

Appendix 1. List of International Statistical Classification of Diseases and Related Health Problems, version 10 (ICD-10) codes used in the study.

CD-10 code	Condition
O00-O07	Pregnancy with abortive outcome
O10-O16	Edema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium
O11	Pre-existing hypertensive disorder with superimposed proteinuria
O14	Gestational hypertension with significant proteinuria
O15	Eclampsia
O20-29	Other maternal disorders predominantly related to pregnancy
O24	Diabetes mellitus in pregnancy
O26	Maternal care for other conditions predominantly related to pregnancy
O26.6	Liver disorders in pregnancy, childbirth and the puerperium
O26.8	Other specified pregnancy-related conditions (pregnancy-related exhaustion and fatigue, peripheral neuritis or renal disease)
O30-O48	Maternal care related to the fetus and amniotic cavity and possible delivery problems
O44	Placenta previa
O45	Premature separation of the placenta (abruptio placentae)
O46	Antepartum hemorrhage, not elsewhere classified
O60-O75	Complications of labor and delivery
O72	Postpartum hemorrhage
O85-O92	Complications predominantly related to the puerperium
O95-O99	Other obstetric conditions not elsewhere classified
O95	Obstetric death of unspecified cause
O96	Death from any obstetric cause occurring more than 42 days but less than 1 year after delivery
O97	Death from sequelae of direct obstetric causes
O99	Other maternal diseases classifiable elsewhere but complicating pregnancy, childbirth and the puerperium
O99.4	Diseases of the circulatory system complicating pregnancy, childbirth and the puerperium

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Appendix 2. Overall and Cause-Specific Maternal Mortality Ratios (MMR per 100,000 Live Births), United States, 1999 to 2014

Year	MMR per 100,000 live births	Cause-specific maternal mortality ratios (per 100,000 live births)							
		Pregnancy with abortive outcome (O00-O07)	Proteinuria/ hypertensive disorders (O10-O16)	Other pregnancy disorders (O20-O29)	Maternal care (O30-O48)	Complications of labor and delivery (O60-O75)	Complications related to the puerperium (O85-O92)	Other obstetric conditions (O95,O98, O99)	Late maternal deaths and sequelae (O96,O97*)
1999	10.3	0.78	2.37	0.73	1.04	1.52	2.12	1.31	0.38
2000	10.0	0.91	1.87	1.03	0.57	1.63	2.29	1.45	0.20
2001	10.3	0.94	1.91	0.97	0.77	1.52	2.51	1.29	0.42
2002	9.4	0.55	1.49	1.59	0.52	1.44	2.04	1.24	0.55
2003	13.3	0.98	1.88	1.74	0.68	1.81	2.15	2.86	1.22
2004	17.0	0.78	1.51	2.33	0.88	1.14	2.48	4.01	3.82
2005	18.4	0.80	1.62	2.97	0.63	1.23	2.95	4.86	3.31
2006	17.8	0.61	1.50	3.12	0.52	1.55	2.56	3.49	4.48
2007	17.8	0.72	1.74	2.69	0.46	1.34	2.15	3.59	5.12
2008	18.7	0.80	1.86	3.39	0.71	1.46	2.68	4.64	3.18
2009	23.2	0.82	1.62	4.21	0.58	1.11	2.71	5.52	6.66
2010	20.6	0.93	1.73	4.10	0.80	1.20	2.53	5.58	3.78
2011	23.5	0.68	2.15	5.21	0.86	1.26	2.43	6.75	4.20

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2012	25.0	0.43	1.92	6.22	0.61	1.09	2.25	7.39	5.14
2013	28.9	0.69	2.29	6.92	0.71	0.84	3.26	7.27	6.97
2014	28.2	0.70	1.88	7.35	0.85	0.65	2.31	7.72	6.69
Rate ratio	2.75	0.90	0.79	10.0	0.82	0.43	1.09	5.88	17.7
95% CI	2.45, 3.08	0.54, 1.49	0.58, 1.07	6.85, 14.7	0.52, 1.30	0.27, 0.68	0.81, 1.46	4.38, 7.89	10.5, 29.7
Rate difference	17.9	-0.08	-0.49	6.62	-0.19	-0.87	0.19	6.41	6.32
95% CI	14.9, 21.4	-0.36, 0.38	-1.00, 0.17	4.27, 10.0	-0.50, 0.31	-1.11, -0.49	-0.40, 0.98	4.44, 9.05	3.60, 10.9
P value	<.001	0.68	0.13	<.001	0.40	<.001	0.58	<.001	<.001

* Late maternal deaths included in maternal mortality ratios (MMR) in the first column.

