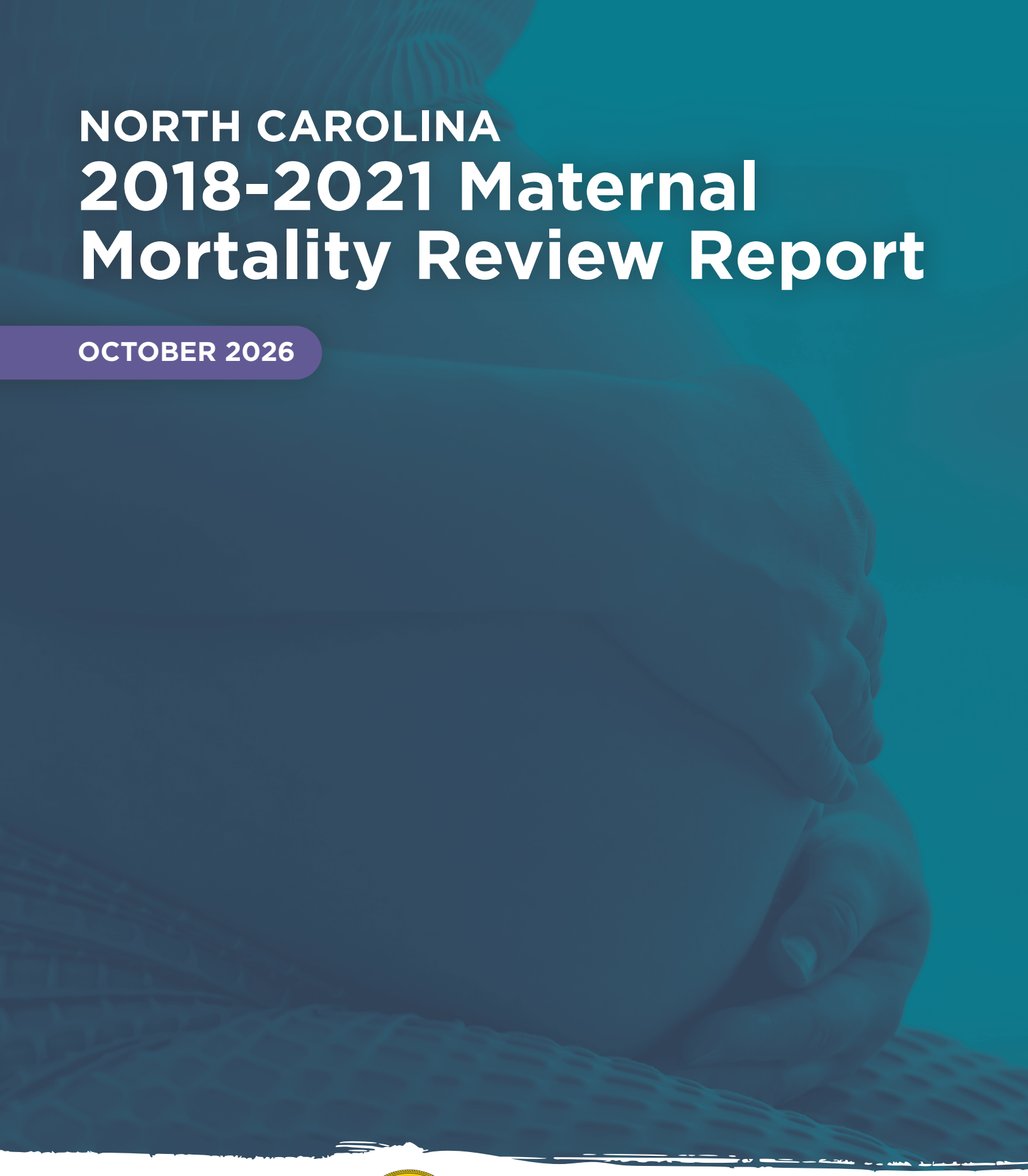
NORTH CAROLINA
2018-2021 Maternal Mortality Review Report

OCTOBER 2026



NC DEPARTMENT OF
HEALTH AND
HUMAN SERVICES
Division of Public Health

EXECUTIVE SUMMARY



State legislation established the North Carolina Maternal Mortality Review Committee (MMRC) in 2015 with a primary goal of reducing maternal mortality in the state by conducting multidisciplinary maternal death reviews and developing recommendations for the prevention of future maternal deaths. The legislation established a multidisciplinary committee appointed by the Secretary of the NC Department of Health and Human Services (NCDHHS).[1] This report provides an overview of all maternal deaths in the state with a primary focus on the patterns and trends in pregnancy-associated deaths that occurred from 2018 to 2021. Additionally, the report highlights recommendations from the committee that focus on providing actionable public health and clinical recommendations aimed at the prevention of future maternal deaths. The case identification process is outlined in the Appendix.

Key Findings

- The MMRC reviewed 450 pregnancy-associated deaths from 2018 through 2021. Among these deaths, 142 occurred in 2021; the highest figure recorded during this period.
- 43% (n=195) of the cases were determined to be pregnancy-related during 2018-2021.
- Both pregnancy-associated mortality ratios (PAMRs) and pregnancy-related mortality ratios (PRMRs) peaked in 2021.
- Among the 195 deaths occurring from 2018-2021 classified as pregnancy-related by the MMRC, mental health conditions were the overall leading cause of death, comprising nearly one-third of all cases (30.8%, n=60)*.
  - 47 of the 60 pregnancy-related mental health conditions deaths involved accidental overdoses.
  - Over 80% of these 47 accidental overdose deaths involved fentanyl (n=38).
- Infections were the second leading cause of pregnancy-related death during 2018-2021 (n=27).
- A total of 16 pregnancy-related deaths were attributable to COVID-19, including 2 deaths in 2020 and 14 in 2021.
- Injuries were the third leading cause of pregnancy-related death, associated with 19 deaths. Most of the injuries were homicides (84%). Among the 16 pregnancy-related homicide deaths:
  - Former or current partners were the perpetrators in all 16 homicide cases.
  - Firearms were noted as the lethal means in 10 of the 16 pregnancy-related Homicides (63%).
- Cardiovascular conditions (n=19) and hemorrhages (n=16) also ranked among the top five leading causes of pregnancy-related death.
- Among the 195 pregnancy-related deaths, more than half occurred during pregnancy, delivery, or within 42 days postpartum (n=109; 55.9%).
- Racial and ethnic differences in pregnancy-related mortality persist. From 2018-2021, the highest PRMRs occurred among Non-Hispanic (NH) Black women with a PRMR of 59.6. This figure was 1.7 times higher than the PRMR among Non-Hispanic White women during this same period (36.1).

- PRMRs increased with advanced maternal age and decreased with higher maternal education levels. Women receiving Medicaid also experienced higher pregnancy-related mortality.
- With regard to geographic patterns in pregnancy-related deaths, PRMRs were higher among women living in rural areas and women living in the southeastern region of the state.
- The majority (87.2%) of pregnancy-related deaths occurring in the 2018-2021 period were preventable, that is 'the committee determined that there was at least some chance of the death being averted by one or more reasonable changes.'
- Discrimination was determined to be a probable contributing factor in 128 pregnancy-related deaths (65.6%) and was the most common contributory factor recorded. MMRCs utilize the CDC definition of discrimination including mental health diagnoses, substance use, weight, geography, race/ethnicity, incarceration history and other considerations.
- More than 6 of 10 pregnancy-related deaths demonstrated evidence of social or emotional stress (63.6%).

**For statistical tracking on the Pregnancy Mortality Surveillance System, the CDC uses the broad category of "Mental Health Conditions" which includes suicide and "unintentional or unknown intent overdose/poisoning related to a substance use disorder.*

BACKGROUND

The 2015 NC legislation established a nine-member multidisciplinary MMRC and in 2022 the legislation was updated to allow an increase up to 20 committee members.[1] The current MMRC includes representation from the following perspectives: maternal fetal medicine, general obstetrics and gynecology, certified nurse midwifery, labor and delivery nursing, forensic pathology, substance use, mental health, public health and community advocacy.

The MMRC conducts comprehensive reviews of every maternal death of NC residents to determine if the death was pregnancy-related or pregnancy-associated. The Centers for Disease Control and Prevention (CDC) provides definitions and guidelines for classifying deaths occurring during pregnancy, childbirth, and in the postpartum period (up to 365 days from the end of the pregnancy).[2] The MMRC uses these frameworks and protocols to ensure case review processes are standardized and consistent.

DEFINITIONS:

- **Pregnancy-Related:** A death during pregnancy or within one year of the end of the 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.
- **Pregnancy-Associated but Not Related:** A death during pregnancy or within one year of the end of pregnancy from a cause that is not related to the pregnancy.
- **Pregnancy-Associated, but unable to determine pregnancy relatedness:** The death of a woman while pregnant or within one year of the end of pregnancy, due to a cause that could not be determined to be pregnancy related or not pregnancy-related.

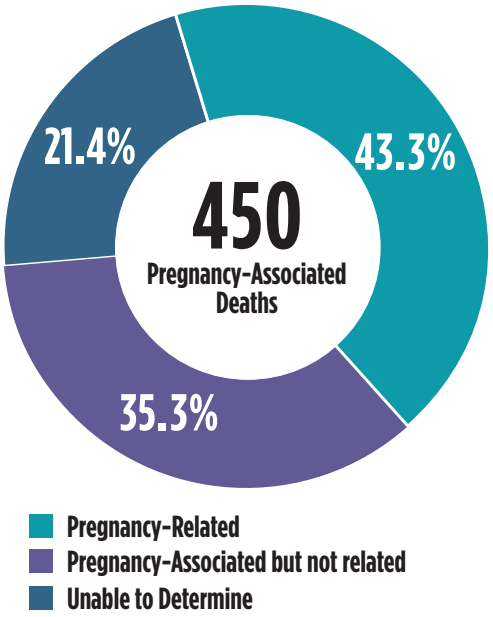
OVERVIEW OF 2018-2021 PREGNANCY-ASSOCIATED DEATHS

Pregnancy-Related

The MMRC reviewed 450 NC resident deaths occurring from 2018 to 2021 (**Figure 1**). Based on Committee determinations, 195 deaths were classified as pregnancy-related (43.3%) and 159 deaths were pregnancy-associated but not related (35.3%). The MMRC was unable to determine pregnancy-relatedness for 96 cases (21.4%).

