

# Pregnancy-Related Deaths: Data from Maternal Mortality Review Committees in 36 US States, 2017–2019



Susanna Trost, MPH; Jennifer Beauregard, MPH, PhD; Gyan Chandra, MS, MBA; Fanny Njie, MPH; Jasmine Berry, MPH; Alyssa Harvey, BS; David A. Goodman, MS, PhD

## Key Findings

- Pregnancy-related deaths occurred during pregnancy, delivery, and up to a year postpartum.
- The leading cause of pregnancy-related death varied by race and ethnicity.
- Over 80% of pregnancy-related deaths were determined to be preventable.

Maternal Mortality Review Committees (MMRCs) are multidisciplinary committees that convene at the state or local level to comprehensively review deaths during or within a year of pregnancy (pregnancy-associated deaths). MMRCs have access to clinical and nonclinical information (e.g., vital records, medical records, social service records) to more fully understand the circumstances surrounding each death, determine whether the death was pregnancy-related, and develop recommendations for action to prevent similar deaths in the future.

Data on 1,018 pregnancy-related deaths among residents of 36 states from 2017–2019 were shared with CDC through the Maternal Mortality Review Information Application (MMRIA).

**Table 1.** Characteristics of pregnancy-related deaths, data from Maternal Mortality Review Committees in 36 US States, 2017–2019 (N=1,018)\*

	N	%
<b>Race and ethnicity</b>		
Hispanic	144	14.4
non-Hispanic American Indian or Alaska Native	9	0.9
non-Hispanic Asian	34	3.4
non-Hispanic Black	315	31.4
non-Hispanic Native Hawaiian and Other Pacific Islander	6	0.6
non-Hispanic White	467	46.6
non-Hispanic other/multiple races	27	2.7
<b>Age at death (years)</b>		
15–19	29	2.9
20–24	155	15.3
25–29	227	22.4
30–34	297	29.3
35–39	225	22.2
40–44	70	6.9
≥45	10	1.0
<b>Education</b>		
12 <sup>th</sup> grade or less; no diploma	135	13.7
High school graduate or GED completed	396	40.1
Some college credit, but no degree	192	19.4
Associate or bachelor's degree	218	22.1
Advanced degree	47	4.8

\*Race or ethnicity was missing for 16 (1.6%) pregnancy-related deaths; age was missing for 5 (0.5%) pregnancy-related deaths; education was missing for 30 (2.9%) pregnancy-related deaths.



Among pregnancy-related deaths with geographic information on place of residence (n=873), approximately 82% of decedents lived in urban areas (Table 2).

**Table 2.** Urbanicity of place of last residence, data from Maternal Mortality Review Committees in 36 US states, 2017–2019\*

	N	%
Urban	714	81.8
Rural	159	18.2

\*Geographic information is based on county of last residence. It is missing (n=144) or undetermined (n=1) for a total of 145 (14.2%) pregnancy-related deaths. Urban classification includes metropolitan division (≥2,500,000) and metropolitan (≥50,000–2,499,999). Rural classification includes micropolitan (10,000–49,999) and rural (<10,000) as captured in MMRIA..

Among pregnancy-related deaths with information on place of last residence

**82% of decedents lived in urban counties.**

Among deaths for which timing in relation to pregnancy is known, approximately 22% of deaths occurred during pregnancy, 25% occurred on the day of delivery (within 24 hours of the end of pregnancy) or within a week after delivery, 23% occurred from 7 to 42 days postpartum, and 30% occurred in the late postpartum period (43–365 days postpartum, Table 3).

**Table 3.** Distribution of pregnancy-related deaths by timing of death in relation to pregnancy, data from Maternal Mortality Review Committees in 36 US states, 2017–2019\*

	N	%
During pregnancy	216	21.6
Day of delivery	132	13.2
1–6 days postpartum	120	12.0
7–42 days postpartum	233	23.3
43–365 days postpartum	301	30.0

\*Specific timing information is missing (n=2) or *unknown* (n=14) for 16 (1.6%) pregnancy-related deaths.

