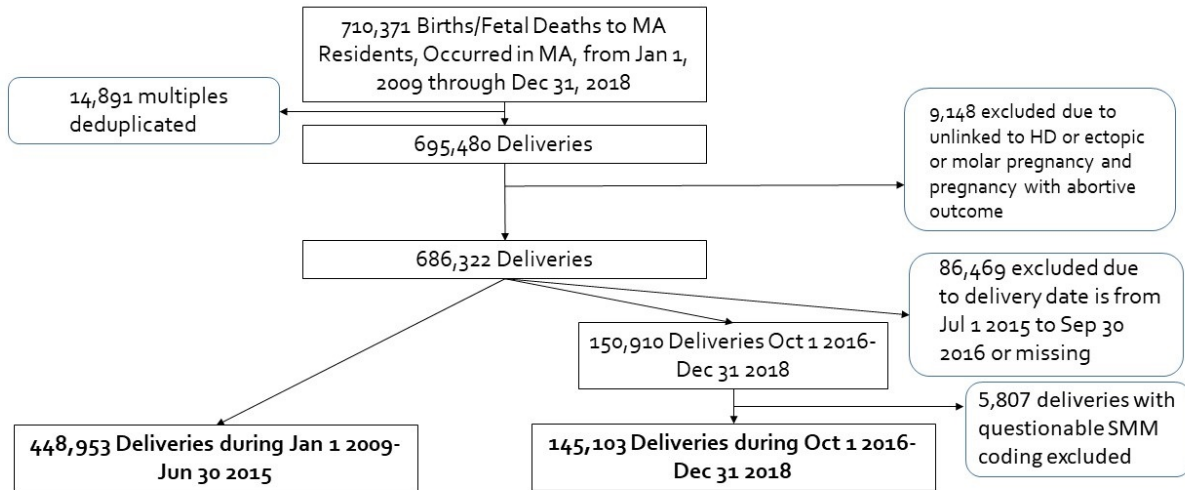


Appendix 1. Flow diagram of study sample with inclusion and exclusion criteria. Our study sample was linked using an integrated SAS application system, LINKPRO 3.01, for probabilistic and deterministic record linkage. The system records where no unique identifiers exist. It calculates and applies probabilistic weights in order to estimate the likelihood that a pair of records from separate files corresponds to the same individual. Since the linkage launched in 1998, more than 99% of birth and fetal death certificates have been linked to their delivery hospital discharge records.



Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

Appendix 2. International Classification of Diseases (ICD)-9 and ICD-10 Codes Used for Severe Maternal Morbidity Identification

ICD-9	ICD-10	ICD-10 Description
410.xx	I21.xx	Acute myocardial infarction
	I22.x	Subsequent ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction
441.xx	I71.xx	Aortic aneurysm and dissection
	I79.0	Aneurysm of aorta in diseases classified elsewhere
584.5 - 584.9	N17.x	Acute kidney failure
669.3x	O90.4	Postpartum acute kidney failure
518.5x	J80	Acute respiratory distress syndrome
518.81	J95.1	Acute pulmonary insufficiency following thoracic surgery
518.82	J95.2	Acute pulmonary insufficiency following nonthoracic surgery
518.84	J95.3	Chronic pulmonary insufficiency following surgery
799.1	J95.82x	Postprocedural respiratory failure
	J96.0x	Acute respiratory failure
	J96.2x	Acute and chronic respiratory failure
	J96.9x	Respiratory failure, unspecified
	R06.03	Acute respiratory distress syndrome
	R09.2	Respiratory arrest
	673.1x	O88.112
O88.113		Amniotic fluid embolism in pregnancy, third trimester
O88.119		Amniotic fluid embolism in pregnancy, unspecified trimester
O88.12		Amniotic fluid embolism in childbirth
O88.13		Amniotic fluid embolism in the puerperium
427.41	I46.x	Cardiac arrest
427.42	I49.0x	Ventricular fibrillation and flutter
427.5		
99.6x	5A2204Z	Restoration of cardiac rhythm, single
	5A12012	Performance of cardiac output, single, manual
286.6	D65	Disseminated intravascular coagulation [defibrination syndrome]
286.9	D68.8	Other specified coagulation effects
641.3x	D68.9	Coagulation defect, unspecified
666.3X	O45.002, O45.003, O45.009	Premature separation of placenta with coagulation defect, unspecified; second, third, unspecified trimester
	O45.012, O45.013, O45.019	Premature separation of placenta with afibrinogenemi; second, third, unspecified trimester