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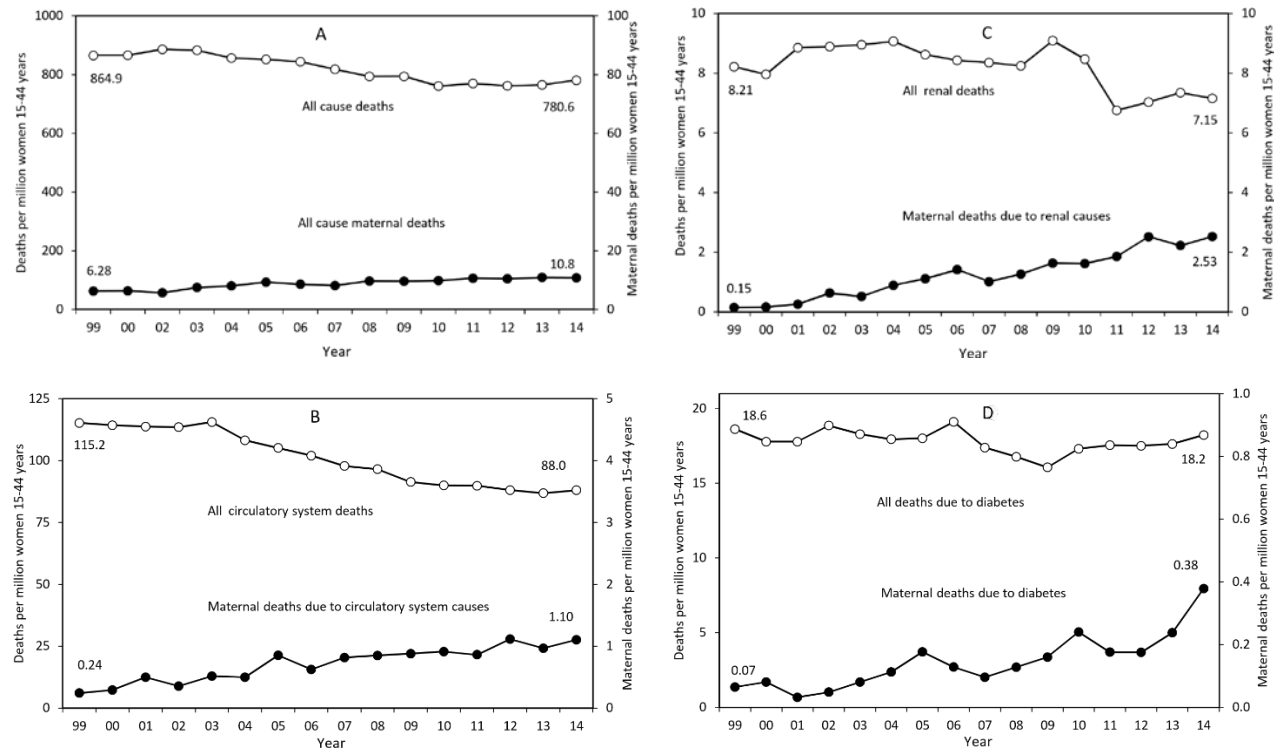
Appendix 3. Numbers of Maternal Deaths (Including Late Maternal Deaths*) and Maternal Mortality Ratios (MMR) by Age, Race and Place of Death, United States, 1993 and 2014