Among pregnancy-related deaths with information on timing,

**53% occurred 7–365 days postpartum.**

Among the 1,018 pregnancy-related deaths, an underlying cause of death was identified for 987 deaths. The 6 most frequent underlying causes of pregnancy-related death — mental health conditions (22.7%), hemorrhage (13.7%), cardiac and coronary conditions (12.8%), infection (9.2%), thrombotic embolism (8.7%), and cardiomyopathy (8.5%) — accounted for over 75% of pregnancy-related deaths (Table 4). Leading underlying cause of death varied by race and ethnicity. Cardiac and coronary conditions were the leading underlying cause of pregnancy-related deaths among non-Hispanic Black persons; mental health conditions were the leading underlying cause of death among Hispanic and non-Hispanic White persons; and hemorrhage was the leading underlying cause of death among non-Hispanic Asian persons. The leading causes of pregnancy-related death among non-Hispanic American Indian or Alaska Native (AIAN) and non-Hispanic Native Hawaiian and other Pacific Islander (NHOPI) persons were not ranked because of small population size.

**Table 4.** Underlying causes of pregnancy-related deaths\*, overall and by race or ethnicity<sup>1</sup>, data from Maternal Mortality Review Committees in 36 US states, 2017–2019<sup>1</sup>

	Total		Hispanic		Non Hispanic									
					AIAN		Asian		Black		NHOPI		White	
	N	%	n	%	n	%	n	%	n	%	n	%	n	%
Mental health conditions <sup>2</sup>	224	22.7	34	24.1	2	-	1	3.1	21	7.0	0	-	159	34.8
Hemorrhage <sup>3</sup>	135	13.7	30	21.3	2	-	10	31.3	33	10.9	1	-	53	11.6
Cardiac and coronary conditions <sup>4</sup>	126	12.8	15	10.6	1	-	7	21.9	48	15.9	0	-	49	10.7
Infection	91	9.2	15	10.6	1	-	0	0.0	23	7.6	0	-	49	10.7
Embolism-thrombotic	86	8.7	9	6.4	0	-	2	6.3	36	11.9	0	-	34	7.4
Cardiomyopathy	84	8.5	5	3.6	0	-	2	6.3	42	13.9	0	-	33	7.2
Hypertensive disorders of pregnancy	64	6.5	7	5.0	0	-	1	3.1	30	9.9	1	-	22	4.8
Amniotic fluid embolism	37	3.8	6	4.3	1	-	7	21.9	10	3.3	2	-	9	2.0
Injury <sup>5</sup>	35	3.6	5	3.6	1	-	1	3.1	15	5.0	0	-	10	2.2
Cerebrovascular accident	25	2.5	2	1.4	0	-	0	0.0	10	3.3	0	-	13	2.8
Cancer	19	1.9	3	2.1	0	-	1	3.1	7	2.3	0	-	7	1.5
Metabolic/endocrine conditions	12	1.2	2	1.4	0	-	0	0.0	6	2.0	0	-	3	0.7
Pulmonary conditions	12	1.2	1	0.7	0	-	0	0.0	4	1.3	1	-	5	1.1

\*Specific cause of death was missing (n=10) or listed as *unknown* (n=21) for a total of 31 (3.0%) pregnancy-related deaths. Only underlying causes with at least 10 pregnancy-related deaths total are included in the table; therefore, the causes in the table may not reflect all causes of death overall or for each race and ethnicity category. Percentages are not presented when the denominator is <10.

<sup>1</sup>Race or ethnicity was missing for 16 (1.6%) pregnancy-related deaths. Deaths among persons classified as non-Hispanic other/multiple races or missing race or ethnicity are included in the total number of deaths.

<sup>2</sup>Mental health conditions include deaths of suicide, overdose/poisoning related to substance use disorder, and other deaths determined by the MMRC to be related to a mental health condition, including substance use disorder.

<sup>3</sup>Excludes aneurysms or cerebrovascular accident (CVA).