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

	O45.022, O45.023, O45.029	Premature separation of placenta with disseminated intravascular coagulation; second, third, unspecified trimester
	O45.092, O45.093, O45.099	Premature separation of placenta with other coagulation defect; second, third, unspecified trimester
	O46.002, O46.003, O46.009	Antepartum hemorrhage with coagulation defect, unspecified; second, third, unspecified trimester
	O46.012, O46.013, O46.019	Antepartum hemorrhage with afibrinogenemia; second, third, unspecified trimester
	O46.022, O46.023, O46.029	Antepartum hemorrhage with dissem intravascular coagulation; second, third, unspecified trimester
	O46.092, O46.093, O46.099	Antepartum hemorrhage with other coagulation defect; second, third, unspecified trimester
	O67.0	Intrapartum hemorrhage with coagulation defect
	O72.3	Postpartum coagulation defects
642.6x	O15.x	Eclampsia
997.1	I97.12x	Postprocedural cardiac arrest
	I97.13x	Postprocedural heart failure
	I97.710	Intraoperative cardiac arrest during cardiac surgery
	I97.711	Intraoperative cardiac arrest during other surgery
046.3	A81.2	Progressive multifocal leukoencephalopathy
348.39	G45.x	Transient cerebral ischemic attacks and related syndromes
362.34	G46.x	Vascular syndromes of brain in cerebrovascular diseases
430.xx	G93.49	Other encephalopathy
431.xx	H34.0x	Transient retinal artery occlusion
432.xx	I60.xx	Nontraumatic subarachnoid hemorrhage
433.xx	I61.xx	Nontraumatic intracerebral hemorrhage
434.xx	I62.xx	Other and unspecified nontraumatic intracranial hemorrhage
435.xx	I63.xx	Cerebral infarction
436.xx	I65.xx	Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction
437.xx	I66.xx	Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction
671.5x	I67.xx	Other cerebrovascular diseases
674.0x	I68.xx	Cerebrovascular disorders in diseases classified elsewhere
997.02	O22.50	Cerebral venous thrombosis in pregnancy, unspecified trimester
	O22.52	Cerebral venous thrombosis in pregnancy, second trimester
	O22.53	Cerebral venous thrombosis in pregnancy, third trimester

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

	I97.81x	Intraoperative cerebrovascular infarction
	I97.82x	Postprocedural cerebrovascular infarction
	O87.3	Cerebral venous thrombosis in the puerperium
518.4	J81.0	Acute pulmonary edema
428.0	I50.1	Left ventricular failure
428.1	I50.20	Unspecified systolic (congestive) heart failure
428.20	I50.21	Acute systolic (congestive) heart failure
428.21	I50.23	Acute on chronic systolic (congestive) heart failure
428.23	I50.30	Unspecified diastolic (congestive) heart failure
428.30	I50.31	Acute diastolic (congestive) heart failure
428.31	I50.33	Acute on chronic diastolic (congestive) heart failure
428.33	I50.40	Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
428.40	I50.41	Acute combined systolic (congestive) and diastolic (congestive) heart failure
428.41	I50.43	Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
428.43	I50.810	Right heart failure, unspecified
	I50.811	Acute right heart failure
	I50.813	Acute on chronic right heart failure
	I50.814	Right heart failure due to left heart failure
	I50.82	Biventricular heart failure
	I50.83	High output heart failure
	I50.84	End stage heart failure
	I50.89	Other heart failure
428.9	I50.9	Heart failure, unspecified
668.0x	O29.112, O29.113, O29.119	Cardiac arrest due to anesthesia during pregnancy; second, third, unspecified trimester
668.1x	O29.122, O29.123, O29.129	Cardiac failure due to anesthesia during pregnancy; second, third, unspecified trimester
668.2x	O29.192, O29.193, O29.199	Oth cardiac comp of anesth during preg; second, third, unspecified trimester
995.4	O29.212, O29.213, O29.219	Cerebral anoxia due to anesth during preg; second, third, unspecified trimester
995.86	O29.292, O29.293, O29.299	Oth cnsl comp of anesth during pregnancy; second, third, unspecified trimester
	O74.0	Aspiration pneumonitis due to anesthesia during labor and delivery

