Pregnancy-Associated Mortality

in New York City, 2016-2020

Maternal Mortality Review Committee

NYC Health

This report includes independent determinations and recommendations from the MMRC, which may not represent the official views of the New York City Health Department.

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This report is dedicated to the 241 women and birthing people who lost their life to a maternal death between 2016 and 2020 and to the families and friends they left behind. It is written in the hope that the recommendations developed by the Maternal Mortality Review Committee will be a blueprint for change and that stakeholders from across sectors — from hospitals to community groups — will work together to implement the report recommendations.

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Dear Fellow New Yorkers,

Pregnancy, birth and the first months of a child's life should be a time of joy; however, for too many New Yorkers, it becomes a time for grieving a maternal death. While these tragic losses are rare, they are disproportionately experienced by Black, non-Hispanic women and birthing people across our city.

Since 2001, the New York City Health Department has been conducting surveillance and producing five-year pregnancy-associated mortality reports. Understanding that many of these deaths are preventable, in January 2018, the Health Department established the Maternal Morality Review Committee (MMRC) to conduct multidisciplinary reviews of all pregnancy-associated deaths in New York City, starting with deaths occurring in 2016. Since then, the MMRC has comprised a total of 81 diverse, multidisciplinary, accomplished and passionate members, including community activists, doulas, midwives, nurses, maternal-fetal medicine specialists, cardiologists, oncologists, psychiatrists, ob-gyns, first responders, and human rights and reproductive justice advocates.

In this 2016-2020 report, the Health Department data show that 241 pregnancy-associated deaths occurred in New York City. Of these deaths, 43.6% were among Black non-Hispanic women and birthing people. The data also show that Black non-Hispanic women and birthing people were four times more likely to die of a pregnancy-associated cause and six times more likely to experience a pregnancy-related death when compared with white non-Hispanic women and birthing people. The 2020 data also reflect the effect of the COVID-19 pandemic on the experiences of women and birthing people by exacerbating preexisting disparities in the American health care system.

The report is organized into four sections: (1) data summary and MMRC recommendations, (2) details on pregnancy-associated deaths (deaths during or within one year of pregnancy from any cause), (3) details on pregnancy-related deaths (deaths from a pregnancy complication, a chain of events initiated by the pregnancy or the aggravation of an unrelated condition by the physiologic effects of the pregnancy), and (4) committee determinations about these deaths. Through deep analysis of available Health Department data, the MMRC uses its findings to develop recommendations to prevent maternal deaths. Those recommendations are presented in this most recent report.

In late 2023, the Health Department launched HealthyNYC, a campaign to increase life expectancy to 83 years by 2030. This campaign includes a goal of reducing pregnancy-associated mortality among Black women by 10% by 2030. The MMRC recommendations are a blueprint for action needed by all New York stakeholders, embodying a path we must take collectively to make a measurable difference with the hope of achieving this goal.

While the maternal mortality numbers alone are staggering, the toll of this crisis must also be measured in those left behind. The devastated families and communities left in the wake of these often-preventable tragedies, as well as the women and birthing people who needlessly lost their lives, are the cornerstone of the MMRC's relentless push for change. We do this work for them and for all New Yorkers.

Sincerely,

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Executive Summary

Each year in NYC, between 50 and 60 women and birthing people lose their life during pregnancy or within one year from the end of pregnancy. The loss of every woman and birthing person is a tragedy. These deaths are devastating to families, leaving children without parents and communities without beloved friends.

In this report we provide information on **pregnancy-associated** and **pregnancy-related** deaths. Pregnancy-associated deaths are those from any cause during pregnancy or within one year from the end of pregnancy, regardless of the outcome of the pregnancy. Pregnancy-related deaths, a subset of pregnancy-associated deaths, are deaths that occur during pregnancy or within one year from the end of pregnancy that are caused by a pregnancy complication, a chain of events initiated by pregnancy or the aggravation of an unrelated condition by the pregnancy.

In NYC, the pregnancy-associated mortality ratio (PAMR) has remained steady since 2001, but unfair, unjust and avoidable inequities persist. In 2016-2020, there were 241 pregnancy-associated deaths in NYC. Of these, 105 (43.6%) were among Black non-Hispanic women and birthing people, who were four times more likely to die of a pregnancy-associated cause compared with white non-Hispanic women and birthing people. Of the subset of 114 pregnancy-related deaths from the same period, 54 (47.4%) were to Black non-Hispanic women and birthing people. Compared with their white counterparts, Black non-Hispanic women and birthing people were six times more likely to die a pregnancy-related death in 2016-2020, and eight times more likely to die a pregnancy-related death on average over the past twenty years.

