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Original Research

Recent Increases in the U.S. Maternal Mortality Rate

Disentangling Trends From Measurement Issues

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OBJECTIVE: To develop methods for trend analysis of vital statistics maternal mortality data, taking into account changes in pregnancy question formats over time and between states, and to provide an overview of U.S. maternal mortality trends from 2000 to 2014.

METHODS: This observational study analyzed vital statistics maternal mortality data from all U.S. states in relation to the format and year of adoption of the pregnancy question. Correction factors were developed to adjust data from before the standard pregnancy question was adopted to promote accurate trend analysis. Joinpoint regression was used to analyze trends for groups of states with similar pregnancy questions.

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.

CONCLUSION: Despite the United Nations Millennium Development Goal for a 75% reduction in maternal mortality by 2015, the estimated maternal mortality rate for 48 states and Washington, DC, increased from 2000 to 2014; the international trend was in the opposite direction. There is a need to redouble efforts to prevent maternal deaths and improve maternity care for the 4 million U.S. women giving birth each year.

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Maternal mortality is an important indicator of the quality of health care both nationally and internationally.[1–5]

The Centers for Disease Control and Prevention's National Center for Health Statistics is the source of official U.S.' maternal mortality statistics used for both subnational and international comparisons.[6] Earlier studies identified significant underreporting of maternal deaths in the National Vital Statistics System.[7,8] To improve ascertainment, a pregnancy question was added to the 2003 revision of the U.S. standard death certificate. The question has checkboxes to ascertain whether female decedents were not pregnant within the past year, pregnant at the time of death, not pregnant but pregnant within 42 days of death, not pregnant but pregnant 43 days to 1 year before death, or unknown if pregnant within the past year.[9] The addition of this question led to increases in reported maternal mortality rates.[6] However, delays in states' adoption of the new pregnancy question together with use of nonstandard pregnancy questions created a situation where, in any given data year, some states were using the U.S. standard question, others were using questions incompatible with the U.S. standard, and still others had no pregnancy question on their death certificates.[6,10,11]

Attributable in part to difficulties in disentangling these effects, the United States has not published an official maternal mortality rate since 2007.[11] This led to a deficit of information both nationally and internationally at a time when greater attention has been focused on maternal mortality than ever before.[1–5,12,13] For example, United Nations' Millennium Development Goal 5a was to reduce the maternal mortality rate by 75% from 1990 to 2015.[12]

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A supplemental data system, the Pregnancy Mortality Surveillance System, collects data on pregnancy-related deaths (within 1 year of pregnancy) and has found recent increases in these deaths.[14,15] However, because this system is largely based on vital statistics data (together with supplementary reports), these data could also have been influenced by the improved ascertainment of vital statistics maternal deaths. Thus, there is currently no clear picture of maternal mortality trends in the United States. The aims of this study were to 1) develop and test methods for trend analysis of vital statistics maternal mortality data, taking into account state revision dates and different question formats; and 2) provide an overview of trends in U.S. maternal mortality rates from 2000 to 2014.

MATERIALS AND METHODS

The World Health Organization defines maternal death as: "The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes."[16] This is the definition used for international maternal mortality comparisons. The World Health Organization also provides a separate definition for late maternal deaths: "The death of a woman from direct or indirect obstetric causes more than 42 days but less than 1 year after termination of pregnancy."[16]

U.S. maternal mortality data used for national and international comparisons are based on information reported on death certificates filed in state vital statistics offices and subsequently compiled into national data through the National Vital Statistics System.[10,11] Physicians, medical examiners, or coroners are responsible for completing the medical portion of the death certificate, including the cause of death. From 1999 to the present, cause-of-death data in the United States have been coded according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision.[10,11] Maternal deaths are denoted by International Statistical Classification of Diseases and Related Health Problems, 10th Revision codes A34, O00–O95, and O98–O99; late maternal deaths are denoted by International Statistical Classification of Diseases and Related Health Problems, 10th Revision codes O96–O97.[6]

Maternal mortality data used in this observational study were derived from the detailed mortality data files publically available from the National Center for Health Statistics and also available through the Centers for Disease Control and Prevention's CDC WONDER.[17,18] Maternal mortality rates were computed per 100,000 live births. Joinpoint regression analysis was used to model trends over time.[19] This approach is also commonly referred to as piecewise or segmented regression and has been implemented to test for differences in adjacent time trends using permutation tests and assessing overall model fit using the Bayesian information criterion.[19] Because the study was based on deidentified, aggregated data from U.S. government public-use data sets, the study was exempt from requiring institutional review board approval.