<sup>4</sup>Cardiac and coronary conditions include deaths of coronary artery disease, pulmonary hypertension, acquired and congenital valvular heart disease, vascular aneurysm, hypertensive cardiovascular disease, Marfan Syndrome, conduction defects, vascular malformations, and other cardiovascular disease; and excludes cardiomyopathy and hypertensive disorders of pregnancy.

<sup>5</sup>Injury includes intentional injury (homicide), unintentional injury, including overdose/poisoning deaths not related to substance use disorder, and injury of unknown intent or not otherwise specified.

**Note:** AIAN = American Indian or Alaska Native, NHOPI = Native Hawaiian and Other Pacific Islander

For each death, MMRCs determine whether the death was a suicide and whether the death was a homicide. Among the 1,018 pregnancy-related deaths, a *suicide manner of death* determination was available for 971 deaths and a *homicide manner of death* determination was available for 1,001 deaths. Deaths without a determination include those where the MMRC selected *unknown* because of insufficient information or nonagreement among committee members. Among those pregnancy-related deaths with a determination, 82 (8.4%) were determined to be a suicide, and 29 (2.9%) were determined to be a homicide (Table 5).

**Table 5.** Among pregnancy-related deaths, Maternal Mortality Review Committee-determined manner of death, data from Maternal Mortality Review Committees in 36 US states, 2017–2019\*

	Suicide		Homicide	
	n	%	n	%
No	880	90.6	971	97.0
Yes	82	8.4	29	2.9
Probably	9	0.9	1	0.1

\*A suicide manner of death determination was missing (n=5) or listed as *unknown* (n=42) for a total of 47 (4.6%) pregnancy-related deaths. A homicide manner of death determination was missing (n=10) or listed as *unknown* (n=7) for a total of 17 (1.7%) of pregnancy-related deaths.

Among the 1,018 pregnancy-related deaths, a preventability determination was made for 996 deaths. Among these, 839 (84%) were determined to be preventable (Table 6).

**Table 6.** Percentage of pregnancy-related deaths determined by MMRCs to be preventable, data from Maternal Mortality Review Committees in 36 US states, 2017–2019\*

	n	%
Preventable	839	84.2
Not Preventable	157	15.8

\*A preventability determination was missing (n=4) or unable to be determined (n=18) for a total of 22 (2.2%) pregnancy-related deaths.

## Data Sources and Methods

Data were shared for aggregate analysis by jurisdictional MMRCs through the Maternal Mortality Review Information Application (MMRIA). MMRIA supports standardized record abstraction, case summary development, documentation of committee decisions, and analysis. Data analyzed included information on pregnancy-related deaths that occurred during 2017–2019 among residents of 36 states: Alabama (2017–2018), Alaska (2019), Arizona (2017–2019), Arkansas (2018–2019), California (2019), Colorado (2017–2019), Connecticut (2017–2019), Delaware (2017–2019), Florida (2017–2019), Georgia (2017–2018), Hawaii (2017–2018), Illinois (2017–2019), Indiana (2017–2019), Kansas (2017–2019), Louisiana (2017–2019), Massachusetts (2017), Minnesota (2017–2018), Mississippi (2017–2019), Missouri (2017–2019), North Carolina (2018–2019), Nebraska (2017–2019), New Hampshire (2017–2019), New Jersey (2017–2019), New Mexico (2017–2019), New York (2018–2019; 2019 excludes NYC), Ohio (2017–2018), Oklahoma (2017–2019), Oregon (2018–2019), Pennsylvania (2018), Tennessee (2017–2019), Texas (2019), Virginia (2018), Washington (2017–2019), West Virginia (2017–2019), Wisconsin (2017), and Wyoming (2018–2019). In some states, only partial years of data were shared. Some states group review of deaths by cause of death and may have only reviewed some causes before sharing data with CDC. Sensitivity analysis did not indicate any major differences in underlying causes of death when data for those states were excluded.