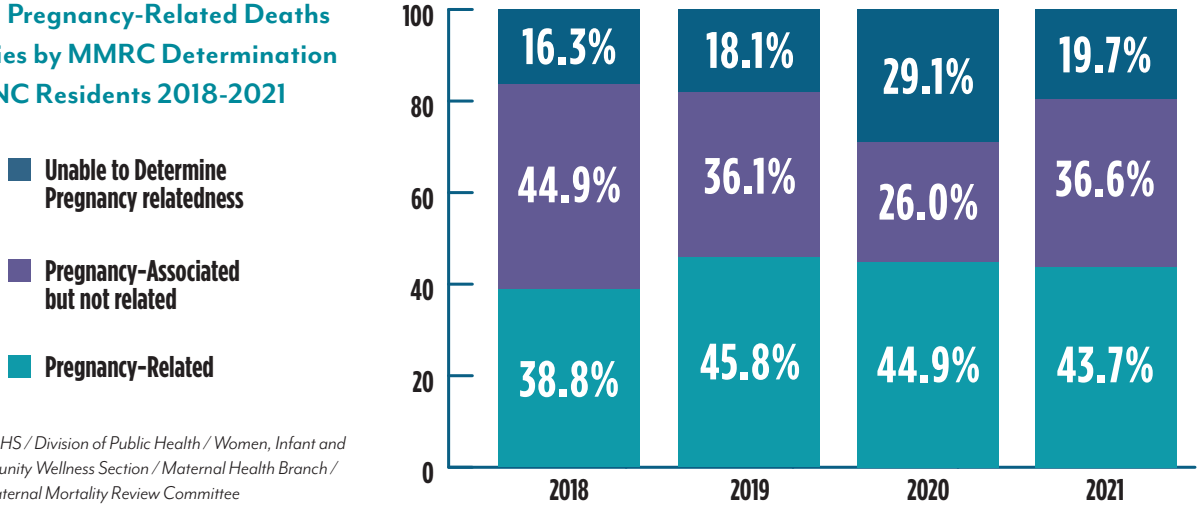
As presented in **Figure 2**, the proportion of cases that the MMRC classified as pregnancy-related remained relatively stable during this period – at 38.8% in 2018, 45.8% in 2019, 44.9% in 2020 and 43.7% in 2021. In 2021, the MMRC was unable to determine the pregnancy-relatedness for 19.7% of cases they reviewed, which represented a lower proportion compared to 2020 (29.1%). Compared with the MMRC review of 2014-2016 data when 26% of cases were determined to be pregnancy-related and only 4% of cases were classified as undetermined, MMRC case reviews for 2018-2021 deaths represent an increase in both cases determined to be pregnancy-related and in those classified as undetermined. The increase in cases classified as 'unable to determine' pregnancy-relatedness by the MMRC is due to several overlapping factors. The multidisciplinary nature of MMRCs means experts from different fields may interpret the same case differently, and if consensus cannot be reached, the death is classified as 'undetermined.' This is more common in complex cases involving suicide, overdose, or chronic conditions, where the influence of pregnancy is not always clear. Social factors like poverty or limited access to care may further complicate assessments.

Figure 1. Pregnancy-Associated Death Categories by MMRC Determination, NC Residents 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

Figure 2. Pregnancy-Related Deaths Categories by MMRC Determination & Year, NC Residents 2018-2021



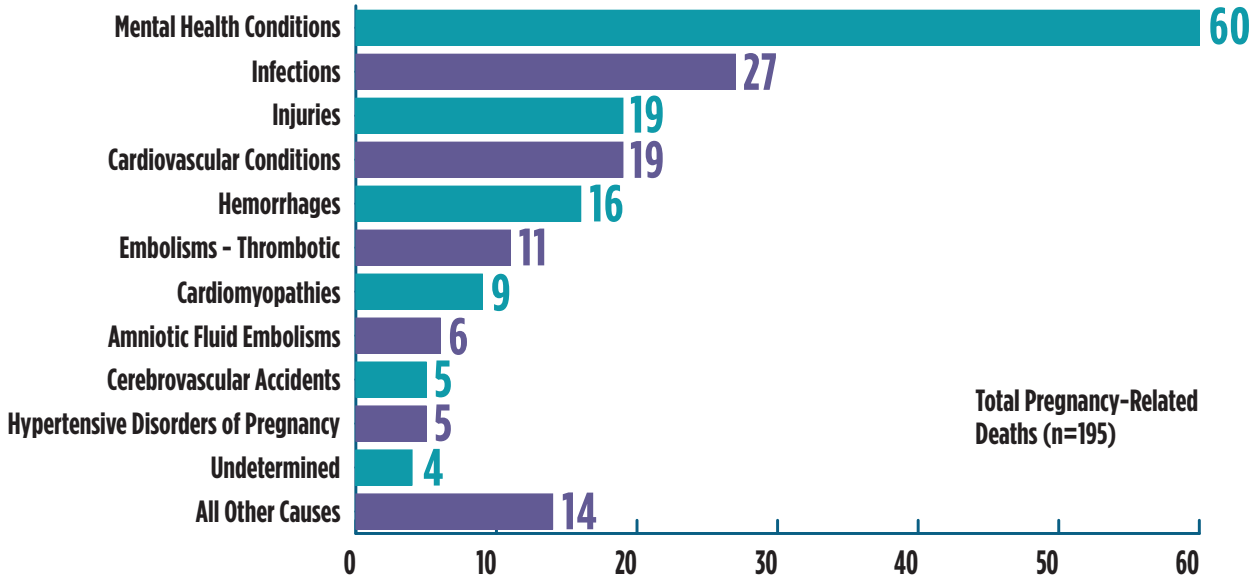
Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee



Causes of Pregnancy-Related Deaths

The MMRC classifies pregnancy-related causes of death using a specific set of categories developed by the CDC.[3] The use of standardized classifications facilitates comparable maternal mortality analysis across MMRCs throughout the United States (US). While the MMRC determines pregnancy-relatedness for all cases, the Committee only assigns a cause of death for cases classified as pregnancy-related. Among the 195 deaths from 2018-2021 that were classified as pregnancy-related by the MMRC (**Figure 3**), mental health conditions were the leading cause of death, comprising nearly one-third of all cases (30.8%, n=60). Infections were the second leading cause of pregnancy-related deaths during this period (13.8%, n=27). Among the infections category, there were 16 pregnancy-related deaths attributable to COVID-19, with 2 deaths occurring in 2020 and 14 deaths in 2021. In addition, there were 10 pregnancy-related infection deaths related to sepsis/septic shock. Other leading causes, in order of magnitude, include injuries, cardiovascular conditions, hemorrhages, non-cerebrovascular embolisms, cardiomyopathies, amniotic fluid embolisms, cerebrovascular accidents, and hypertensive disorders of pregnancy. The causes of 14 pregnancy-related deaths are not presented due to small numbers (fewer than five deaths for each cause category). The MMRC was unable to determine a cause of death for four cases.

Figure 3. Leading Causes of Pregnancy-Related Deaths, NC Residents 2018-2021

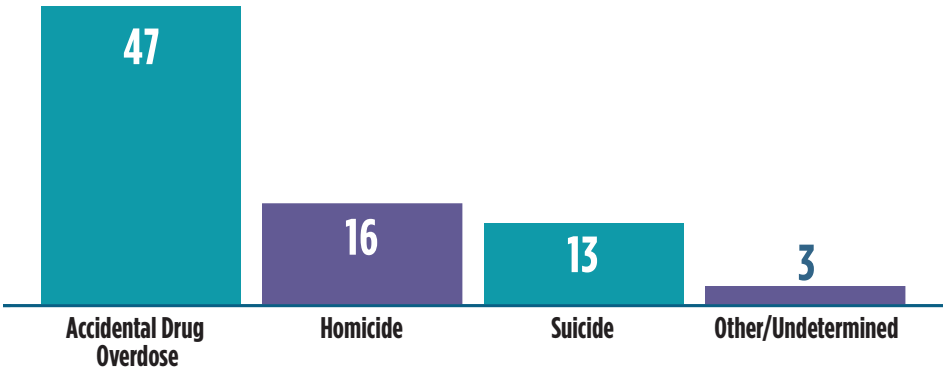


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

Overdoses, Suicides and Homicides

The cause of death classifications on the Maternal Mortality Review Information Application (MMRIA) committee decision form do not include specific categories for accidental poisonings (overdoses) or suicides that would allow the MMRC to specify these as the underlying cause of pregnancy-related deaths.[2] Deaths from overdose and suicide are classified under Mental Health Conditions when the Committee determines pre-existing mental health conditions or substance use disorders were the underlying causes of the death. In cases where an overdose was determined to be unrelated to any preexisting mental health condition or substance use disorder, the MMRC may attribute the cause to Unintentional Drug Overdose within the Injury category.

Figure 4. Pregnancy-Related Deaths due to Mental Health Conditions & Injuries (n=79), NC Residents 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

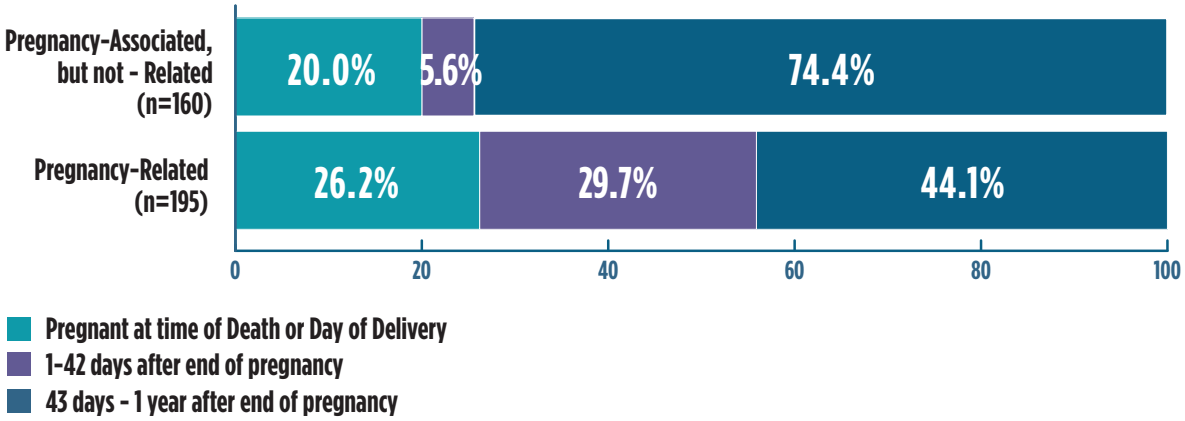
Figure 4 examines the two leading causes of pregnancy-related deaths from 2018 to 2021 — mental health conditions and injuries — in further detail. Among the 79 pregnancy-related deaths attributed to mental health conditions or injuries, 47 involved accidental drug-overdose (59.5%). Individuals dying of overdose do not always have a history of substance use disorder (SUD). Of the 47 accidental overdose fatalities, SUD was a confirmed or suspected contributing factor in 37 cases (79%). The majority of accidental overdose deaths involved fentanyl (n=38). Other injury-related deaths include 16 homicides, 13 suicides, one motor vehicle accident, one injury death for which the MMRC was unable to determine intent, and one death associated with a substance use disorder that did not involve an overdose. Among the 13 pregnancy-related suicides, five involved hanging/strangulation/suffocation, four involved firearms, three involved poisoning/overdose, and one involved a motor vehicle. Among the suicides, the MMRC concluded that mental health conditions contributed to the death in all 13 cases. Former or current partners were the perpetrators in all 16 homicide cases. Firearms were noted as the lethal means in 10 of the 16 pregnancy-related homicides (63 percent).