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

	O74.1	Other pulmonary complications of anesthesia during labor and delivery
	O74.2	Cardiac complications of anesthesia during labor and delivery
	O74.3	Central nervous system complications of anesthesia during labor and delivery
	O89.0x	Pulmonary complications of anesthesia during the puerperium
	O89.1	Cardiac complications of anesthesia during the puerperium
	O89.2	Central nervous system complications of anesthesia during the puerperium
	T88.2XXA	Shock due to anesthesia, initial encounter
	T88.3XXA	Malignant hyperthermia due to anesthesia, initial encounter
038.xx	O85	Puerperal sepsis
670.2x	R65.21	Severe sepsis with septic shock
998.02	R65.20	Severe sepsis without septic shock
995.92	T81.44XA	Sepsis following a procedure
995.91	T81.12XA	Postprocedural septic shock
785.52	I76	Septic arterial embolism
449	O86.04	Sepsis following an obstetrical procedure
	A40.x	Streptococcal sepsis
	A41.x	Other sepsis
	A32.7	Listerial sepsis
669.1x	O75.1	Shock during or following labor and delivery
	R57.x	Shock, not elsewhere classified
785.50		
785.51	T78.2XXA	Anaphylactic shock, unspecified, initial encounter
785.59		
995.0	T88.6XXA	Anaphylactic reaction due to adverse effect of correct drug or medicament properly administered, initial encounter
	T81.10XA	Postprocedural shock unspecified, initial encounter
998.0x	T81.11XA	Postprocedural cardiogenic shock, initial encounter
998.00	T81.19XA	Other postprocedural shock, initial encounter
998.01		
998.09		
282.42	D57.0x	Hb-SS disease with crisis
282.62	D57.21x	Sickle cell/Hb-C disease with crisis
282.64	D57.41x	Sickle cell thalassemia with crisis
282.69	D57.81x	Other sickle cell disorders with crisis
289.52		
415.0	I26.01	Septic pulmonary embolism with acute cor pulmonale
	I26.02	Saddle embolus of pulmonary artery with acute cor pulmonale
	I26.09	Other pulmonary embolism with acute core pulmonale