The timing of states adopting the revised death certificate, including the pregnancy question, is shown in Table 1. For the purposes of this study, revised refers to states that have adopted the 2003 revision of the U.S. standard death certificate and unrevised refers to states that have not yet adopted the 2003 revision and thus are using the older (1989) version of the death certificate. Before revision, 18 states had a pregnancy question on their death certificate; however, for only three of these states (Alabama, Maryland, and New Mexico) did the question collect data on pregnancy within the 42-day standard timeframe. The other 15 states had pregnancy questions with timeframes ranging from 3 to 18 months after pregnancy. Thirty-two states and Washington, DC, did not have a pregnancy question on their unrevised death certificate. T1

Only four states (California, Idaho, Montana, and New York) revised their death certificates in 2003, the year that the death certificate revision was intended to take place. A few states continued to revise each year until 44 states and Washington, DC (all except Alabama, Colorado, Maryland, Massachusetts, Virginia, and West Virginia) had revised by January 1, 2014 (Massachusetts and Virginia both revised late in 2014). All states that revised their death certificates now had a pregnancy question comparable with the U.S. standard, except for California, which adopted a pregnancy question asking only about pregnancies within the past year. Thus, as of January 1, 2014, all states except California, Colorado, Massachusetts, Virginia, and West Virginia were supplying pregnancy data for the standard 42-day timeframe.

It would be preferable to analyze data individually for each state; however, maternal death is a rare event, and the number of cases (396 U.S. deaths in 2000 and 856 in 2014) was not sufficient to support individual state analysis for all but the most populous states (California and Texas). Rather, states needed to be grouped by some mechanism to create groups large enough for analysis. However, states varied

Table 1. State Death Certificate Revision Dates and Pregnancy Question Types, 2014

State	Unrevised		Revision Date*	Analysis Group†
	Pregnancy Question?	Pregnant Within Last		
Alabama	Yes	42 d	Not revised	4
Alaska	No		2014	3
Arizona	No		2010	1
Arkansas	No		2008	1
California	No		2003	Separate
Colorado	No		Not revised	3
Connecticut	No		2005	1
Delaware	No		2007	1
Florida	Yes	3 mo	2005	2
Georgia	No		2008	1
Hawaii	No		2014	3
Idaho	No		2003	1
Illinois	Yes	3 mo	2008	2
Indiana	Yes	90 d	2008	2
Iowa	Yes	12 mo	2011	2
Kansas	No		2005	1
Kentucky	Yes	12 mo	July 2010	2
Louisiana	Yes	12 mo	July 2012	2
Maine	No		Rolling 2010	1
Maryland	Yes	42 d	Not revised	4
Massachusetts	No		September 2014	3
Michigan	No		2004	1
Minnesota	Yes	12 mo	March 2011	2
Mississippi	Yes	90 d	2012	2
Missouri	Yes	90 d	2010	2
Montana	No		2003	1
Nebraska	Yes	3 mo	2005	2
Nevada	No		2008	1
New Hampshire	No		April 2004	1
New Jersey	Yes	90 d	2004	2
New Mexico	Yes	6 wk	2006	4
New York City	Yes	12 mo	2003	2
New York State	Yes	6 mo	2003	2
North Carolina	No		2014	3
North Dakota	Yes	18 mo	2008	2
Ohio	No		2007	1
Oklahoma	No		2004	1
Oregon	No		2006	1
Pennsylvania	No		2012	1
Rhode Island	No		2006	1
South Carolina	No		2005	1
South Dakota	No		2004	1
Tennessee	No		2012	1
Texas	Yes	12 mo	2006	‡
Utah	No		2005	1
Vermont	No		July 2008	1
Virginia	Yes	3 mo	October 2014	3
Washington	No		2004	1
Washington, DC	No		Mid-2005	1
West Virginia	No		Not revised	3
Wisconsin	No		September 2013	3
Wyoming	No		2004	1

All states adopted the U.S. standard question when revised except for California, which adopted a question on pregnancy within the past 1 year.