Timing of Pregnancy-Related Deaths

Figure 5 presents the temporal proximity of the death to delivery/pregnancy for both pregnancy-related and pregnancy-associated deaths. Pregnancy-related deaths were more likely to occur within a shorter time frame from pregnancy or delivery. During 2018–2021, among the 195 pregnancy-related

deaths, more than half occurred during pregnancy, delivery, or within 42 days postpartum (n=109; 55.9%). In contrast, among deaths classified as pregnancy-associated but not related, only 25.6% (n=41) transpired during pregnancy, delivery or within 42 days postpartum.

Figure 5. Pregnancy Associated Deaths Reviewed by the NC Maternal Mortality Review Committee (MMRC) by Determination and Timing of Death, NC Residents 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

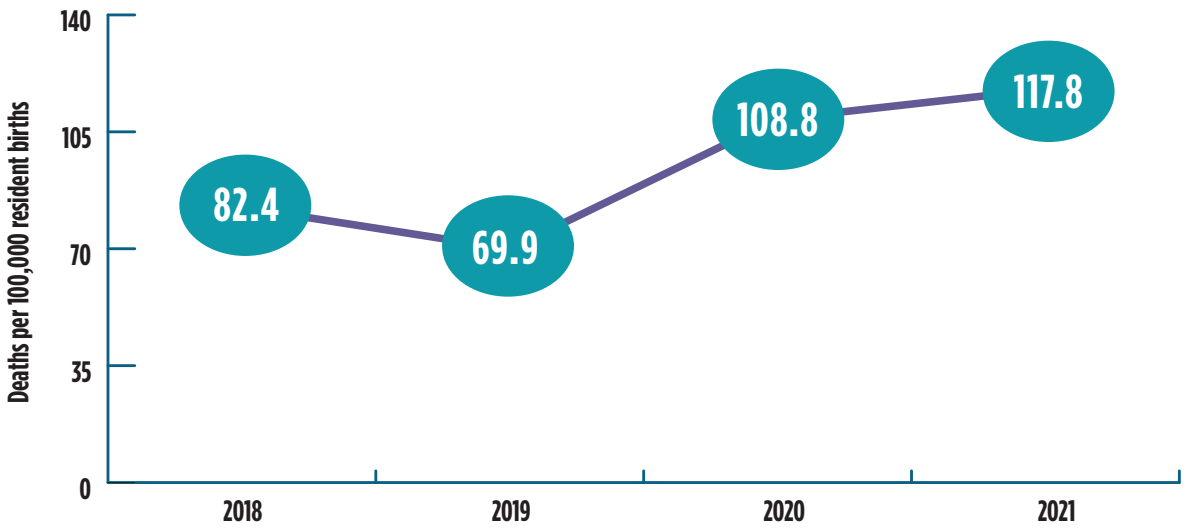
Pregnancy Associated & Pregnancy-Related Mortality Ratios

Caution Regarding Interpreting Ratios based on Small Numbers: *Many of the ratios presented in this report are based on a relatively small number of deaths in the numerator. Rates and ratios based on a small number may be unstable which can make interpretation challenging. Readers are urged to pay close attention to the range of the confidence intervals (C.I.) to gauge the degree of instability in the ratios.*[4]

PREGNANCY-ASSOCIATED MORTALITY RATIOS

As noted earlier, the MMRC reviews all pregnancy-associated deaths which include all deaths while pregnant or within one year of the end of pregnancy, regardless of the cause, proximity to pregnancy/delivery, or pregnancy-relatedness. During the four-year period 2018 through 2021, the MMRC reviewed an average of 103 pregnancy-associated deaths each year. The pregnancy-associated mortality ratio (PAMR) represents the number of deaths occurring within one year of pregnancy/delivery per 100,000 resident births. As presented in **Figure 6**, in 2018 North Carolina's overall PAMR was 82.4 deaths per 100,000 resident births (C.I. 66.1-98.7). In 2019, the PAMR decreased to 69.9 deaths per 100,000 resident births (C.I. 54.9-84.9) and in 2020 the ratio increased to 108.8 (C.I. 89.9-127.7). The 2021 PAMR of 117.8 (C.I. 98.5-137.2) was the highest ratio recorded during the 4-year period. However, due to a relatively small number of pregnancy-associated deaths each year, interpretation of trends is complicated by significant overlap in confidence intervals.

Figure 6. Pregnancy-Associated Mortality Ratios (PAMRS) by Year of Death, NC Residents 2018-2021

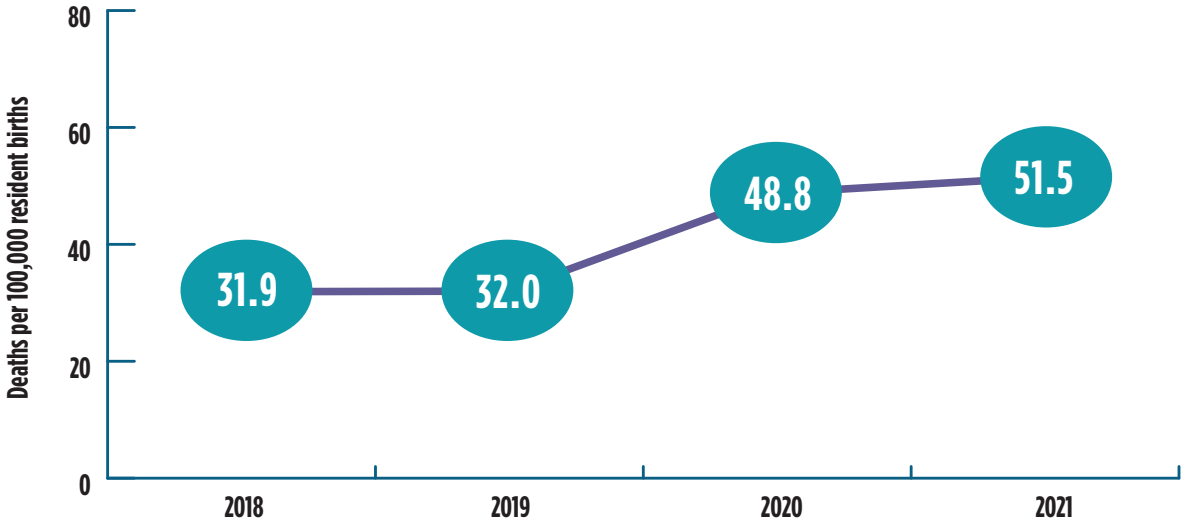


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

PREGNANCY-RELATED MORTALITY RATIOS

The pregnancy-related mortality ratio (PRMR) represents the number of deaths that the MMRC determined to be pregnancy-related per 100,000 resident births. Pregnancy-related deaths represent a subset of all-pregnancy associated deaths, therefore these ratios are smaller than PAMRs. On average, 49 pregnancy-related resident deaths occurred each year from 2018-2021. **Figure 7** presents PRMRs from 2018 through 2021. In 2018, the PRMR was 31.9 (C.I. 21.8-42.1). In 2019, the PRMR remained virtually unchanged at 32.0 (C.I. 21.8-42.2). By 2020, the PRMR increased to 48.8 (C.I. 26.2-61.5) and in 2021 the PRMR reached a peak at 51.5 (38.6-64.3). As with the PAMR, the 2021 PRMR represented the highest ratio recorded during this time period, although overlapping confidence intervals during this period hinders a clear interpretation of the trends.

Figure 7. Pregnancy-Related Mortality Ratios (PRMRs) by Year of Death, NC Residents 2018-2020



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

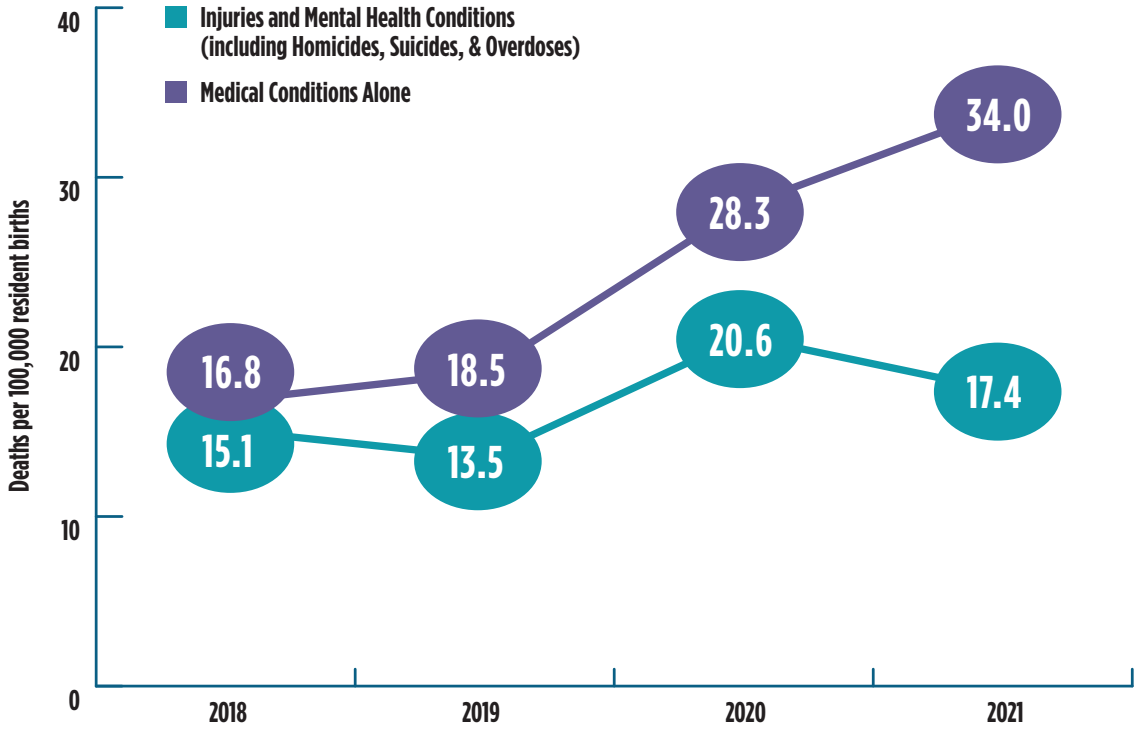
CAUSE OF DEATH CATEGORY

Examination of pregnancy-related mortality by cause of death can highlight cause categories associated with changes in PRMRs over time. However, with most pregnancy-related cause of death categories having fewer than 10 deaths per year during this period, detailed analysis of trends for specific causes of death is not feasible. An alternative approach allows us to examine trends in pregnancy-related causes of death by aggregating cases into larger cause of death groupings:

1. **Injuries and mental health conditions:** including homicides, suicides, accidental overdoses, and other related causes. There were 79 deaths from mental health conditions and injuries from 2018 to 2021.
2. **Medical conditions:** including infections, cardiovascular conditions, hemorrhages, embolisms, cardiomyopathies, amniotic fluid embolisms, cerebrovascular accidents, hypertensive disorders of pregnancy, cancer, hematologic disorders, pulmonary conditions, neurological conditions, metabolic disorders, anesthesia complications, and gastrointestinal disorders). There were 112 deaths related to medical causes from 2018 to 2021.