Racism — not race — drives these disparities. Structural racism — the ways in which society fosters racial discrimination through mutually reinforcing systems of oppression — is at the heart of health inequity in the U.S.[1] Maternal health inequities are no exception.[2] NYC has one of the highest rates of residential segregation[3] and income inequality[4] in the country. Historic and current intentional underinvestment in neighborhoods where Black non-Hispanic women and birthing people live limits residents' access to high-quality[5] health care and social services, healthy foods, and other resources critical to good health and positive pregnancy outcomes. Chronic stressors, such as interpersonal racism, weather the bodies of Black non-Hispanic women and birthing people[6] earlier compared with

[1] Bailey ZD, Kriefer N, Agénor M, Graves J, Linos N, Bassett MT. Structural racism and health inequities in the USA: evidence and interventions. *Lancet*. 2017;389(10077):1453-1463. doi:**10.1016/S0140-6736(17)30569-X**

[2] Liu SY, Fiorentini C, Bailey Z, Huynh M, McVeigh K, Kaplan D. Structural racism and severe maternal morbidity in New York State. *Clin Med Insights Womens Healt*h. 12:1-8. doi:**10.1177/1179562X19854778**

[3] Othering & Belonging Institute; University of California, Berkeley. Most to least segregated cities in 2020. Viewed August 2, 2024. **https://belonging.berkeley.edu/most-least-segregated-cities-in-2020**

[4] Fiscal Policy Institute. Inequality in New York and options for progressive tax reform: a statistical overview of the state's economic inequality and its implications for tax policy. November 10, 2022. Viewed August 2, 2024. **https://fiscalpolicy.org/wp-content/uploads/2022/11/Inequality-and-Tax-Reform_Final-1.pdf**

[5] Tucker MJ, Berg CJ, Callaghan WM, Hsia J. The Black-white disparity in pregnancy-related mortality from 5 conditions: differences in prevalence and case-fatality rates. *Am J Public Health*. 2007;97:247-251. doi:**10.2105/AJPH.2005.072975**

[6] Geronimus AT. The weathering hypothesis and the health of African-American women and infants: evidence and speculations. *Ethn Dis*. 1992;2(3):207-221. PMID:**1467758**

white non-Hispanic women and birthing people, contributing to poorer health outcomes.[7] In addition, anti-Blackness in health care manifests in Black non-Hispanic women and birthing people not being listened to or having their concerns dismissed or downplayed, making it difficult to establish trusting relationships with clinicians within health care systems and resulting in less healthy lives overall and less positive pregnancy outcomes in particular.[8]

In January 2018, in response to these unjust and preventable inequities, the NYC Department of Health and Mental Hygiene (NYC Health Department) convened the NYC Maternal Mortality Review Committee (MMRC, or the Committee) to conduct multidisciplinary reviews of all pregnancy-associated deaths among New York State (NYS) residents who died in New York City, starting with deaths that occurred in 2016. The NYC Health Department uses standards and protocols developed by the CDC and used in 46 other states and jurisdictions. The NYS Department of Health (NYSDOH) also adopted this same methodology to convene a second MMRC that reviews deaths of NYS residents who die in-state outside of NYC, starting with 2018 deaths. The NYC Health Department shares the NYC data with the NYSDOH, which also produces statewide reports.

The NYC MMRC conducts a thorough review of all pregnancy-associated deaths to determine (1) preventability, (2) underlying cause of death, (3) contributing factors to death and (4) specific recommendations for action to prevent future deaths. This report presents the NYC pregnancy-associated mortality data and recommendations from the NYC MMRC's review of the 241 maternal deaths in NYC in 2016-2020. Key findings include:

- In 2016-2020, the pregnancy-associated mortality ratio (PAMR) in NYC was 42.9 deaths per 100,000 live births, and the pregnancy-related mortality ratio (PRMR) was 20.3 deaths per 100,000 live births.
- In 2016-2020, Black non-Hispanic women and birthing people experienced a PAMR four times higher and a PRMR six times higher than white non-Hispanic women and birthing people.
- Overall, the MMRC determined that 62.7% of pregnancy-associated deaths and 74.6% of pregnancy-related deaths were preventable.
- Mental health conditions,[9] represented mainly by overdoses, emerged as the leading cause of pregnancy-associated deaths in 2016-2020, while hemorrhage was the leading cause of pregnancy-related deaths.[10]
- For Black non-Hispanic women and birthing people, the leading cause of pregnancy-associated death was cardiovascular conditions, followed by mental health conditions and embolism. For Black non-Hispanic women and birthing people, the leading cause of pregnancy-related death was cardiovascular conditions, followed by embolism and hemorrhage.

[7] Geronimus AT, Hicken M, Keene D, Bound J. "Weathering" and age patterns of allostatic load scores among Blacks and whites in the United States. *Am J Public Health*. 2006;96(5):826-833. doi:**10.2105/AJPH.2004.060749**

[8] Vedam S, Stoll K, Taiwo TK, et al. The Giving Voice to Mothers study: inequity and mistreatment during pregnancy and childbirth in the United States. *Reprod Health*. 2019;16. Article No. 77. doi:**10.1186/s12978-019-0729-2**

[9] For the deaths reviewed, mental health conditions include overdoses and suicide.

[10] See Appendix B, Table 21 on Page 99 for detailed cause of death codes and categorizations (Pregnancy Mortality Surveillance System maternal mortality cause of death list [PMSS]).