* Revision dates are as of January 1 of the stated year unless otherwise specified. States listed as not revised are those that were not revised as of December 2014.

† Analysis group 1 includes states that did not have an unrevised pregnancy question and adopted the U. S. standard question by January 2013. Group 2 includes states that had an unrevised pregnancy question with a timeframe longer than the U.S. standard. Group 3 includes states that had not revised by late 2013 with either no pregnancy question or a nonstandard pregnancy question on their unrevised death certificate. Group 4 includes states that had an unrevised pregnancy question consistent with the U.S. standard.

‡ Group 2 for correction factor; separate for trend analysis.

widely in revision dates and unrevised question formats. Therefore, we developed a correction procedure to combine data from states with similar characteristics that revised their death certificates in different data years.

The correction factor was developed to adjust unrevised data to be comparable with revised data and was computed for a group of 24 states and Washington, DC, that, before revision, did not have a pregnancy question (analysis group 1, Table 1).

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

For states that revised in the middle of the year, data from their revision year were dropped, and data from the two following and 2 preceding years were used in the computation. Data for states that revised in 2014 were excluded from these computations, because these states did not yet have 2 years of data after the revision to contribute. This correction factor was multiplied by the number of unrevised deaths for each state before the revision to estimate the number of maternal deaths in the unrevised years. Adjusted numbers of deaths were then used to compute maternal mortality rates for the combined 24 states and Washington, DC.

This same methodology was used to develop a correction factor for a group of 14 states (including Texas, analyzed separately) that had a nonstandard pregnancy question with a timeframe longer than the 42 days standard (analysis group 2, Table 1) before revision.

Analysis groups 3 and 4 include 11 states whose data were analyzed as reported without recourse to correction factors. Group 3 includes eight states that had not revised as of late 2013 and either did not have a pregnancy question on their unrevised death certificate (Alaska, Colorado, Hawaii, North Carolina, Massachusetts, West Virginia, and Wisconsin) or had a pregnancy question with a longer timeframe (Virginia). Wisconsin revised in September 2013 and was excluded from the 2013 data point. Group 4 includes three states (Alabama, Maryland, and New Mexico) that had an unrevised pregnancy question asking about deaths during or within 42 days after pregnancy.

California is the only state that revised their death certificate with a pregnancy question inconsistent with the U.S. standard. The California question only asks about pregnancies within the past year. In addition, there were changes over time in specific data provided by California to the National Center for Health Statistics for deaths at less than 42 days, making use of this measure impracticable.[6,20] Thus, maternal and late maternal deaths were combined for the California trend analysis.

Finally, we estimated maternal mortality rates for 48 states and the District of Columbia from 2000 to 2014. California and Texas were excluded from this estimation: California because it does not provide comparable data and Texas as a result of uncertainty regarding recent trends (see "Results").

First, we computed a weighted average of the slope of the regression lines from analysis groups 1–4. The slopes of the four regression lines were weighted by the total number of live births from 2000 to 2014 that were included in the maternal mortality rate computations. Then we computed a combined, reported 2014 maternal mortality rate for states that had a pregnancy question comparable with the U.S. standard in 2014. We applied the average slope to this rate to back-estimate maternal mortality rates back to 2000. This exercise yielded estimated maternal mortality rates for the 48 states and the District of Columbia for the period 2000–2014.

RESULTS

Simply totaling the raw, unadjusted data from all states regardless of whether they revised their death certificates results in a reported U.S. maternal mortality rate that more than doubled from 9.8 maternal deaths per 100,000 live births in 2000 to 21.5 in 2014.[17] However, the adjusted maternal mortality rate increased more slowly for a group of 24 states and Washington, DC (analysis group 1, Table 1) that only included a pregnancy question after they revised their death certificates (Fig. 1). The correction factor for group 1 states was 1.932 (483 maternal deaths in the 2 years after revision, 250 maternal deaths in the 2 years before revision). The modeled adjusted maternal mortality rate for group 1 states, which adjusts for presumed undercounting in the years before revision, increased from 18.2 in 2000 to 22.8 in 2014. The slope