As shown in **Figure 8**, PRMRs associated with medical conditions remained higher than PRMRs related to injuries and mental health conditions throughout the four-year period. PRMRs associated with medical conditions increased each year, from a low of 16.8 in 2018 (C.I. 9.4-24.2) to a high of 34.0 in 2021 (C.I. 23.6-44.4). As noted previously, COVID played a larger role in medical PRMRs in 2021 when there were 14 deaths attributed to the infection, compared with 2 in 2020. Pregnancy-related mortality associated with injuries and mental health conditions experienced less variability during this period, with a PRMR of 15.1 in 2018 (C.I. 8.1-22.1) to 17.4 in 2021 (C.I. 10.0-24.9). When comparing these cause categories over time, it is important to bear in mind that the confidence intervals are fairly wide and often overlap across this period.

Figure 8. Pregnancy-Related Mortality Ratios (PRMRs) by Cause of Death and Year, NC Residents 2018-2021

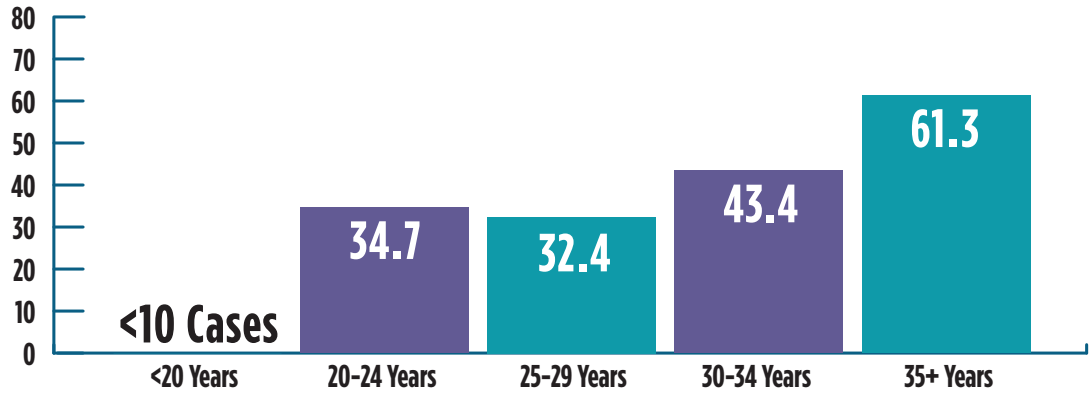


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

MATERNAL AGE

Figure 9 reveals that North Carolina's pregnancy-related mortality ratios generally increase with advanced maternal age. Ratios were highest among women ages 35 and over, with a PRMR of 61.3 (C.I. 44.1-78.4) per 100,000 resident births from 2018-2021. PRMRs were also high among women ages 30 to 34 (43.4; C.I. 32.2-54.5). PRMRs were comparably low among women ages 20 to 24 (34.7; C.I. 23.0-46.3) and ages 25 to 29 (32.4; C.I. 22.9- 41.8). There were nine deaths among teenage mothers under age 20 from 2018 to 2021, therefore ratios are not presented for this group due to small numbers.

Figure 9. Pregnancy-Related Mortality Ratios (PRMRs) by Age Group, NC Residents 2018-2021

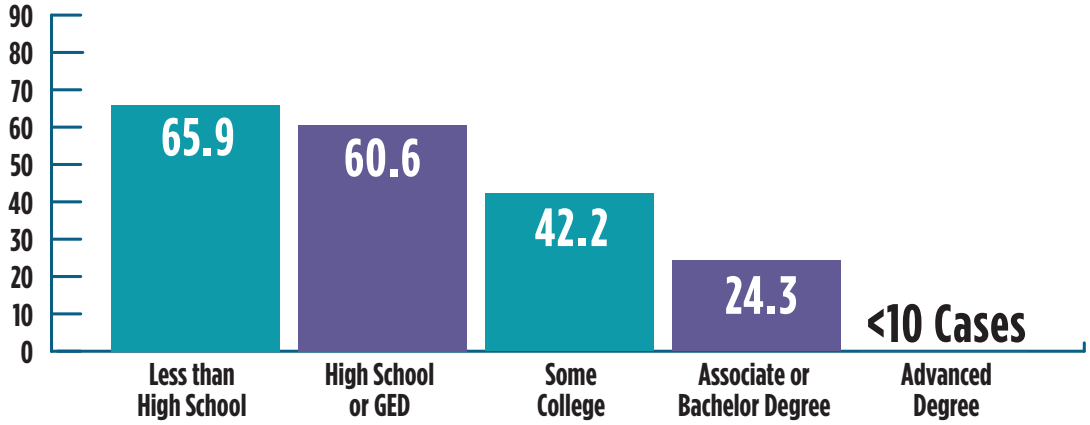


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

MATERNAL EDUCATION LEVEL

Pregnancy-related mortality is inversely related to maternal education – as education levels increase, PRMRs decrease. **Figure 10** displays NC pregnancy-related mortality ratios by maternal education level. Among the 195 pregnancy-related deaths identified from 2018-2021, those having less than a high school education experienced the highest pregnancy-related mortality ratio of 65.9 (C.I. 45.2-86.6). In contrast, PRMRs were lowest among women with an Associate or Bachelor's degree, with a ratio of 24.3 (C.I. 16.3-32.4). Ratios are not presented for those having advanced degrees due to a small number of deaths among this group (n=9).

Figure 10. Pregnancy-Related Mortality Ratios (PRMRs) by Education Level, NC Residents 2018-2021

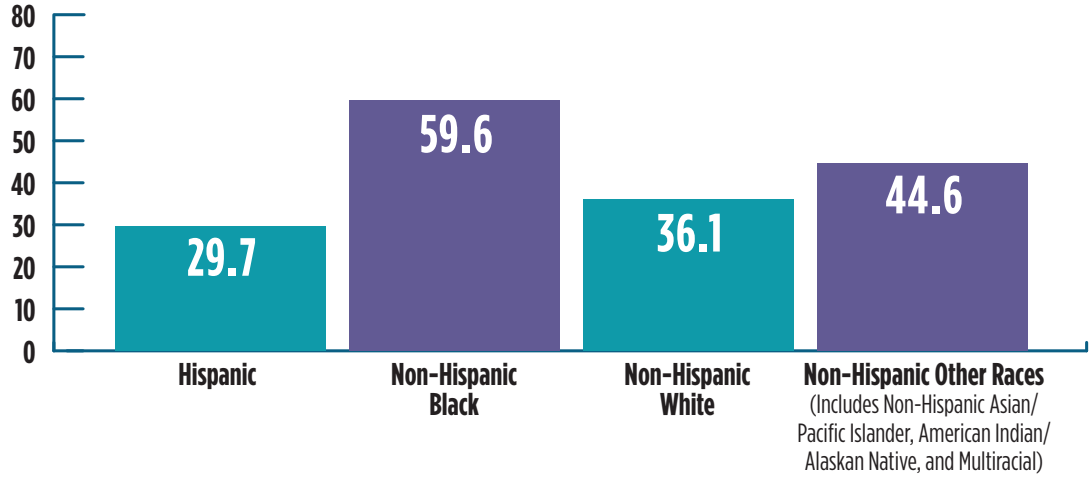


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

MATERNAL RACE/ETHNICITY

As shown in **Figure 11**, racial and ethnic differences in pregnancy-related mortality persist. From 2018-2021, the highest PRMRs occurred among Non-Hispanic (NH) Black women with a PRMR of 59.6 (C.I. 45.1-74.1). Non-Hispanic women of other races had the second highest PRMR at 44.6, however due to a relatively small number of deaths (n=17), this ratio had a wide confidence interval (C.I. 23.4-65.8). The PRMR for NH White women was 36.1 (C.I. 28.7-43.6). In 2018-2021, Non-Hispanic Black women had PRMRs 1.7 times higher than Non-Hispanic White women. Fewer than 10 pregnancy-related deaths occurred among Non-Hispanic American Indians/ Alaskan Natives (n=8), Asian/Pacific Islanders (n=4), and Multiracial (n=3) women from 2018-2021. As a result, PRMRs are calculated using the aggregate deaths among these groups in the "Non-Hispanic Other Races" category. Hispanics had the lowest PRMRs during this period at 29.7 (C.I. 17.5-41.8).

Figure 11. Pregnancy-Related Mortality Ratios (PRMRs) by Race/Ethnicity, NC Residents 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

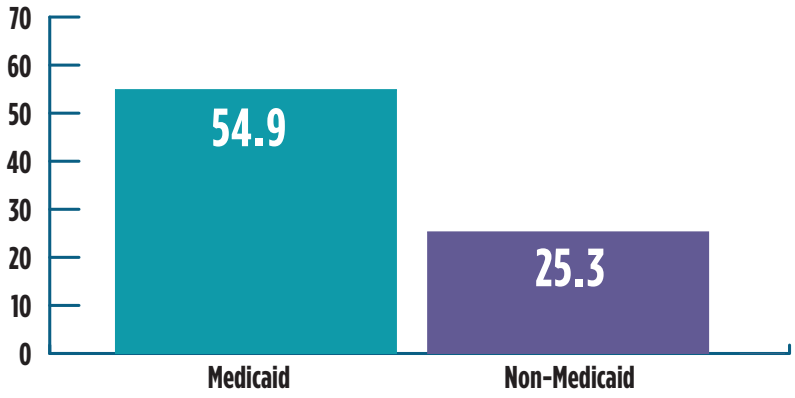
NC maternal mortality data from 2018–2021 shows a pregnancy-related mortality ratio (PRMR) of 20.5 deaths per 100,000 live births for individuals who were married at the time of death in contrast to a PRMR of 68.8 deaths per 100,000 live births (C.I. 57.2–80.4) among individuals who were unmarried, divorced, separated, or widowed. This elevated mortality risk among unmarried individuals aligns with previous data-driven assessments of mortality patterns conducted by the CDC across 13 state Maternal Mortality Review Committees. Although death certificate data is limited exclusively to legal marital status, these highly divergent ratios strongly emphasize the need to address underlying gaps in financial resources and social support infrastructure for non-married pregnant populations.