- Significant age and educational disparities in PAMRs were observed, revealing higher mortality among women and birthing people age 40 and older. The PAMR was significantly lower among women and birthing people with at least some college compared with those who had a high school or GED diploma.
- Geographic disparities existed. Staten Island and the Bronx had higher PAMRs compared with Manhattan. However, within specific community districts, the highest PAMRs were in Brownsville (146.9 deaths per 100,000 live births), Crown Heights (114.5) and Red Hook-Gowanus (113.2) in Brooklyn, and Rockaway-Broad Channel (113.6) in Queens.
- The MMRC began to assess discrimination[11] as a contributing factor to deaths starting in 2020. Discrimination determinations include forms such as racism, ableism, bias due to substance use and bias due to weight. Where discrimination was assessed (n=150 deaths), the Committee determined that discrimination contributed to 50.0% of all pregnancy-associated deaths.
- The MMRC determined that substance use disorder contributed to 18.3% of deaths and that mental health conditions other than substance use disorder contributed to 25.3% of deaths.
- Over 90% of pregnancy-associated deaths due to mental health conditions and hemorrhage were considered preventable by the MMRC.
- The top contributing factors across all 151 preventable deaths were clinical skill/quality of care and lack of continuity of care/care coordination.
- The top contributing factors across the six leading causes of preventable death were: mental health conditions — lack of continuity of care/care coordination; cardiovascular conditions — lack of continuity of care/care coordination; hemorrhage — clinical skill/quality of care; embolism — clinical skill/quality of care; pulmonary conditions — clinical skill/quality of care; infection — clinical skill/quality of care and continuity of care/care coordination.
- The MMRC prioritized 48 recommendations for all actors to address (36 from deaths that occurred in 2016-2020, plus 12 from deaths due to mental health conditions that occurred in 2021, included because of the magnitude of deaths and the urgency of addressing the epidemic). These recommendations are a blueprint for NYC to use to prevent future maternal deaths.

[11] Discrimination is defined as treating someone less or more favorably based on the group, class or category they belong to, resulting from biases, prejudices and stereotyping. The Committee included in their deliberations discussions of discrimination related to racism as well as other forms of discrimination such as ableism, and bias due to substance use or weight.

Recommendations (2016-2020)

The MMRC makes specific, actionable recommendations to prevent future maternal deaths based on a review of each death. Each year, these recommendations are reviewed and prioritized by MMRC members based on frequency, cause of death (prioritizing leading causes of death for Black women and birthing people), impact, and feasibility, and arranged according to level.[12] Covering the five-year period in 2016-2020, the below recommendations were prioritized by the Committee based on the above categories in its review of the 241 deaths.

System Level

Policymakers and Government

1. Provide universal health care for all people who reside in the U.S.
2. Assess the availability of walkable, affordable healthy food sources and safe spaces for physical activity and play for adults and children, and plan for ongoing maintenance.
3. Develop programs to diversify the clinical workforce to ensure culturally matched care that facilitates effective communication between patients and providers.
4. Standardize child welfare policies and implementation regarding mandated reporting of child abuse and neglect in the context of substance use, ensuring policies and implementation do not disproportionately impact people of color.
5. Prioritize pregnant women and birthing people experiencing mental illness, substance use disorder, or domestic or intimate partner violence for resources including greater access to safe, stable housing and home-based programs.
6. Establish and fund a network of maternal medical homes to coordinate postpartum care, with a focus on those with chronic conditions, mental health conditions and substance use disorder.
7. Prioritize funding to support community-based organizations serving non-English-speaking women and birthing people during and after pregnancy.

Regulatory Agencies and Professional Organizations

8. Fund and support NYC birthing hospitals to implement established bundles on preventing primary cesarean and increasing access to labor and vaginal birth after cesarean (VBAC).
9. Create a system to audit facilities for patterns of discrimination (for example, auditing descriptions in clinical records such as “noncompliant,” “combative,” “resistant,” “frequent flyer,” “refusing to cooperate”) and link facilities to training programs about patient-centered care and shared decision-making.
10. Include a mandatory checklist in the cardiac bundle with a clear pathway for transfer to higher level of care, regardless of insurance status.

[12] Definition of levels of recommendations: 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, 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 communities based on common interests and shared circumstances.

Insurers

11. Cover prenatal and one-year postpartum home visiting services as an essential benefit for all people, with a priority on those with chronic disease and mental illness.

Health Departments

12. Develop an education program, including anti-stigma training and training about racialized and class-based responses to behavioral health disorders, for clinicians who treat substance use or mental health disorders, addressing the comprehensive care needs of reproductive-age women and birthing people with substance use and mental health disorders.

13. Partner with professional organizations to implement a campaign to educate clinicians about the use and benefits of opioid agonist therapy in pregnancy and the risks of withdrawal for women and birthing people and their fetuses during and after pregnancy.

14. Partner with existing intimate partner violence advocates to develop a broad public health campaign on rights, actions and resources available to people experiencing domestic or intimate partner violence, ensuring that all hospitals and police precincts are reached with this information.

Hospital Systems

15. Ensure all birthing facilities and clinicians have universal access to prenatal records.

16. Provide annual training and simulation to all clinicians (including emergency medicine, critical care, anesthesiology and obstetric clinicians) treating pregnant or postpartum women and birthing people in the components of the American College of Obstetricians and Gynecologists' (ACOG) District II Safe Motherhood Initiative Obstetric Hemorrhage safety bundle,[13] and support and audit appropriate implementation.