Determinant	1993			2014			Rate	95%	P value
	Deaths	Live births	MMR/ proportion†	Deaths	Live births	MMR proportion†	ratio 2014 vs 1993	confidence interval	
<u>All maternal deaths including late maternal deaths</u>									
Age <25 years	84	1,551,774	5.41	165	1,134,414	14.5	2.69	2.07-3.49	<.001
25-34	136	2,030,013	6.70	405	2,226,450	18.29	2.72	2.24-3.30	<.001
35-44	82	416,124	19.71	350	618,769	56.6	2.87	2.26-3.65	<.001
>=45	0	2,329	0.00	202	8,443	2392.5	-	-	<.001
Race: White	152	3,149,833	4.83	691	3,019,863	22.9	4.74	3.98-5.65	<.001
African American	135	658,875	20.49	370	640,562	57.8	2.82	2.31-3.43	<.001
Other	15	191,532	7.83	62	327,651	18.9	2.42	1.37-4.25	0.002
Hospital - inpatient	202	-	66.89	674	-	60.0	0.90	0.82-0.98	0.02
Hospital-outpatient/ER	55	-	18.21	180	-	16.0	0.88	0.67-1.16	0.91
Home	30	-	9.93	195	-	17.4	1.75	1.22-2.51	0.003
Hospice	0	-	0.00	32	-	2.85	-		0.04
Other	14	-	4.64	42	-	3.74	0.81	0.45-1.46	0.48
Total	302	4,000,240	7.55	1,123	3,988,076	28.2	3.73	3.28-4.24	<.001

* Late maternal deaths identified by ICD-10 codes O96 and O97 included among maternal deaths.

† Age- and race-specific MMRs expressed per 100,000 live births; rates by place of death expressed as a proportion of all maternal deaths.

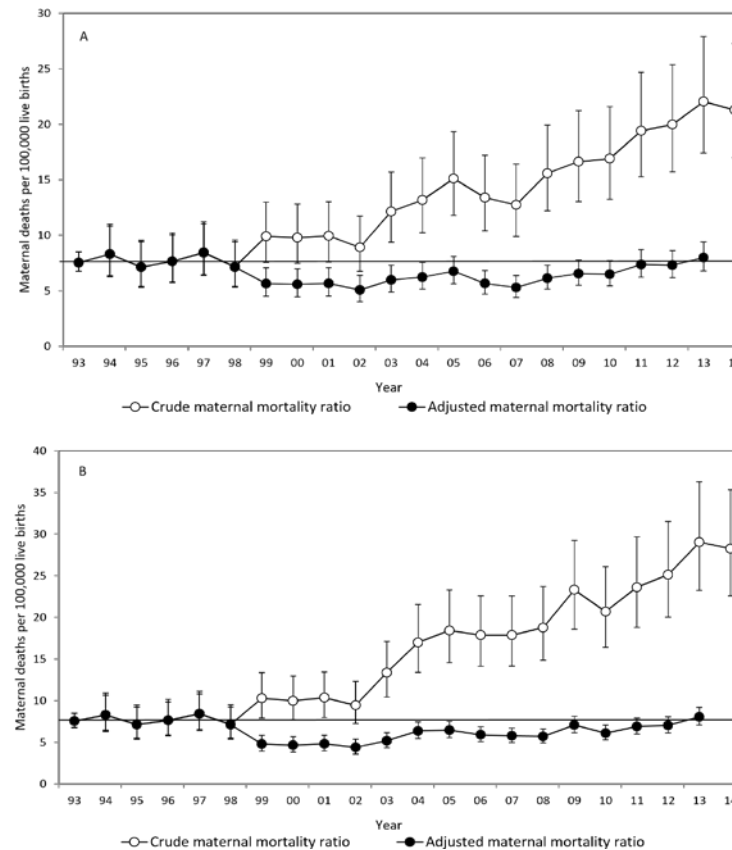
Appendix 4. All-cause mortality (primary y-axis) and all maternal deaths (secondary y-axis) (A), deaths from circulatory system causes (primary y-axis) and maternal deaths from circulatory system causes (secondary y-axis) (B), deaths from renal disorders (primary y-axis) and maternal deaths from renal disorders (secondary y-axis) (C), and deaths from diabetes mellitus (primary y-axis) and maternal deaths from diabetes mellitus (secondary y-axis) (D) per 1,000,000 women aged 15–44 years in the United States, 1999–2014.



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Appendix 5. Results of Poisson regression analysis showing crude and adjusted maternal mortality rate ratios and 95% confidence intervals, with late maternal deaths excluded (A), and included (B) in the calculation of maternal mortality ratios, United States, 1993 to 2014. The adjusted models included variables for a separate pregnancy question on the death certificate, International Classification of Diseases (ICD-10) coding and a standard pregnancy checkbox on the death certificate.