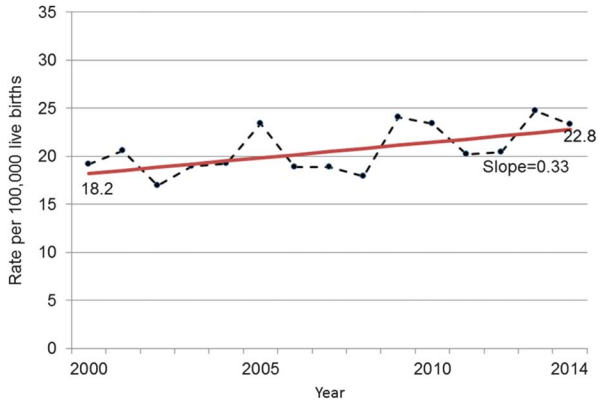

Fig. 1. Adjusted maternal mortality rates, analysis group 1, 2000–2014. Includes 24 states and Washington, DC, that did not have a pregnancy question on their unrevised death certificate and that adopted the U.S. standard question on revision: Arkansas, Arizona, Connecticut, Delaware, Georgia, Idaho, Kansas, Maine, Michigan, Montana, New Hampshire, Nevada, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, Vermont, Washington, and Wyoming.
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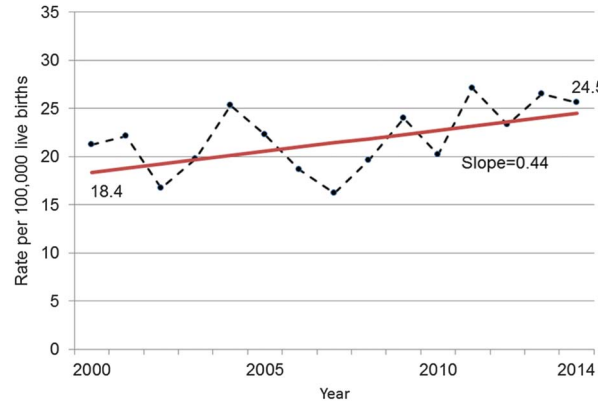

Fig. 2. Adjusted maternal mortality rates, analysis group 2, 2000–2014. Includes 13 states that had a pregnancy question asking about a longer timeframe on their unrevised death certificate and that adopted the U.S. standard question upon revision: Florida, Illinois, Indiana, Idaho, Kentucky, Louisiana, Mississippi, Minnesota, Missouri, Nebraska, New Jersey, New York, and North Dakota.
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of the regression line was 0.33 (95% confidence interval [CI] 0.07–0.58) and was based on 3,108 maternal deaths and 19,328,481 live births from 2000 to 2014.

Group 2 included states that had a nonstandard pregnancy question before revision and revised to the U.S. standard. The correction factor for these states was 2.067 (676/327 maternal deaths). Among these states, the adjusted maternal mortality rate was higher than reported in 2000 (18.4) and rose to 24.5 in 2014. The slope of the regression line was 0.44 (95% CI 0.05–0.82) (based on 3,098 maternal deaths and 18,136,263 births) (Fig. 2).

Data for analysis groups 3 (eight states) and 4 (three states) are analyzed without adjustment and are shown in Figure 3. For group 3, states that did not revise and did not have a comparable question prerevision, the rates reported are uniformly lower than for other states and the modeled maternal mortality rate was 8.0 in 2000 and increased to 10.4 in 2013. The slope of the regression line was 0.19 (95% CI −0.02 to 0.39) (638 maternal deaths and 6,804,191 live births). For analysis group 4, states that already had a comparable pregnancy question on their death certificate throughout the study period, the modeled maternal mortality rate rose from 14.0 in 2000 to 19.9 in 2014. The slope of the regression line was 0.42 (95% CI 0.09–0.75) (425 maternal deaths and 2,453,198 live births).