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

	I26.90	Septic pulmonary embolism without acute cor pulmonale
	I26.92	Saddle embolus of pulmonary artery without acute cor pulmonale
	I26.93	Single subsegmental pulmonary embolism without acute core pulmonale
	I26.94	Multiple subsegmental pulmonary emboli without acute cor pulmonale
	I26.99	Other pulmonary embolism without acute cor pulmonale
415.1x	O88.012-O88.03	Obstetric air embolism
673.0x	O88.212-O88.23	Obstetric thromboembolism
673.2x	O88.312-O88.33	Obstetric pyemic and septic embolism
673.3x	O88.812-O88.83	Other obstetric embolism
673.8x	T80.0XXA	Air embolism following infusion, transfusion and therapeutic injection, initial encounter
99.0x	30230H0	Transfusion of autologous whole blood into peripheral vein, open approach
	30230K0	Transfusion of autologous frozen plasma into peripheral vein, open approach
	30230L0	Transfusion of autologous fresh plasma into peripheral vein, open approach
	30230M0	Transfusion of autologous plasma cryoprecipitate into peripheral vein, open approach
	30230N0	Transfusion of autologous red blood cells into peripheral vein, open approach
	30230P0	Transfusion of autologous frozen red cells into peripheral vein, open approach
	30230R0	Transfusion of autologous platelets into peripheral vein, open approach
	30230T0	Transfusion of autologous fibrinogen into peripheral vein, open approach
	30230H1	Transfusion of nonautologous whole blood into peripheral vein, open approach
	30230K1	Transfusion of nonautologous frozen plasma into peripheral vein, open approach
	30230L1	Transfusion of nonautologous fresh plasma into peripheral vein, open approach
	30230M1	Transfusion of nonautologous plasma cryoprecipitate into peripheral vein, open approach
	30230N1	Transfusion of nonautologous red blood cells into peripheral vein, open approach
	30230P1	Transfusion of nonautologous frozen red cells into peripheral vein, open approach
	30230R1	Transfusion of nonautologous platelets into peripheral vein, open approach
	30230T1	Transfusion of nonautologous fibrinogen into peripheral vein, open approach
	30233H0	Transfusion of autologous whole blood into peripheral vein, percutaneous approach
	30233K0	Transfusion of autologous frozen plasma into peripheral vein, percutaneous approach
	30233L0	Transfusion of autologous fresh plasma into peripheral vein, percutaneous approach
	30233M0	Transfusion of autologous plasma cryoprecipitate into peripheral vein, percutaneous approach
	30233N0	Transfusion of autologous red blood cells into peripheral vein, percutaneous approach
	30233P0	Transfusion of autologous frozen red cells into peripheral vein, percutaneous approach
	30233R0	Transfusion of autologous platelets into peripheral vein, percutaneous approach
	30233T0	Transfusion of autologous fibrinogen into peripheral vein, percutaneous approach
	30233H1	Transfusion of nonautologous whole blood into peripheral vein, percutaneous approach
	30233K1	Transfusion of nonautologous frozen plasma into peripheral vein, percutaneous approach
	30233L1	Transfusion of nonautologous fresh plasma into peripheral vein, percutaneous approach