17. Ensure there is a robust referral system in place for pregnant women and birthing people with complex chronic illnesses, with appropriate subspecialty doctors and nurses during pregnancy and interconception periods.

18. In collaboration with community partners, pilot a multitiered level complex obstetric rehabilitation program model — including telehealth, alternate care platforms and home visits — for pregnant women and birthing people with significant chronic disease at hospital discharge.

19. Train clinicians who treat people with mental health conditions and substance use disorder to ask about reproductive health needs and to evaluate and refer patients to preconception care.

Facility Level

Birthing Facilities

20. Implement midwifery care standards for all people giving birth.

21. Mandate training on patient-centered care for all clinicians.

22. Utilize maternal early warning signs protocols in all maternity care facilities.

[13] American College of Obstetricians and Gynecologists. Obstetric Hemorrhage Bundle. Viewed August 2, 2024. **https://www.acog.org/community/districts-and-sections/district-ii/programs-and-resources/safe-motherhood-initiative/obstetric-hemorrhage**

23. Implement ACOG recommendations on postpartum care, especially for people at high risk for poor outcomes.[14]
24. Develop a system of follow-up for missed appointments that includes exploring barriers to care and strategies to overcome barriers while respecting the agency of the person, with a priority focus on pregnant and postpartum women and birthing people with chronic illnesses.
25. Inpatient hospital teams should ensure that patients have access to critical medication and follow up to ensure they have support and access to medication after discharge.
26. Develop mechanisms to identify women and birthing people who have a pattern of repeat emergency department visits and offer them intensive care management and local referrals for social services.
27. Develop and enforce systems to audit outpatient records during wellness visits for pregnant and postpartum women and birthing people with high-risk conditions for complete assessment and treatment plans.
28. Provide counseling and guidance to all pregnant women and birthing people who seek alternatives to blood transfusion, including available alternatives and components of alternatives.
29. Create and distribute a dynamic referral list of financially accessible care centers for postpartum women and birthing people with mental health conditions and substance use disorder.

Provider Level

Clinicians

30. Verbally assess pregnant and parenting women and birthing people for mental health conditions, substance use disorder and domestic or intimate partner violence, and ensure that subsequent referrals to supportive services are made to avoid family separation whenever possible.
31. Prior to discharge, verbally screen all postpartum women and birthing people for mental health conditions and substance use disorder and refer those with a positive screen to a maternal medical home, and then follow up in a timely manner after discharge.
32. For oncologists, prioritize education about how to align reproductive life planning with cancer care.
33. For primary care clinicians and specialists treating chronic illness or mental health disorders, ensure that women and birthing people are connected to clinicians offering comprehensive reproductive health care services.

Community Level

Community-Based Organizations (Must Be Accompanied by Funding)

34. Raise awareness of all postpartum warning signs, with a focus on cardiovascular disease, postpartum depression and hypertension.
35. Create ongoing health information campaigns to educate the public on the long-term health effects of chronic illnesses in pregnancy and postpartum periods.
36. Creatively educate the public to destigmatize substance use and mental health disorders including among pregnant and postpartum people.

[14] American College of Obstetricians and Gynecologists. Optimizing postpartum care. ACOG Committee Opinion No. 736. Obstet Gynecol. 2018;131:e140-150. doi:**10.1097/AOG.0000000000002633**

Recommendations (Mental Health, 2021)

In January 2024, the Committee completed their review of the 58 pregnancy-associated deaths that occurred in 2021. Of these, 36.2% (21 deaths) were due to mental health conditions (20 overdoses, and one suicide). In 2016-2020, there were 34 overdose deaths. Because of the magnitude of these deaths, which mirrors citywide trends, and the urgency of addressing this epidemic, we are including the below 12 additional mental health recommendations from Committee review of 2021 deaths in this report. The full dataset and recommendations from review of the 2021 deaths will be included in the annual report "Pregnancy-Associated Mortality in New York City, 2021."

System Level

Policymakers and Government

1. Federal and state lawmakers should reform mandated-reporting laws for health care providers to prioritize support for families and minimize harm. NYS should immediately remove health care providers from the list of mandated reporters.
2. NYS government should immediately decriminalize all substance use and expand treatment and harm reduction services.
3. The Office of Children and Family Services (OCFS), in partnership with parents impacted by NYC Administration for Children's Services (ACS) involvement, should create clear transparent guidelines for ACS to use when assessing and responding to referrals involving women and birthing people. Guidelines should include a duty to consider and mitigate the impact of interventions on the health of parents and ensure that interventions are conducted in ways that best preserve opportunities for family reunification.
4. OCFS should direct ACS and hospital systems to stop the practice of notifying Child Protective Services (CPS) because of a history of CPS case or open CPS case at birth.
5. NYS governmental agencies should fund the creation of centers for parents, newborns and children, pregnant people, and postpartum people with mental health and substance use and misuse needs, or those without care for their children during and after childbirth, that begins with respite center care (independent of ACS) and segues into long-term supportive housing that includes customized, individual patient-specific evaluation, drug use or misuse treatment, and easy access to psychological care, as well as peer supports, parenting supports, and necessary resources.
6. NYS governmental agencies should invest resources in making free doula care, supportive housing, peer supports and community-based centers for harm reduction accessible to all women and birthing people, with a primary focus on those in historically and purposefully underserved communities, and provide financial incentives to hospitals to facilitate referrals for women and birthing people to organizations that can provide holistic support and resources for mental health, substance use and intimate partner violence (IPV).