California and Texas were analyzed separately because they had trends that were markedly different from other U.S. states and sufficient numbers of maternal deaths for reliable trend analysis. Texas had an unrevised question about pregnancies in the past 12 months and revised to the U.S. standard question in 2006. Adjusted maternal mortality rates for Texas show only a modest increase from 2000 to

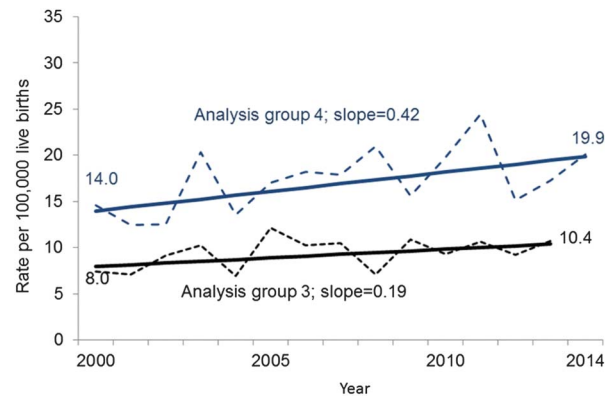

Fig. 3. Unadjusted maternal mortality rates, analysis groups 3 and 4, 2000–2014. Group 3 includes eight states that did not have a pregnancy question on their unrevised death certificate (Alaska, Colorado, Hawaii, North Carolina, Massachusetts, West Virginia, and Wisconsin) or that had a pregnancy question with a longer timeframe (Virginia) and had not revised as of late 2013 (Wisconsin revised in late 2013 and their data were excluded from the 2013 data point). Group 4 includes three states (Alabama, Maryland, and New Mexico) that had an unrevised pregnancy question consistent with the U.S. standard.
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2010, from a rate of 17.7 in 2000 to 18.6 in 2010. The slope of this regression line was 0.12 (95% CI −0.22 to 0.46) (564 maternal deaths and 4,246,835 live births) (Fig. 4). However, after 2010, the reported maternal mortality rate for Texas doubled within a 2-year period to levels not seen in other U.S. states. Joinpoint trend analysis was done separately for the 2000–2010 and the 2011–2014 periods because the trends for these two periods differed widely.

California data are shown in Figure 5 for maternal and late maternal deaths combined (those occurring within 1 year of pregnancy). The California rate was markedly lower in 2000–2002, before the pregnancy question was adopted, and the reported rate nearly doubled once the pregnancy question (asking about pregnancies less than 1 year) was introduced in 2003. Because the 2000–2002 data were clearly not comparable, joinpoint regression analysis was done for the 2003–2014 data. The modeled maternal mortality rates decreased from 21.5 in 2003 to 15.1 in 2014. The slope of the line was −0.58 (95% CI −1.05 to −0.11) or a 0.58 unit of decrease in the combined maternal and late maternal mortality rate per year (based on 1,190 maternal deaths and 6,356,032 live births).

Finally, we provide estimated maternal mortality rates for 48 states and the District of Columbia from 2000 to 2014 (Table 2). For the 48 states and the District of Columbia (excluding California and Texas), the estimated maternal mortality rate in 2000 was 18.8, and the rate increased slowly to a rate of 23.8 in 2014, an increase of 26.6% (Table 2). The slope of the regression line was 0.36 (95% CI 0.05–0.67) based on 7,269 reported maternal deaths and 46,722,133 live births from 2000 to 2014. Because the reported (unadjusted) maternal mortality rate for the 48 states and the District of Columbia increased by 132.3% from 2000 to 2014 (from 9.9 to 23.0),[17] we estimate that 20.1% (26.6/132.3%) of the observed increase in the maternal mortality rate from 2000 to

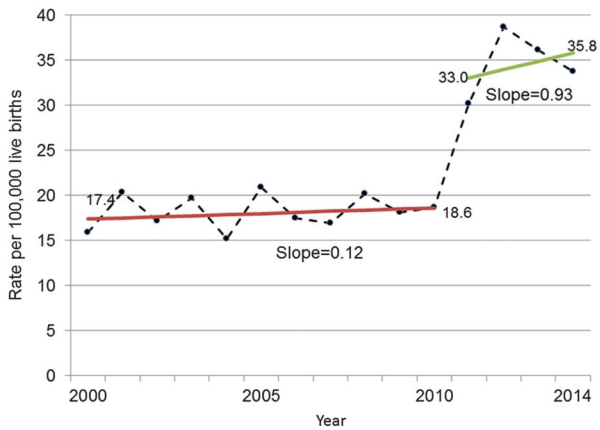

Fig. 4. Adjusted maternal mortality rates, Texas, 2000–2014. Texas revised to the U.S. standard pregnancy question in 2006. The unrevised question asked about pregnancies within the past 12 months.