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

	30233M1	Transfusion of nonautologous plasma cryoprecipitate into peripheral vein, percutaneous approach
	30233N1	Transfusion of nonautologous red blood cells into peripheral vein, percutaneous approach
	30233P1	Transfusion of nonautologous frozen red cells into peripheral vein, percutaneous approach
	30233R1	Transfusion of nonautologous platelets into peripheral vein, percutaneous approach
	30233T1	Transfusion of nonautologous fibrinogen into peripheral vein, percutaneous approach
	30240H0	Transfusion of autologous whole blood into central vein, open approach
	30240K0	Transfusion of autologous frozen plasma into central vein, open approach
	30240L0	Transfusion of autologous fresh plasma into central vein, open approach
	30240M0	Transfusion of autologous plasma cryoprecipitate into central vein, open approach
	30240N0	Transfusion of autologous red blood cells into central vein, open approach
	30240P0	Transfusion of autologous frozen red cells into central vein, open approach
	30240R0	Transfusion of autologous platelets into central vein, open approach
	30240T0	Transfusion of autologous fibrinogen into central vein, open approach
	30240H1	Transfusion of nonautologous whole blood into central vein, open approach
	30240K1	Transfusion of nonautologous frozen plasma into central vein, open approach
	30240L1	Transfusion of nonautologous fresh plasma into central vein, open approach
	30240M1	Transfusion of nonautologous plasma cryoprecipitate into central vein, open approach
	30240N1	Transfusion of nonautologous red blood cells into central vein, open approach
	30240P1	Transfusion of nonautologous frozen red cells into central vein, open approach
	30240R1	Transfusion of nonautologous platelets into central vein, open approach
	30240T1	Transfusion of nonautologous fibrinogen into central vein, open approach
	30243H0	Transfusion of autologous whole blood into central vein, percutaneous approach
	30243K0	Transfusion of autologous frozen plasma into central vein, percutaneous approach
	30243L0	Transfusion of autologous fresh plasma into central vein, percutaneous approach
	30243M0	Transfusion of autologous plasma cryoprecipitate into central vein, percutaneous approach
	30243N0	Transfusion of autologous red blood cells into central vein, percutaneous approach
	30243P0	Transfusion of autologous frozen red cells into central vein, percutaneous approach
	30243R0	Transfusion of autologous platelets into central vein, percutaneous approach
	30243T0	Transfusion of autologous fibrinogen into central vein, percutaneous approach
	30243H1	Transfusion of nonautologous whole blood into central vein, percutaneous approach
	30243K1	Transfusion of nonautologous frozen plasma into central vein, percutaneous approach
	30243L1	Transfusion of nonautologous fresh plasma into central vein, percutaneous approach
	30243M1	Transfusion of nonautologous plasma cryoprecipitate into central vein, percutaneous approach
	30243N1	Transfusion of nonautologous red blood cells into central vein, percutaneous approach
	30243P1	Transfusion of nonautologous frozen red cells into central vein, percutaneous approach
	30243R1	Transfusion of nonautologous platelets into central vein, percutaneous approach
	30243T1	Transfusion of nonautologous fibrinogen into central vein, percutaneous approach
68.39	OUT9OZZ	Resection of uterus, open approach

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

68.49	OUT97ZL	Resection of Uterus, Supracervical, Via Natural or Artificial Opening
68.59	OUT97ZZ	Resection of uterus, via natural or artificial opening
68.69	OUT90ZL	Resection of uterus, supracervical, open approach
68.79		
68.9x		
31.1	OB110F4	Bypass trachea to cutaneous with tracheostomy device, open approach
	OB113F4	Bypass trachea to cutaneous with tracheostomy device, percutaneous approach
	OB114F4	Bypass trachea to cutaneous with tracheostomy device, percutaneous endoscopic approach
96.70	5A1935Z	Respiratory ventilation, less than 24 consecutive hours
96.71	5A1945Z	Respiratory ventilation, 24-96 consecutive hours
96.72	5A1955Z	Respiratory ventilation, greater than 96 consecutive hours

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.

Appendix. 3 Comparison of Characteristics of Analytic Sample to U.S. Birthing Population, 2009-2018.

	U.S. (n=39,528,323)	Analytic Sample (n=594,056)
Maternal Age	%	%
< 20	7.0	4.2
20-24	22.1	14.2
25-29	28.7	24.7
30-34	26.4	33.8
35-39	12.8	18.6
40+	3.0	4.4
Race Ethnicity		
Non-Hispanic White	54.0	62.1
Non-Hispanic Black	15.0	10.1
Non-Hispanic Asian/Pac.Isl.	6.5	8.9
Non-Hispanic American Indian Alaskan Native	1.0	0.9
Hispanic	23.5	18.1
Parity		
1	39.2	45.3
2	31.8	34.3
3	16.8	13.6
4+	12.2	6.9
Maternal Education		
< High School	15.9	10.2
High School or GED	25.4	22.9
Some College	28.8	21.2
College and Above	29.9	45.7

Data from U.S. Data -- United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Division of Vital Statistics, Natality public-use data 2007-2019, on CDC WONDER Online Database, October 2020. Accessed 9/26/21.

Declercq E, Cabral H, Cui X, Liu C, Amutah-Onukagha N, Larson e, et al. Using longitudinally linked data to measure severe maternal morbidity. *Obstet Gynecol* 2022;139.

The authors provided this information as a supplement to their article.

©2022 American College of Obstetricians and Gynecologists.