 25 . . . . .	21	21	11	11
25–39 . . . . .	72	72	26	26
40 and over . . . . .	28	12	8	3
40–44 . . . . .	12	12	3	3
45 and over . . . . .	16	–	5	–

\* Rate does not meet NCHS standards of reliability.

– Quantity zero

<sup>1</sup>California did not have the standard checkbox item.

<sup>2</sup>Total includes more race and Hispanic groups than shown.

SOURCE: NCHS, National Vital Statistics System, Mortality.





# Maternal Mortality Statistics



The screenshot displays the CDC National Center for Health Statistics website. At the top, it says "CDC Centers for Disease Control and Prevention" and "National Center for Health Statistics". The main heading is "Maternal Mortality". Below this, there is a news item: "NCHS released maternal mortality statistics for 2018, an extensive review of data quality, and new coding for death certificates based on this review." A grid of links includes "Detailed Evaluation of Changes in Data Collection Methods", "Implementation of New Coding Methods", "Data Files and Resources", "Maternal Mortality Reports", "Frequently Asked Questions", and "Contact NCHS". A "CDC-INFO" logo is also visible.

**National Vital Statistics Reports**  
Volume 69  
Evaluating the Impact of the Pregnancy Checklist on Maternal Mortality Statistics  
by Donna L. H. Director, and A. ...

**NATIONAL CENTER FOR HEALTH STATISTICS**  
**Vital and Health Statistics**  
Series 3, Number 44 January 2020

**Abstract**  
Objective—The objective of this study was to evaluate the impact of the pregnancy checklist on maternal mortality statistics in the United States. Methods—Information from the National Vital Statistics System (NVSS) for the period 1999–2017 was analyzed. Deaths were classified as maternal mortality based on the pregnancy checklist items. Results—Information from the NVSS identified 1,520 deaths classified as maternal mortality. The ratio for all deaths (all ages) was 1.52 in 2002. With the pregnancy checklist, the ratio for all deaths (all ages) was 1.52 in 2017.

**The Impact of the Pregnancy Checklist and Misclassification on Maternal Mortality Trends in the United States, 1999–2017**  
Analytical and Epidemiological Studies

To access other NCHS reports about maternal mortality, public-use data files, and resources, visit <https://www.cdc.gov/nchs/maternal-mortality/>.

CS313496

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National Vital Statistics Reports, Vol. 69, No. 2, January 30, 2020

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