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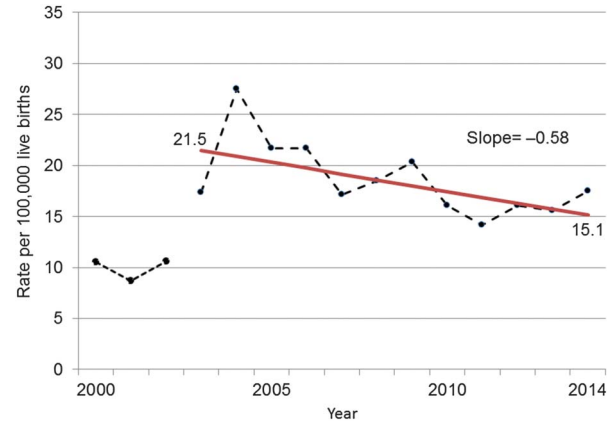

Fig. 5. Unadjusted combined maternal and late maternal mortality rates, California, 2000–2014. Includes pregnancy-related deaths occurring within 1 year of pregnancy. California revised their death certificate in 2003 to a non-standard question that asks about deaths within 1 year of pregnancy. Before 2003, California did not have a pregnancy question on their death certificate.

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Table 2. Estimated Maternal Mortality Rates, 48 States and the District of Columbia, 2000–2014

Year	Maternal Mortality Rate
2000	18.8
2001	19.2
2002	19.5
2003	19.9
2004	20.3
2005	20.6
2006	21.0
2007	21.3
2008	21.7
2009	22.0
2010	22.4
2011	22.8
2012	23.1
2013	23.5
2014	23.8

Rates back-estimated from reported 2014 rate for states with the standard pregnancy question using a weighted average of the slopes from groups 1–4; see "Materials and Methods."

* Excludes California and Texas.

2014 was the result of a real increase in maternal mortality, and 79.9% was the result of improved ascertainment.

Because the results of the modeling for groups 1 and 2 could vary depending on the magnitude of the correction factors, we did sensitivity analysis to assess the degree to which these factors might differ under differing conditions. For groups 1 and 2 separately, we computed correction factors using 1-year, 2-year, and 3-year intervals in both the numerator and denominator. Computing the 3-year correction factor involved dropping data for one state (Louisiana) that did not have 3 years of revised data to contribute. Within group 2, we computed correction factors separately for Texas and for all other states. We also computed separate correction factors for states with a pregnancy question with a timeframe of less than 6 months compared with states with a timeframe of 6 months or greater. Because all of the resulting values were within 6% of the correction factors used in the study, and because the use of the 3-year correction factor would have involved dropping data from Louisiana, the 2-year correction factors were retained in the final study.

DISCUSSION

Despite the United Nations Millennium Development Goal for a 75% reduction in maternal mortality from 1990 to 2015, the reported (unadjusted) U.S. maternal mortality rate more than doubled from 2000 to 2014. As we have shown, most of the reported increase in maternal mortality rates from 2000 to 2014 was the result of improved ascertainment of maternal deaths. However, combined data for 48 states and the District of Columbia showed an increase in the estimated maternal mortality rate from 18.8 in 2000 to 23.8 in 2014, a 26.6% increase. Notably, the smaller increase seen in the adjusted data appears to be a result of earlier estimates of the U.S. national rate being substantially underreported. Clearly at a time when the World Health Organization reports that 157 of 183 countries studied had decreases in maternal mortality between 2000 and 2013,[21] the U.S. maternal mortality rate is moving in the wrong direction. Among 31 Organization for Economic Cooperation and Development countries reporting maternal mortality data, the United States would rank 30th, ahead of only Mexico.[22]

California, however, showed a marked decline in maternal and late maternal mortality from 2003 to 2014. California has made concerted efforts to reduce maternal mortality, including initiating a statewide pregnancy-associated mortality review in 2006 and contracting with the California Maternal Quality Care Collaborative to investigate primary causes of maternal death. This collaborative developed and promulgated evidence-based tool kits to address two of the most common, preventable contributors to maternal death (obstetric hemorrhage and preeclampsia) and implemented quality improvement initiatives throughout the state.[23–25] These efforts appear to have helped reduce maternal mortality in California.[23]