We used race and ethnicity data from the birth or fetal death records, when available, and from death records when a birth record or fetal death record was unavailable. Race and Hispanic origin are reported separately on the birth, fetal, and death records; more than one race can be selected. All deaths with a notation of Hispanic origin are classified as Hispanic. For deaths with missing notation of Hispanic origin, race-ethnicity of the decedent was classified as missing. For deaths with a notation of non-Hispanic origin but a notation of race was missing, the race and ethnicity of the decedent was classified as missing. For non-Hispanic persons, race was classified as: non-Hispanic single-race White, non-Hispanic single-race Black, non-Hispanic single-race American Indian or Alaska Native (AIAN), non-Hispanic single-race Asian, non-Hispanic single-race Native Hawaiian or Other Pacific Islander (NHOPI). For brevity, text and tables omit the term *single-race*. Text from the *Other* race field was not recoded. When *Other* race or more than one race were noted, race was classified as *non-Hispanic other/multiple races*. Age at death was based on information from the death record. We used education level from the birth or fetal death record, when available, and from death records when a birth or fetal death record was unavailable. If the death occurred during the postpartum period, and the death record indicated an education one level higher than the birth record, we relied on the higher education level from the death record. Geographic information is based on county of last residence from the death record, when available, and from the birth or fetal death record when missing or undetermined on the death record. Geographic classifications are those produced by Texas A&M Geoservices.<sup>‡</sup>

Timing of death in relation to pregnancy was assigned by using the number of days between the date of death and the end of pregnancy, as documented by the MMRC abstractor, or as calculated by using the number of days between the date of death on the death record and the date of birth or fetal death on the linked birth or fetal death record by CDC. MMRIA instructs MMRC abstractors to enter 0 number of days if the death occurs on the day of delivery. Deaths classified as occurring on the *day of delivery* occurred within 24 hours of the end of pregnancy. If the specific number of days was missing, deaths that the MMRC abstractor classified as *pregnant at the time of death*, or with the standard pregnancy checkbox on the death certificate marked as *pregnant at the time of death*, were classified as *during pregnancy*. We completed a manual review of narratives and abstracted records in MMRIA to confirm the classification of timing of deaths for all decedents, and recoded inaccurate timing of deaths. When available, the timing of death documented in the narrative was used to classify timing of deaths when deaths were missing a timing classification based on the number of days, abstractor-assigned category, and pregnancy checkbox. Deaths that did not have enough information to determine the exact timing of death were classified as *unknown*. Deaths without a narrative were classified as *missing*. Pregnancy-related deaths determined by the MMRCs to be suicides were assigned an underlying cause of death of mental health conditions during analysis, if not already assigned this cause of death by an MMRC. Deaths where the MMRCs determined the means of fatal injury to be *overdose/poisoning*, and where the MMRCs determined that substance use disorder contributed to the death, were assigned an underlying cause of death of mental health conditions during analysis, if not already assigned this cause of death by an MMRC.

## Definitions

**Pregnancy-Related:** A death during pregnancy or within one year of the end of pregnancy from a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the physiologic effects of pregnancy. In addition to having a temporal relationship to pregnancy, these deaths are causally related to pregnancy or its management.

**Preventability:** A death is considered preventable if the committee determines that there was at least some chance of the death being averted by one or more reasonable changes to patient, community, provider, facility, and/or systems factors. MMRIA allows MMRCs to document preventability decisions in two ways: (1) determining preventability as a *yes* or *no*, and/or (2) determining the chance to alter the outcome by using a scale that indicates *no chance*, *some chance*, or *good chance*. Any death with a *yes* response or a response that there was *some chance* or a *good chance* to alter the outcome was considered *preventable*. Deaths with a *no* response or *no chance* were considered *not preventable*.

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<sup>‡</sup><https://geoservices.tamu.edu/>

## About the authors

Susanna Trost is a CDC Foundation Field Employee assigned to the National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health; Fanny Njie, Alyssa Harvey, and Jasmine Berry are Oak Ridge Institute for Science and Education (ORISE) Fellows in the National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health; Jennifer Beauregard, Gyan Chandra, and David Goodman are with the National Center for Chronic Disease Prevention and Health Promotion, Division of Reproductive Health.

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