Health Departments

7. The NYC Health Department should make naloxone kits available to hospitals, so providers can hand patients, family members or companions a naloxone kit upon discharge.
8. The NYC Health Department should share data on ACS involvement in pregnancy-associated deaths with City Council and the NYSDOH to support the creation of an oversight committee to investigate the connection between ACS involvement and maternal death and to explore avenues for legal accountability for harm to pregnant people and parents.

Hospital Systems

9. Hospital systems and government agencies should invest in community-based centers for support, including family counseling, for postpartum people experiencing mental health challenges and their families, and hospitals should refer to them.

Regulatory Agencies and Professional Organizations

10. ACOG, anesthesia societies, the American College of Nurse-Midwives, the Association of Women's Health, Obstetric and Neonatal Nurses, and substance use treatment organizations should provide specific guidance to providers as well as patient-facing educational materials on postpartum pain management for pregnant women and birthing people with substance use disorders.

Facility Level

11. All birthing facilities should ensure that perinatal care providers have adequate training and resources to recognize, refer and assess maternal mental health conditions, substance use disorders and IPV in the perinatal period that includes a plan of safe care.

Provider Level

12. Providers should follow recommendations of ACOG related to postpartum follow-up for high-risk pregnancies, including mental health and substance use disorder.

Overview of the Maternal Mortality Review Committee

The NYC MMRC conducts multidisciplinary reviews of all pregnancy-associated deaths among NYS residents who died in NYC. The NYSDOH runs a second committee that reviews deaths to NYS residents who died in-state outside NYC using the same methods. The NYC Health Department shares data with the NYSDOH for statewide reports.

The vision of the MMRC is to reduce preventable maternal mortality and severe maternal morbidity in NYC by targeting and eliminating inequities in these outcomes. The MMRC's work to advance racial equity is grounded in the core concepts of racial, social, sexual and reproductive justice. The mission of the MMRC is to gain a holistic understanding of the contributing factors that led to each maternal death and identify actionable recommendations to prevent future maternal deaths.

Members of the MMRC agree to:

- Embrace the vision and mission of the MMRC
- Maintain an anti-racist framework and participate in opportunities to learn
- Acknowledge the pervasive stress of racism and other forms of oppression, both historical and current, within communities of color as root causes of health inequities
- Consider peoples' journeys from a systemic perspective by examining whether there was a policy or practice at work that impacted their health and maintained inequity
- Uphold the premise that every person has a human right to respectful, safe and quality care
- Consider the social determinants of health (for example, racism, housing, employment, education) as critical factors when reviewing cases and when making recommendations
- Practice respect for the person who died, their family, caregivers and fellow Committee members
- Share expertise, including lived experience, and learn from and respect that of fellow Committee members

MMRC members serve two-year terms. In 2016-2020, 81 people served as Committee members. Fifty-seven percent had clinical expertise and 43% were nonclinical. Thirty-five percent identified as Black non-Hispanic and 10% as Hispanic, the two groups with the highest rates of maternal mortality. Members were a diverse, multidisciplinary group representing a wide range of expertise, including community activists, doulas, midwives, nurses, maternal-fetal medicine specialists, cardiologists, oncologists, psychiatrists, ob-gyns, first responders, and human rights and reproductive justice advocates.

Cases from a one-year cohort are reviewed within two years of the death to allow sufficient time for case identification, including data linkage and cleaning, collection of medical and other relevant records, case adjudication for cases in the court system, case abstraction, and case review. This case identification and review process and timeline is the gold standard for maternal death review surveillance as established by the CDC, which the NYC Health Department is required to follow, along with all other 46 state and territorial committees funded by the CDC, as joint grantees of the Enhancing Reviews and Surveillance to Eliminate Maternal Mortality program.

The NYC Health Department's role in surveillance is distinct from the regulatory role over hospitals held by the NYSDOH. All hospitals must report adverse events, including maternal deaths, in real time to the NYSDOH through the New York Patient Occurrence Reporting and Tracking System (NYPORTS), which is tasked with hospital oversight. The NYC Health Department and MMRC did not have access to the NYPORTS database and do not have regulatory authority over hospitals.

Methodology

The Bureau of Maternal, Infant and Reproductive Health in the Division of Family and Child Health at the NYC Health Department is responsible for ongoing surveillance of pregnancy-associated deaths in NYC in close collaboration with the Bureau of Vital Statistics and the Office of Chief Medical Examiner (OCME). The methodology for pregnancy-associated mortality surveillance in NYC was first described in "Active Surveillance of Maternal Mortality in New York City" (2002),[15] which continues to form the basis for our surveillance methods today.