The Texas data are puzzling in that they show a modest increase in maternal mortality from 2000 to 2010 (slope 0.12) followed by a doubling within a 2-year period in the reported maternal mortality rate. In 2006, Texas revised its death certificate, including the addition of the U.S. standard pregnancy question, and also implemented an electronic death certificate. However, the 2006 changes did not appreciably affect the maternal mortality trend after adjustment, and the doubling in the rate occurred in 2011–2012. Texas cause-of-death data, like with data for most states, are coded at the National Center for Health Statistics, and this doubling in the rate was not found for other states. Communications with vital statistics personnel in Texas and at the National Center for Health Statistics did not identify any data processing or coding changes that would account for this rapid increase. There were some changes in the provision of women's health services in Texas from 2011 to 2015, including the closing of several women's health clinics.[26,27] Still, in the absence of war, natural disaster, or severe economic upheaval, the doubling of a mortality rate within a 2-year period in a state with almost 400,000 annual births seems unlikely. A future study will examine Texas data by race–ethnicity and detailed causes of death to better understand this unusual finding.

The larger correction factor for group 2 than for group 1 states is not surprising when examined in the context of National Center for Health Statistics coding rules. These rules code pregnancy data for states with a pregnancy question with a timeframe longer than the 42-day standard to late maternal death (O96–97) codes, which are by definition excluded from standard maternal mortality calculations.[6] This decision is understandable as the more conservative approach, because the exact timing of death was unknown. However, it has caused significant disruption in trend analysis of maternal and late maternal mortality rates. This is because most maternal deaths within 1 year of pregnancy actually occur during or very soon after pregnancy. For example, in 2009 (approximately the midpoint in the adoption of the revised certificate), 64% of maternal deaths at less than 1 year were coded

to the late maternal (O96–O97) category for the eight unrevised states that had a pregnancy question with a timeframe longer than the 42-day standard compared with just 21% for the 30 revised states that had adopted the U.S. standard pregnancy question.

The strengths of the study include the use of vital statistics data that provide information on all births and deaths in the United States during the study period. The limitations of the study are also those of vital statistics and include concerns about the accuracy of cause-of-death information provided by the physician, medical examiner, or coroner.[7,28] The prompt nature of vital statistics registration also means that such registration may initially occur based on an interim cause of death, which, depending on the efficiency of state systems, may or may not be updated after cause-of-death investigations are completed.[29] Evaluation of the accuracy of reporting of the pregnancy question is important because this information is used in conjunction with the reported causes of death to classify maternal deaths.[28] However, the pregnancy data are currently not included on public-use data sets,[17,18] so such evaluations are infeasible for non–National Center for Health Statistics researchers. During the time period under study, states have increasingly moved toward electronic death registration and away from paper-based death certificates. The National Center for Health Statistics has continued to provide training in cause-of-death certification to state vital statistics personnel and has recently taken on a greater role in coding cause-of-death data. However, these changes are unlikely to have substantially influenced maternal mortality reporting.[20]

It is an international embarrassment that the United States, since 2007, has not been able to provide a national maternal mortality rate to international data repositories such as those run by the Organization for Economic Cooperation and Development.[22] This inability reflects the chronic underfunding over the past two decades of state and national vital statistics systems. Indeed, it was primarily a lack of funds that led to delays (of more than a decade in many states) in the adoption of the 2003 revised birth and death certificates. This delay created the complex data comparability problem addressed in this study. The lack of publication of U.S. maternal mortality data since 2007 has also meant that these data have received a lesser degree of scrutiny and quality control when compared with published vital statistics measures such as infant mortality. For example, had the National Center for Health Statistics and the Texas vital statistics office both been publishing annual maternal mortality rates, the unusual findings from Texas for 2011–2014 would certainly have been investigated much sooner and in greater detail. Accurate measurement of maternal mortality is an essential first step in prevention efforts, because it can identify at-risk populations and measure the progress of prevention programs.

In conclusion, the maternal mortality rate for 48 states and Washington, DC, from 2000 to 2014 was higher than previously reported, is increasing, and places the United States far behind other industrialized nations. There is a need to redouble efforts to prevent maternal deaths and improve maternity care for the 4 million U.S. women giving birth each year.

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U.S. maternal mortality rates are higher than previously reported and are increasing.

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