MEDICAID STATUS

From 2018 through 2021, Medicaid recipients comprised 53 percent of all resident births in North Carolina.[5] During this period, women who were covered by Medicaid had significantly higher PRMRs compared to women who were not on Medicaid. Medicaid recipients had a PRMR of 54.9 (C.I. 45.8-64.0), compared with a PRMR of 25.3 (C.I. 18.6-31.9) among those who were not on Medicaid. Both the American College of Obstetricians and Gynecologists (ACOG) and the American Public Health Association (APHA) advise that extending Medicaid coverage for 12 months postpartum may help reduce maternal morbidity and mortality.[6,7] North Carolina extended Medicaid postpartum coverage from 60 days to 12 months on April 1, 2022 and fully expanded Medicaid for adults up to 138 percent of poverty on December 1, 2023.[8] Moving forward, the MMRC will continue to monitor PRMRs before and after these Medicaid policy changes to assess the potential impact on pregnancy-related mortality in North Carolina.

Figure 12. Pregnancy-Related Mortality Ratios (PRMRs) by Medicaid Status, NC Residents 2018-2021



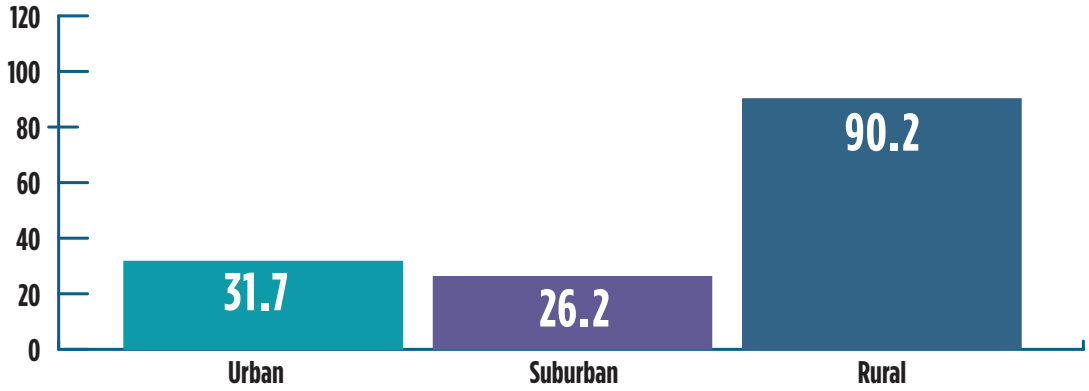
Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

URBAN/RURAL RESIDENCE

The National Center for Health Statistics (NCHS) categorizes US counties into six categories that include large central metro, large fringe metro, medium metro, small metro, micropolitan, and noncore. Large central metro and large fringe metro are classified as urban counties. Medium metro and small metro can be classified as suburban and micropolitan and noncore counties are designated as rural. As shown in **Figure 13**, residents of North Carolina's rural counties experienced the highest ratios during 2018-2021 with a PRMR of 90.2 (C.I. 71.2-109.3). Suburban counties had the lowest PRMR at 26.2 (C.I. 19.2-33.2). Women living in urban counties had a similarly lower PRMR at 31.7 (C.I. 23.3-40.1). Confidence intervals overlapped among urban and suburban counties, indicating that there was not a significant difference in PRMRS across these groups.



Figure 13. Pregnancy-Related Mortality Ratios (PRMRs) by Urban/Rural Status, NC Residents 2018-2021

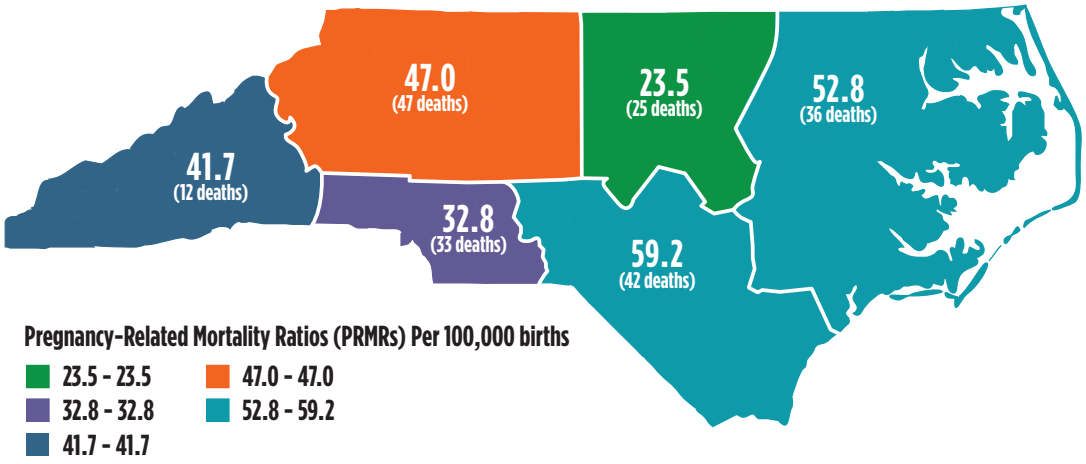


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

REGION

The Division of Public Health's Women, Infant, and Community Wellness Section (WICWS) categorizes North Carolina counties into six Perinatal Care Regions for maternal and infant health surveillance: 1. Western, 2. Northwestern, 3. Southwestern, 4. Northeastern, 5. Southeastern, and 6. Eastern. Examining pregnancy-related mortality ratios by region (**Figure 14**), women living in counties in the Southeastern region had the highest pregnancy-related mortality with a ratio of 59.2 (C.I. 41.3-77.1). Women residing in the Northeastern region of the state had the lowest PRMR at 23.5 (C.I. 14.3-32.7).

Figure 14. Pregnancy-Related Mortality Ratios (PRMRs) by Perinatal Care Region, NC Residents 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

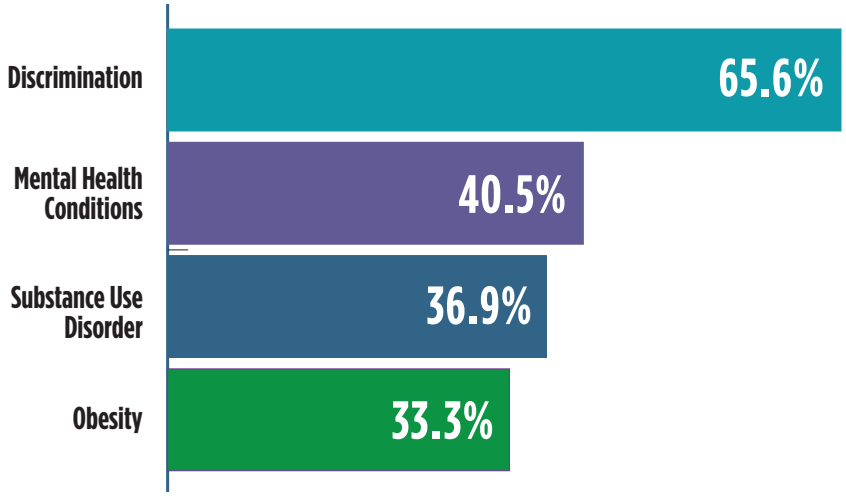
Other Factors Associated with Pregnancy-Related Deaths

CONTRIBUTORY FACTORS

The MMRC documented specific conditions that may have played a contributory role in 2018-2021 pregnancy-related deaths. These conditions include obesity, mental health, substance use disorders, and discrimination. **Figure 15** presents the proportion of pregnancy-related deaths where these factors were documented as contributing or probably contributing.

- **Discrimination:** Discrimination was determined to be a contributing factor in 128 pregnancy-related deaths (65.6%) and was the most common contributory factor recorded. Beyond racial and ethnic dynamics, this classification recognizes the multifaceted nature of discrimination. It specifically accounts for marginalized statuses arising from factors such as obesity, regional location, criminal justice involvement, and substance-related stigmas.
- **Mental Health Conditions:** Mental health conditions were the second most recorded contributory factor, noted for 4 in 10 pregnancy-related deaths (40.5%; n=79).
- **Substance Use Disorder:** The MMRC determined that substance use disorder contributed to 72 pregnancy-related deaths (36.9%).
- **Obesity:** A smaller, but still substantial proportion of pregnancy-related deaths recorded that obesity may have been a contributory factor (n=65; 33.3%).