Step 1: Identify Pregnancy-Associated Deaths

The Bureau of Maternal, Infant and Reproductive Health relies on multiple data sources to identify pregnancy-associated deaths in NYC. These sources include death certificates, vital records linkage data and hospital discharge data. For each case identified, the bureau requests an electronic copy of the person's death certificate along with any corresponding birth or fetal death certificates and all medical records from the hospitals and clinical facilities.

- **Death certificates** are searched by the Bureau of Vital Statistics for any person who died in NYC and was pregnant at the time of death or within one year before death, as identified by the pregnancy checkbox or select underlying causes of death (ICD codes O00-O99 and A34).
- **Vital records linkage** is conducted by the Bureau of Vital Statistics by matching death certificates of women and birthing people age 12 to 60 who died in NYC to determine if a birth or fetal death certificate was issued to that person in the year before their death.
- **Hospital discharge data** is sourced from the NYSDOH Statewide Planning and Research Cooperative System (SPARCS), which records all inpatient hospital discharges in New York. Researchers from the NYSDOH use this data to identify people age 12 to 60 who had a pregnancy-related hospitalization and subsequently died. The identification process relies on ICD diagnosis and procedure codes to identify deaths associated with pregnancy complications. Any maternal deaths that may have been missed by NYC vital records linkage data are reported to NYC by NYS.

Step 2: Create a Narrative of Each Death

Prior to Committee meetings, medical abstractors develop a case narrative for each maternal death using vital records, autopsy reports, hospital records, and outpatient medical and psychosocial records. Narratives are typically five to six pages and include a summary of the death, description and history of the person's death, and information on prenatal care, childbirth, and events of the death.

[15] Pallin DJ, Sundaram V, Laraque F, Berenson L, Schomberg DR. Active surveillance of maternal mortality in New York City. *Am J Public Health*. 2002;92(8):1319-1322. doi:**10.2105/ajph.92.8.1319**

Step 3: Review the Deaths by Committee

After reviewing case narratives in Committee meetings, the MMRC discusses each death and determines whether the death was causally related to pregnancy, the underlying cause of death, whether there was a chance to alter the outcome (preventability), key contributing factors to the death and specific, feasible recommendations for actions that should be taken to prevent future deaths.

Step 4: Enter the Information Into a Database

After the Committee meetings, the operations team enters all Committee decision information into a database that is shared with NYSDOH. The NYC Health Department and NYSDOH issue reports with recommendations for action.