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Appendix 6. Maternal Mortality Ratios Including Late Maternal Deaths (per 100,000 Live Births), and Crude and Adjusted Maternal Mortality Rate Ratios, United States, 1993 to 2014

Year	Maternal mortality ratio	Unadjusted			Adjusted*		
		Rate ratio	95% confidence interval	P value	Rate ratio	95% confidence interval	P value
Separate question	-	0.65	0.59-0.71	<.001	1.14	1.06-1.24	0.001
ICD-10 coding	-	2.38	2.15-2.63	<.001	2.13	2.02-2.25	<.001
Checkbox	-	2.54	2.40-2.69	<.001	1.90	1.74-2.07	<.001
1993	7.55	1.00	Reference	Reference	1.00	Reference	Reference
1994	8.28	1.10	0.84-1.45	0.50	1.10	0.86-1.41	0.46
1995	7.10	0.94	0.71-1.26	0.69	0.94	0.73-1.23	0.67
1996	7.63	1.01	0.77-1.34	0.92	1.01	0.78-1.31	0.94
1997	8.43	1.12	0.85-1.47	0.42	1.12	0.87-1.43	0.39
1998	7.13	0.95	0.71-1.26	0.71	0.94	0.73-1.22	0.66
1999	10.3	1.36	1.05-1.77	0.02	0.64	0.52-0.77	<.001
2000	10.0	1.32	1.02-1.72	0.04	0.62	0.51-0.75	<.001
2001	10.3	1.37	1.06-1.78	0.02	0.64	0.53-0.78	<.001
2002	9.42	1.25	0.96-1.63	0.10	0.58	0.48-0.71	<.001
2003	13.3	1.77	1.38-2.27	<.001	0.69	0.58-0.82	<.001
2004	17.0	2.25	1.78-2.86	<.001	0.84	0.72-0.99	0.03
2005	18.4	2.44	1.93-3.08	<.001	0.86	0.74-1.00	0.05
2006	17.8	2.37	1.87-2.99	<.001	0.78	0.67-0.91	0.001
2007	17.8	2.37	1.87-2.99	<.001	0.77	0.66-0.89	<.001
2008	18.7	2.49	1.97-3.14	<.001	0.76	0.65-0.87	<.001
2009	23.2	3.09	2.46-3.88	<.001	0.94	0.82-1.08	0.37
2010	20.6	2.74	2.17-3.46	<.001	0.81	0.70-0.93	0.004
2011	23.5	3.13	2.49-3.93	<.001	0.91	0.79-1.05	0.20
2012	25.0	3.33	2.65-4.17	<.001	0.93	0.81-1.07	0.32
2013	28.9	3.85	3.08-4.81	<.001	1.07	0.94-1.22	0.33
2014	28.2	3.74	2.99-4.68	<.001	-†	-†	-†

* Adjusted for a separate pregnancy question on death certificates, International Statistical Classification of Diseases and Related Health Problems (ICD-10) coding, and the standard pregnancy checkbox on death certificates.

† Indicator variable for the year 2014 aliased as it was a linear combination of the other variables (collinearity).

The regression equation is: $\text{Log P(maternal death)} = -9.5502 + (0.0947 * v_{1994}) + (-0.0574 * v_{1995}) + (0.0102 * v_{1996}) + (0.1091 * v_{1997}) + (-0.0580 * v_{1998}) + (0.4535 * v_{1999}) + (-0.4832 * v_{2000}) + (-0.4483 * v_{2001}) + (-0.5403 * v_{2002}) + (-0.3748 * v_{2003}) + (-0.1704 * v_{2004}) + (-0.1543 * v_{2005}) + (-0.2451 * v_{2006}) + (-0.2675 * v_{2007}) + (-0.2804 * v_{2008}) + (-0.0638 * v_{2009}) + (-0.2118 * v_{2010}) + (-0.0908 * v_{2011}) + (-0.0699 * v_{2012}) + (0.0660 * v_{2013}) + (0.1334 * \text{Separate question}) + (0.7575 * \text{ICD10}) + (0.6415 * \text{Standard checkbox})$.

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