Figure 15. Percentage of Pregnancy-Related Deaths (n=195) with Key Contributory Factors Documented by MMRC, NC Residents 2018-2021

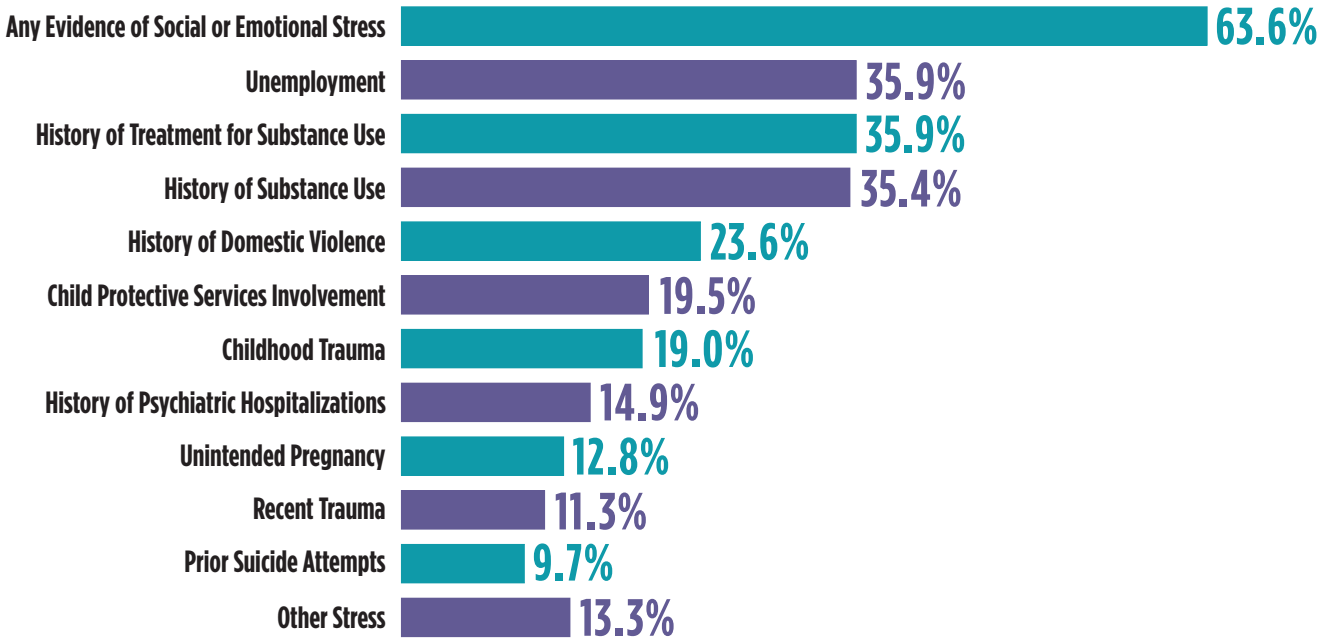


Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

Social and Emotional Stress Documented Through Abstraction

Social and/or emotional stress indicators are documented during abstraction. These stressors, defined in the MMRIA database, include: a history of domestic violence, history of psychiatric hospitalizations, child protective services involvement, history of substance use, unemployment, history of treatment for substance use, unintended pregnancy, recent trauma, history of childhood trauma, prior suicide attempts, or other sources of social/emotional stress. Among the 195 pregnancy-related deaths occurring during 2018-2021, 63.6% had some evidence of social or emotional stress at the time of their death (**Figure 16**). Unemployment (35.9%), a history of treatment for substance use (35.9%), a history of substance use (35.4%), and a history of domestic violence (23.6%) were the four most common categories of social/emotional stress documented among pregnancy-related deaths during this period. Additionally, while not included among the social and emotional stress categories, case abstraction noted that 19.0% of pregnancy-related deaths (n=37) had a history of incarceration, 22.6% had a history of prior arrest(s) (n=44), 20.5% had a history of unstable housing (n=40), and 13.8% had a current or past history of homelessness (n=27).

Figure 16. Pregnancy-Related Deaths (n=133) by Evidence of Social or Emotional Stress, NC Residents 2018-2021



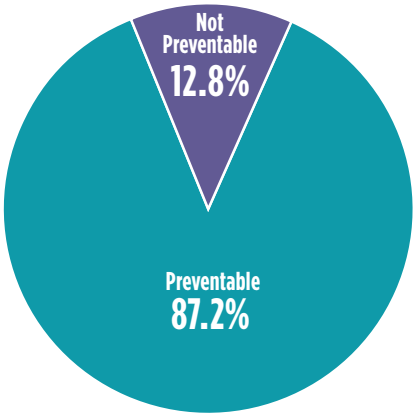
Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

Preventability of Pregnancy-Related Deaths

During review, the MMRC also makes determinations regarding whether a death may have been preventable. As shown in **Figure 17** the MMRC determined that the majority (87.2%) of pregnancy-related deaths from 2018-2021 were preventable, that is "the committee determined that there was at least some chance of the death being averted by one or more reasonable changes to patient, family, provider, facility, system and/or community factors".

Among the 170 preventable deaths occurring during 2018-2021, the Committee concluded there was "some chance" to alter the outcome for 80 deaths and a "good chance" to avert the outcome for 82 deaths (**Table 1**). The MMRC was unable to determine whether there was a chance to alter the outcome for eight deaths classified as preventable.

Figure 17. Pregnancy-Related Deaths: Proportion NC MMRC Determined to be Preventable, NC Residents 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

Table 1. Pregnancy-Related Deaths by Preventability, NC Residents 2018-2021

Chance to Alter Outcome	PREVENTABILITY		
	Not Preventable	Preventable	Total
No Chance	25	0	25
Some Chance	0	80	80
Good Chance	0	82	82
Unable to Determine	0	8	8
Total	**25**	**170**	**195**

Source: NCDHHS / Division of Public Health / Women, Infant, and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

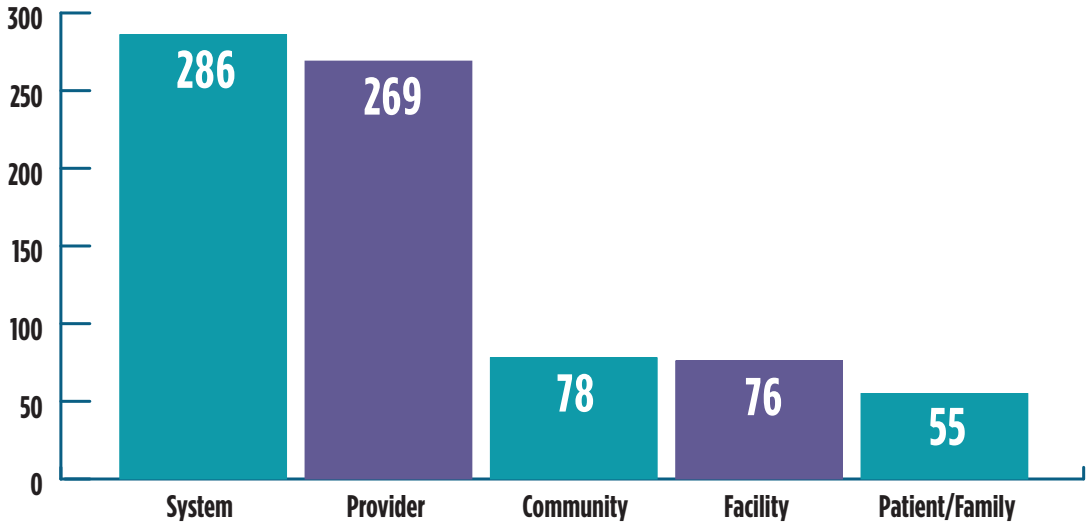
COMMITTEE RECOMMENDATIONS

The MMRC utilizes CDC's MMRIA system's five standardized categories for classifying committee recommendations by contributing factors. These categories are:

- **Patient/Family:** An individual before, during or after a pregnancy, and their family, internal or external to the household, with influence on the individual.
- **Provider:** An individual with training and expertise who provides care, treatment, and/or advice.
- **Facility:** A physical location where direct care is provided – ranges from small clinics and urgent care centers to hospitals with trauma centers.
- **System:** Interacting entities that support services before, during, or after a pregnancy – ranges from health care systems and payors to public services and programs.
- **Community:** A grouping based on a shared sense of place or identity — ranges from physical neighborhoods to a community based on common interests and shared circumstances.

Among the 162 pregnancy-related deaths that the MMRC classified as preventable and where there was some chance to alter the outcome, 764 recommendations were developed with an average of five recommendations per case. Recommendations focusing on the system level were the most common (n=286; 37%), followed by approximately one-third (35%) centering on the provider level. Other recommendations focused on patient/family, facility, and community levels. When the MMRC was first established, due to the nature of the cases reviewed, recommendations were primarily medically focused. In more recent years, the MMRC began making broader, more comprehensive recommendations acknowledging the role of social drivers and non-medical drivers of health and systems that sustain and maintain circumstances associated with pregnancy-related deaths. **Figure 18** presents total recommendations made based on standardized categories.

Figure 18. Committee Recommendations by Category, NC Pregnancy-Related Deaths 2018-2021



Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

Using the standardized MMRIA committee determinations form, the MMRC also categorizes its recommendations into contributing factor groupings. These groupings allow for comparisons of the most common types of committee decisions and examination of trends in recommendation categories over time. As presented in **Table 2**, among the 764 recommendations made by the MMRC from 2018 through 2021, one in four (25%) MMRC recommendations focused on clinical skills and quality of care (n=192). Among the other leading MMRC recommendation categories were Knowledge (Lack of Knowledge Regarding Importance of Event or of Treatment or Follow-up), Lack of Access/Financial Resources, Lack of Standardized Policies/Procedures, and Lack of Continuity/ Coordination of Care.

Table 2. MMRC Recommendations by Contributing Factor & Year, NC Pregnancy-related Deaths 2018-2021

CONTRIBUTING FACTOR	YEAR				
	2018-21	2018	2019	2020	2021
Total	**764**	**176**	**224**	**195**	**169**
Clinical Skill/Quality of Care	192	40	46	58	48
Knowledge	117	17	28	36	36
Access/Financial	79	16	24	19	20
Policies/Procedures	57	18	17	12	10
Continuity of Care/Care Coordination	56	7	24	21	4
Delay	41	14	8	8	11
Assessment	31	6	11	7	7
Discrimination	29	8	8	6	7
Violence	27	11	14	2	0
Substance Use Disorder – Alcohol, Illicit/Prescription Drugs	22	8	12	0	2
Communication	19	6	5	3	5
Outreach	11	6	2	3	0
Referral	11	1	3	5	2
Cultural/Religious	10	2	4	4	0
Other	11	4	3	1	3
Adherence	9	2	0	3	4
Unstable Housing	7	1	3	2	1
Social Support/Isolation	7	1	4	1	1
Mental Health Conditions	6	0	1	2	3
Chronic Disease	6	2	3	0	1
Legal	6	2	1	1	2
Trauma	3	2	1	0	0
Environmental	2	0	0	1	1
Law Enforcement	2	2	0	0	0
Tobacco Use	1	0	0	0	1
Equipment/Technology	1	0	1	0	0
Structural Racism	1	0	1	0	0

Source: NCDHHS / Division of Public Health / Women, Infant and Community Wellness Section / Maternal Health Branch / NC Maternal Mortality Review Committee

MMRC RECOMMENDATIONS BY LEADING CAUSE OF DEATH

Note: The CDC's MMRIA system's five standardized categories are abbreviated as follows for each recommendation: S=System; F=Facility, P=Provider, C=Community, Pt/F= Patient/Family