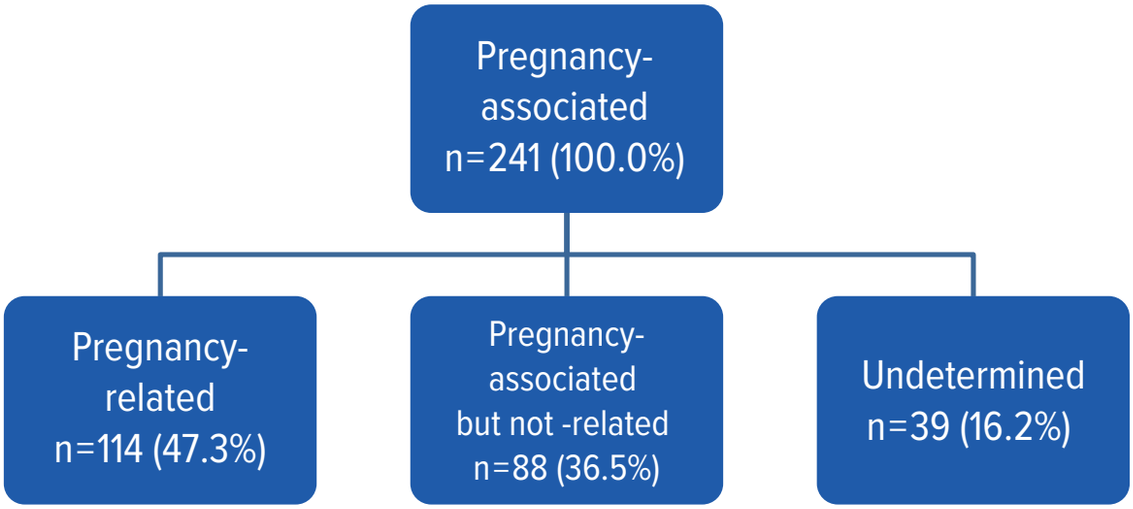
Definitions

- **Pregnancy-associated death:** Death of a woman or birthing person from any cause during pregnancy or within one year from the end of pregnancy, regardless of the outcome of the pregnancy. Pregnancy-associated deaths are further categorized into three subsets based on whether they are causally related to the pregnancy.
    - **Pregnancy-related death:** Death of a woman or birthing person during pregnancy or within one year from the end of pregnancy that is caused by a pregnancy complication, a chain of events initiated by pregnancy or the aggravation of an unrelated condition by the physiological effects of pregnancy.
    - **Pregnancy-associated but not -related death:** Death of a woman or birthing person during pregnancy or within one year from the end of pregnancy due to a cause not related to the pregnancy.
    - **Pregnancy-associated but unable to determine pregnancy-relatedness:** A death of a woman or birthing person while pregnant or within one year of pregnancy, due to a cause that could not be determined to be pregnancy-related or not pregnancy-related.
- **Pregnancy-associated mortality ratio (PAMR)[16]:** Number of pregnancy-associated deaths per 100,000 live births. This ratio is typically higher than the PRMR (see below) because it includes both pregnancy-related and non-pregnancy-related deaths.
- **Pregnancy-related mortality ratio (PRMR):** Number of pregnancy-related deaths per 100,000 live births.
- **Maternal death (also known as maternal mortality):** Traditionally defined as a death of a woman or birthing person while pregnant or within 42 days from the end of pregnancy from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes. This definition meets the World Health Organization definition of maternal mortality and is identified from cause of death codes on death certificates alone, which are subject to misclassification and underreporting. The term is often used colloquially and interchangeably with pregnancy-related deaths.

[16] The number of live births used in the denominator is an approximation of the population of pregnant women and birthing people who are at risk of a maternal death. Therefore, we define this measure as ratio. It has been referred to as rate as an equivalent measure by other researchers.