Perinatal Care Region 1

MENTAL HEALTH CONDITIONS

- Obstetric providers should adhere to American College of Obstetricians and Gynecologist (ACOG) clinical guidelines, ensuring standardized screening for mental health, (Clinical Practice Guideline No 4) and substance use, (Committee Opinion No 711) occurs at every trimester and during the postpartum visit. (P)
- Obstetric providers should implement a policy to proactively offer naloxone to pregnant and postpartum patients – and their families – with a history of opioid use disorder or overdose. (P)
- Health care providers providing care for perinatal patients with substance use disorder should prioritize continuous Medication for Opioid Use Disorder, recognizing that discontinuing pharmacotherapy during pregnancy or within the first postpartum year severely elevates maternal overdose and relapse risks. (P)
- Emergency Department providers should implement a policy to proactively offer naloxone to pregnant and postpartum patients – and their families – with a history of opioid use disorder or overdose. (P)
- Inpatient and outpatient obstetric settings should prioritize integrating behavioral health and substance use specialists to facilitate immediate, same-day intervention by trained clinicians throughout the perinatal period. (F)
- Obstetric care protocols should ensure close-interval postpartum scheduling for individuals with documented substance use disorders and prompt follow up if the postpartum appointment is missed. (F)
- Carceral facilities should establish formalized protocols to guarantee the uninterrupted continuation of Medication for Opioid Use Disorder for pregnant individuals throughout incarceration. (F)
- North Carolina legislature should allocate additional resources to expand family-centered, inpatient substance use disorder treatment for pregnant and postpartum people, ensuring they can stay with their children during recovery. (S)
- North Carolina Department of Health and Human Services (NCDHHS) should launch a public health campaign in conjunction with the North Carolina Harm Reduction Coalition & trusted community partners to increase awareness of the statewide standing order for naloxone, ensuring residents know it is available at pharmacies without a personal prescription. (S)
- Health care systems should implement mandatory, coordinated, multimodal pain management protocols for pregnant patients with substance use disorders undergoing cesarean surgery, aligning with established best practice guidelines. (S)

CARDIOVASCULAR CONDITIONS

- Emergency Medical Services (EMS) providers should suspect potential cardiac conditions in postpartum patients, obtain an electrocardiogram (EKG), and provide early notification to the receiving emergency department. (P)
- Providers, hospitals, and community systems should ensure comprehensive education for patients, families, and staff regarding Association of Women's Health, Obstetric and Neonatal Nursing (AWHONN) post-birth warning signs to facilitate prompt response. (P)(S)
- Health care providers should ensure continuity of evidence-based, high-quality care for pregnant and postpartum individuals, regardless of pandemic-related services. (P)
- Health care systems should perform an autopsy on unexpected deaths of pregnant or recently pregnant patients, with family consent, to determine the exact cause of death. (S)
- Professional organizations should establish standardized clinical protocols for monitoring and managing the cardiovascular effects of stimulant use throughout the perinatal and postpartum periods. (S)
- Public health agencies should collaborate with trusted community partners to implement educational initiatives focused on the risks associated with chronic stimulant use. (C)

Perinatal Region 2

MENTAL HEALTH

- Obstetric providers should adhere to ACOG clinical guidelines, ensuring standardized screening for mental health, (Clinical Practice Guideline No. 4) and substance use, (Committee Opinion No. 711) occurs at every trimester and during the postpartum visit (P)
- Obstetric providers should implement a policy to proactively offer naloxone to pregnant and postpartum patients – and their families – with a history of opioid use disorder or overdose. (P)
- Facilities providing treatment for substance use disorders for perinatal patients should ensure comprehensive assessment and verified access to evidence-based treatment throughout pregnancy and postpartum. (F)
- Inpatient and outpatient obstetric settings should prioritize integrating behavioral health and substance use specialists to facilitate immediate, same-day intervention by trained clinicians throughout the perinatal period.
- Health care systems should implement mandatory, coordinated, multimodal pain management protocols for pregnant patients with substance use disorders undergoing cesarean sections, aligning with established best practice guidelines. (S)
- North Carolina legislature should allocate additional resources to expand family-centered, inpatient substance use disorder treatment facilities for pregnant and postpartum women, ensuring they can stay with their children during recovery. (S)
- North Carolina DHHS should launch a public health campaign in conjunction with the North Carolina Harm Reduction Coalition & trusted community partners to increase awareness of the statewide standing order for naloxone, ensuring residents know it is available at pharmacies without a personal prescription. (S)

INFECTION

- Providers should ensure rapid transfer of pregnant and postpartum patients with COVID-19 to the Intensive Care Unit (ICU) if they develop significant respiratory distress. (P)
- Providers must ensure pregnant and postpartum COVID-19 patients have immediate access to all necessary medical interventions, including Extracorporeal Membrane Oxygenation (ECMO), or rapidly transfer them to a specialized tertiary care facility. (P)
- Birthing facilities should adopt evidence-based practices outlined in the Alliance for Innovation on Maternal Health (AIM) Safe Reduction of Primary Cesarean Birth Bundle to optimize maternal outcomes and reduce first-time cesarean births. (F)
- Facilities offering labor and delivery services should implement dedicated, specialized sepsis teams for pregnant patients who meet the criteria. (F)
- Community organizations and health care providers should collaborate to offer subsidized child care and transportation services, ensuring individuals can attend essential medical visits throughout pregnancy and the first postpartum year. (S)
- Public health agencies and institutions should establish strategic partnerships with social media networks to disseminate corroborated, evidence-based data, particularly during emergencies. (S)
- Health care systems and providers should adopt sepsis protocols that align with AIM bundles for best practices. (S)
- North Carolina DHHS and national health organizations should be provided adequate funding to support social and traditional media campaigns of evidence based and factual health information during public health emergencies. (S)
- North Carolina policymakers and insurers should collaborate to fund and equip hospitals with essential resources for maternity care. (S)

INJURY (HOMICIDES AND SUICIDES)

- Obstetric providers should integrate postpartum care planning into prenatal visits and facilitate a direct, coordinated transition to the patient's primary care provider following the comprehensive postpartum check. (P)
- Public health initiatives should prioritize intimate partner violence outreach by expanding the dissemination of resources in secure, accessible public locations by utilizing discreet tools, such as QR codes, to ensure survivors can safely and privately access support services. (S)
- North Carolina General Assembly should fund public health initiatives that prioritize intimate partner violence outreach by providing discreet, QR-code resources in secure public locations, allowing survivors to safely and privately access vital support services. (S)
- Federal agencies should ensure ongoing funding to research and implement best practices for intimate partner violence screening, covering frequency, timing, and type from pregnancy to late postpartum. (S)
- Professional organizations should create standardized, evidence-based guidelines for primary care, outlining best practices for postpartum visit schedules, routine screenings, and comprehensive health assessments, including intimate partner violence. (S)

Perinatal Care Region 3

MENTAL HEALTH

- Health care providers should provide or facilitate referrals for pregnant and postpartum patients to evidence-based Medications for Opioid Use Disorder combined with behavioral counseling. (P)
- Obstetric providers should implement a policy to proactively offer naloxone to pregnant and postpartum patients – and their families – with a history of opioid use disorder or overdose. (P)
- Obstetric care protocols should ensure close-interval postpartum scheduling for individuals with documented substance use disorders and prompt follow up if the postpartum appointment is missed. (P)
- Health care providers should implement structured protocols to ensure prompt referral, continuous monitoring, and thorough follow-up for perinatal patients with active mental health conditions. (P)
- Obstetric providers, community advocates, and respected local leaders should develop a collaborative framework to educate expectant patients on effective, evidence-based treatment options for substance use disorders. (P)
- Inpatient and outpatient obstetric settings should prioritize integrating behavioral health and substance use specialists to facilitate immediate, same-day intervention by trained clinicians throughout the perinatal period. (F)
- Health care systems should develop standardized, multimodal pain management guidelines for cesarean deliveries in patients with substance use disorders which align with evidence-based best practices. (F)

HEMORRHAGE

- Obstetric practitioners should adopt a proactive strategy in the monitoring and management of postpartum hemorrhage secondary to uterine atony, up to and including hysterectomy. (P)
- Health care providers should use ACOG evidence-based practices to improve obstetric hemorrhage outcomes. (P)
- All health care providers should be aware of and evaluate the potential of an ectopic pregnancy when an individual presents with 1st trimester bleeding. (P)

Perinatal Care Region 4

INFECTION

- Obstetricians and other maternal care providers should routinely educate pregnant patients on COVID-19 immunization and provide on-site vaccine administration. (P)
- Providers should ensure rapid transfer for pregnant and postpartum patients with COVID-19 to the ICU if they develop significant respiratory distress. (P)
- Providers must ensure pregnant and postpartum COVID-19 patients have immediate access to all necessary medical interventions, including ECMO, or rapidly transfer them to a specialized tertiary care facility. (P)
- All sites providing vaccinations should ensure that vaccine safety materials for pregnant patients are available in all required languages. (F)

- Trusted community partners and public health should develop and disseminate information regarding the safety of COVID 19 vaccines during pregnancy to improve public understanding and trust. (C)
- State and local public health agencies should integrate trusted community organizations and leaders into emergency communication frameworks to enhance information dissemination and public trust. (S)

HEMORRHAGE

- Obstetric clinical teams should maintain a high level of readiness for surgical intervention when initial medical management fails to control postpartum bleeding per ACOG Bulletin No. 183. (P)
- Obstetric providers should possess the expertise to recognize cesarean surgical complications and secure immediate specialist consultation throughout postoperative recovery if needed. (P)

CARDIOVASCULAR CONDITIONS

- All health care professionals managing pregnancy should be proficient in and apply ACOG Practice Bulletins No. 222 and 203 on hypertension. (P)
- Health care providers should ensure that patients with complex cardiovascular disease deliver at tertiary care centers equipped with multidisciplinary cardio-obstetric teams to effectively manage potential acute cardiac decompensation. (P)
- Health care systems should implement automated warning flags within electronic health records to identify hypertensive disorders of pregnancy, seamlessly integrated with direct access to ACOG Practice Bulletins Nos. 222 and 203 to guide optimal delivery timing. (S)

Perinatal Region 5

MENTAL HEALTH

- Obstetric providers should implement a policy to proactively offer naloxone to pregnant and postpartum patients – and their families – with a history of opioid use disorder or overdose. (P)
- Obstetric providers should adhere to ACOG clinical guidelines, ensuring standardized screening for mental health, (Clinical Practice Guideline No. 4) and substance use, (Committee Opinion No. 711) occurs at every trimester and during the postpartum visit (P)
- EMS should transport patients needing advanced life support or resuscitation to the Emergency Department for more clinically appropriate resuscitative measures. (P)
- North Carolina DHHS should launch a public health campaign to increase awareness of the statewide standing order for naloxone, ensuring residents know it is available at pharmacies without a personal prescription. (S)
- Carceral facilities should establish formalized protocols to guarantee the uninterrupted continuation of Medication for Opioid Use Disorder for pregnant individuals throughout incarceration. (S)
- For nonviolent offenses, the justice system should allow pregnant individuals to complete substance use treatment rather than placing them in jail. (S)
- Health care and legal systems must be educated that involuntary commitment is not an appropriate response to prenatal substance use. (S)

INJURY (HOMICIDES AND SUICIDES)

- Health care providers should implement standardized Intimate Partner Violence screening protocols during prenatal and postpartum care, as recommended by ACOG Committee Opinion No. 518. (P)
- Providers and facilities should prioritize intimate partner violence outreach by expanding the dissemination of resources in secure, accessible locations by utilizing discreet tools, such as QR codes, to ensure survivors can safely and privately access support services. (S)
- Community support services should provide ongoing community outreach and education to include written materials, webinars, trainings, community events and a method of participation in a multidisciplinary taskforce addressing Intimate Partner Violence. (C)
- Public Health should partner with local support networks to launch a continuous public health initiative on Intimate Partner Violence, ensuring residents remain aware of available resources. (S)

Perinatal Care Region 6

HYPERTENSIVE DISORDERS

- Emergency Department providers should be proficient in and apply ACOG's Practice Bulletins Nos. 222 and 203 on hypertension. (P)
- Hospitals should include emergency department providers in federally mandated drills and simulations to maintain continuous awareness and training for pregnancy and postpartum hypertensive crises. (S)
- Hospital systems should establish clinical guidelines and safety bundles for severe hypertension and pulmonary edema in pregnancy and postpartum, including mandated staff training on these protocols and using electronic health record alerts to prompt immediate treatment. (S)
- Communities, stakeholders, state and federal public health entities should provide awareness of severe maternal warning signs and symptoms to all pregnant and postpartum individuals and their families on an ongoing basis. (C)

MENTAL HEALTH

- Obstetric providers should adhere to ACOG clinical guidelines, ensuring standardized screening for mental health, (Clinical Practice Guideline No. 4) and substance use, (Committee Opinion No. 711) occurs at every trimester and during the postpartum visit. (P)
- Providers who prescribe narcotics should follow appropriate protocols for managing post-surgical pain for patients who take medications for opioid use disorder throughout pregnancy and 12 months postpartum. (P)
- Health care providers providing care for perinatal patients with substance use disorders should prioritize continuous Medication for Opioid Use Disorder, recognizing that discontinuing pharmacotherapy during pregnancy or within the first postpartum year severely elevates maternal overdose and relapse risks. (P)
- Obstetric practices should establish clear protocols to track and follow up with pregnant patients who miss psychiatric appointments, ensuring seamless care coordination. (F)

- Pregnancy care management for at-risk pregnancies should provide close follow up when there are concerns about possible mood disorders, substance use and/or Child Protective Service involvement and continue their services through 12 weeks postpartum. (S)
- Federal, State and Local government should ensure all people have access to safe & affordable housing and health care services through the lifespan. (S)

APPENDIX

Pregnancy-Associated Death Case Identification

In North Carolina, pregnancy-associated deaths are identified through multiple data sources including Vital Statistics linkages, literal cause(s) of death recorded on death certificates, diagnoses recorded on hospital discharge and emergency department data, and pregnancy checkbox information on the death certificate. This is consistent with methods outlined by the Centers for Disease Control and Prevention.9 Deaths occurring during pregnancy or within one year of the end of the pregnancy MMRC case files. For Vital Records linkages, death certificate data for women ages 10 to 60 are matched with birth and fetal death certificate data using the CDC's "LinkPlus" data linkage software.[10]

Manual review is conducted for all Vital Records linkages to ensure accuracy. Literal causes of death are also queried for key words indicative of pregnancy-related causes, such as peripartum, pregnancy, ectopic, eclampsia, and uterine rupture. Inpatient hospital discharge and emergency department records are also reviewed to identify pregnancy-related diagnostic codes with a discharge status of deceased. The pregnancy checkbox was added to the North Carolina death certificate beginning with 2014 deaths. Due to known issues with the reliability of information reported in the pregnancy checkbox, maternal deaths identified through the pregnancy checkbox alone are confirmed either through examining the literal cause(s) of death, evaluating confirmatory sources such as inpatient hospital or emergency department records, obituaries, social media, news reports, and/or pregnancy confirmation from the medical certifier listed on the death certificate.[11] Cases that are unable to be confirmed are flagged for abstractor confirmation using medical records.

To verify the completeness of pregnancy-associated death identification, additional enhanced case ascertainment was conducted for 2018-2021 deaths through collaboration with the North Carolina Violent Death Reporting System (NC-VDRS) and the State Unintentional Drug Overdose Reporting System (SUDORS).[12] The NC-VDRS and SUDORS are injury surveillance systems that capture information from multiple sources, including medical examiner/coroner and toxicology reports. In some instances, information regarding pregnancy status that is not available via traditional MMRC case ascertainment is found in these systems. Through linkage with NC-VDRS and SUDORS systems, six additional pregnancy-associated deaths from 2018-2021 were confirmed and underwent committee review.

Case Abstraction

After initial pregnancy-associated deaths are identified and verified, relevant medical, behavioral health, legal and social media information is gathered and compiled into a detailed de-identified narrative by the abstraction team, consisting of a Nurse and Licensed Clinical Social Worker, for MMRC review. Abstractors utilize the MMRIA database to store abstraction information. The MMRIA system provides a standardized method for collecting information from the death certificate, birth certificate, fetal death certificate, autopsy report, prenatal care record, behavior health record, emergency department records and others. Social and environmental information is also included.

Case Review Process

In comparison to the 2014-2016 MMRC report, the 2018-2021 report reflects significantly more pregnancy-related deaths related to mental health conditions and accidents resulting from the Committee's adoption of new guidelines.[13,14] Beginning with review of 2018 cases, the MMRC began conducting reviews for suicide and accidental drug overdose deaths. North Carolina's participation in the CDC's Rapid Maternal Overdose Review (RMOR) project also informed the decision to review overdose cases using an enhanced and consistent process for determining pregnancy-relatedness.[14,15]

Citations

1. North Carolina Legislature, § 130A-33.60. *Maternal Mortality Review Committee; membership, compensation.* Available at: https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/BySection/Chapter_130A/GS_130A-33.60.pdf
2. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. *Maternal mortality review committee decisions form reference guide for pregnancy-associated death identification.* (May 2025). Available at: https://www.cdc.gov/maternal-mortality/php/mmrc/reference-guide.html
3. Centers for Disease Control & Prevention (CDC). *About Maternal Mortality Review Committees* (May 15, 2024). Available at: https://www.cdc.gov/maternal-mortality/php/mmrc/index.html#cdc_generic_section_4-six-key-decisions
4. Buescher PA. NCDHHS, State Center for Health Statistics (SCHS). *Statistical Primer No. 12: Problems with Rates Based on Small Numbers.* August 2008. Available at: https://digital.ncdcr.gov/Documents/Detail/problems-with-rates-based-on-small-numbers/3281121
5. North Carolina Department of Health and Human Services, Division of Public Health. State Center for Health Statistics (SCHS). *North Carolina Resident Live Births by Risk Factors and Characteristics.* Available at: https://schs.dph.ncdhhs.gov/data/vital.cfm
6. American College of Obstetricians and Gynecologists. *Policy Priorities: Extend Postpartum Medicaid Coverage.* https://www.acog.org/advocacy/policy-priorities/extend-postpartum-medicaid-coverage

7. American Public Health Association. *Expanding Medicaid coverage for birthing people to one year postpartum. Policy Brief.* October 25, 2021; No. LB21-02. Available at: https://www.apha.org/policy-and-advocacy/public-health-policy-briefs/policy-database/2022/01/07/expanding-medicaid-coverage-for-birthing-people-to-one-year-postpartum
8. North Carolina Department of Health and Human Services. *NCDHHS Press Release: Postpartum Coverage Extended to 12 Months for NC Medicaid Beneficiaries Beginning April 1.* March 31, 2022. Available at: https://www.ncdhhs.gov/news/press-releases/2022/03/31/postpartum-coverage-extended-12-months-nc-medicaid-beneficiaries-beginning-april-1
9. U.S. Department of Health and Human Services, Centers for Disease Control & Prevention (CDC). *Reference Guide for Pregnancy-Associated Death Identification.* May 15, 2024. Available at: https://www.cdc.gov/maternal-mortality/php/mmrc/reference-guide.html
10. U.S. Department of Health and Human Services, Centers for Disease Control & Prevention (CDC), National Program of Cancer Registries. *Link Plus.* November 8, 2024. Available at: cdc.gov/national-program-cancer-registries/registry-plus/link-plus.html
11. Catalano A, Davis NL, Petersen EE, Harrison C, Kieltyka L, You M, Conrey E J, Ewing AC, Callaghan WM, & Goodman DA (2020). Pregnant? Validity of the pregnancy checkbox on death certificates in four states, and characteristics associated with pregnancy checkbox errors. *American Journal of Obstetrics and Gynecology.* 222(3), 269.e1–269.e8. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7056489/pdf/nihms-1065592.pdf
12. Austin AE, Naumann RB, DiPrete BL, Geary S, Proescholdbell SK, Jones-Vessey KA. (2024). Pregnancy-associated homicide, suicide and unintentional opioid-involved overdose deaths, North Carolina 2018-2019. *Injury Prevention,* 30(5), 393-399. Available at: https://pubmed.ncbi.nlm.nih.gov/38195655/
13. North Carolina Department of Health and Human Services, Women, Infant, & Community Wellness Section (WICWS), Maternal Health Branch, NC Maternal Mortality Review Committee (MMRC). *North Carolina Maternal Mortality Review Report: 2014-2016.* (December 2021). Available at: https://wicws.dph.ncdhhs.gov/docs/2014-16-MMRCReport_web.pdf
14. Smid MC, Maeda J, Stone NM, Sylvester H, Baksh L, Debbink M P, Varner M W, Metz T D. Standardized criteria for review of perinatal suicides and accidental drug-related deaths. *Obstetrics & Gynecology.* 2020; 136(4), 645–653. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC8086704/pdf/nihms-1690686.pdf
15. Quick-Graham L, Jones B, Moore-Patterson R, Sheffield-Abdullah K. A closer look at preventable pregnancy-associated deaths due to opioid overdose in North Carolina. *North Carolina Medical Journal*, 2023; 84(1). Available at: https://ncmedicaljournal.com/article/67782-a-closer-look-at-preventable-pregnancy-associated-deaths-due-to-opioid-overdose-in-north-carolina



NC DEPARTMENT OF
HEALTH AND
HUMAN SERVICES
Division of Public Health

dph.ncdhhs.gov

Women, Infant and Community Wellness Section • Maternal Health Branch •
NCDHHS is an equal opportunity employer and provider. • 10/2026