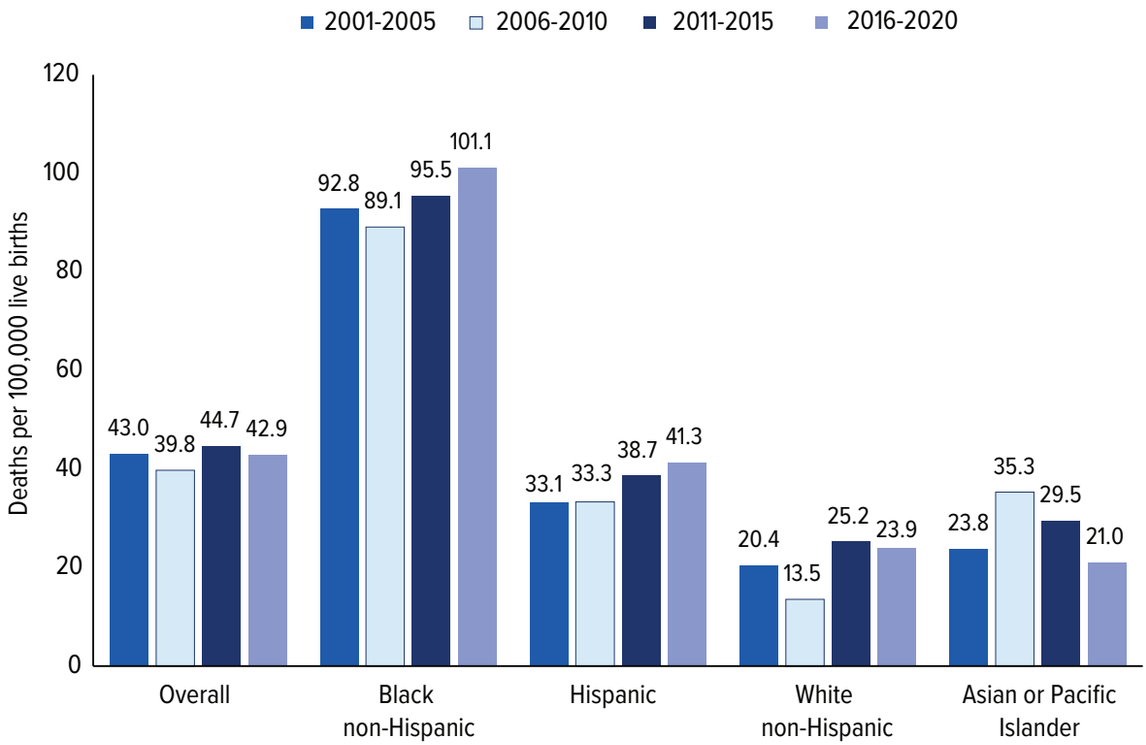
Trends

Figure 1. Classification of Pregnancy-Associated Deaths in NYC, 2016-2020



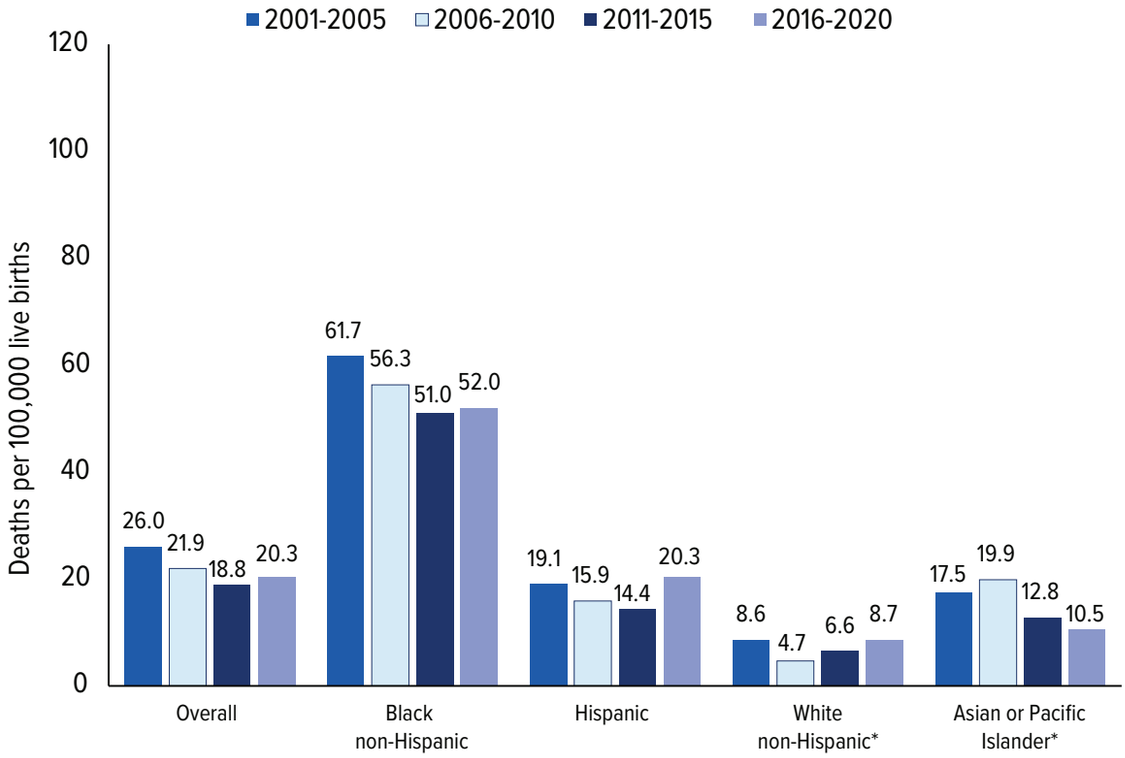
- In 2016-2020, there were a total of 241 pregnancy-associated deaths in NYC. Of these, 114 (47.3%) were pregnancy-related and 88 (36.5%) were pregnancy-associated but not -related. There were 39 deaths where the relationship between pregnancy and death could not be determined.

Figure 2. Five-Year Pregnancy-Associated Mortality Ratio by Maternal Race and Ethnicity, NYC, 2001-2020



- In 2016-2020, the overall PAMR in NYC was 42.9 deaths per 100,000 live births.
- The overall PAMR in NYC showed fluctuations between 39.8 and 44.7 deaths per 100,000 live births across the four time periods (2001-2005, 2006-2010, 2011-2015 and 2016-2020). However, the differences were not statistically significant.
- There were fluctuations in PAMR within racial and ethnic groups, but none were statistically significant.
- Among racial and ethnic groups, Black non-Hispanic women and birthing people consistently had the highest PAMR compared with other groups across the four time periods.
- For the period 2016-2020, the PAMR for Black non-Hispanic women and birthing people (101.1 deaths per 100,000 live births) was four times higher than that for white non-Hispanic women and birthing people (23.9). In earlier periods (2001-2005, 2006-2010 and 2011-2015), the disparities were five times (92.8 vs. 20.4), seven times (89.1 vs. 13.5) and four times (95.5 vs. 25.2), respectively.
- Hispanic women and birthing people also had a higher PAMR compared with white non-Hispanic women and birthing people, with this PAMR being almost two times higher for the period 2016-2020.

Figure 3. Five-Year Pregnancy-Related Mortality Ratio by Maternal Race and Ethnicity, NYC, 2001-2020



*PRMRs for white non-Hispanic and Asian or Pacific Islander women and birthing people are based on fewer than 20 cases and should be interpreted with caution.

- In 2016-2020, the overall PRMR in NYC was 20.3 deaths per 100,000 live births.
- The overall PRMR in NYC showed a decreasing trend over the first three time periods (2001-2005, 2006-2010 and 2011-2015), and slightly increased in 2016-2020[17] compared with the 2011-2015 period. However, the changes were not statistically significant.
- There were fluctuations in PRMR within racial and ethnic groups, but none were statistically significant.
- In 2016-2020, Black non-Hispanic women and birthing people had the highest PRMR, at 52.0 deaths per 100,000 live births, followed by Hispanic (20.3), Asian or Pacific Islander (10.5) and white non-Hispanic women and birthing people (8.7).
- In 2016-2020, the PRMR for Black non-Hispanic women and birthing people was six times higher than that for white non-Hispanic women and birthing people. In earlier periods (2001-2005, 2006-2010 and 2011-2015), the disparities were greater, at seven times (61.7 vs. 8.6), 12 times (56.3 vs. 4.7) and eight times (51.0 vs. 6.6), respectively.
- On average, over the past 20 years, this same disparity was eight times. This should be interpreted with caution, however, as the PRMR among white non-Hispanic women and birthing people is based on fewer than 20 deaths and as a result may fluctuate more than PRMRs based on higher numbers.

[17] The PRMR increase may be attributed to a change in how these deaths were characterized. Before 2016, deaths due to homicide and mental health conditions, including overdose and suicide, were categorized as pregnancy-associated but not -related. Starting in 2016, when the MMRC began to review deaths, the committee considered whether these deaths were pregnancy-related, and some were reclassified from pregnancy-associated but not -related to either pregnancy-related or Unable to determine classifications.

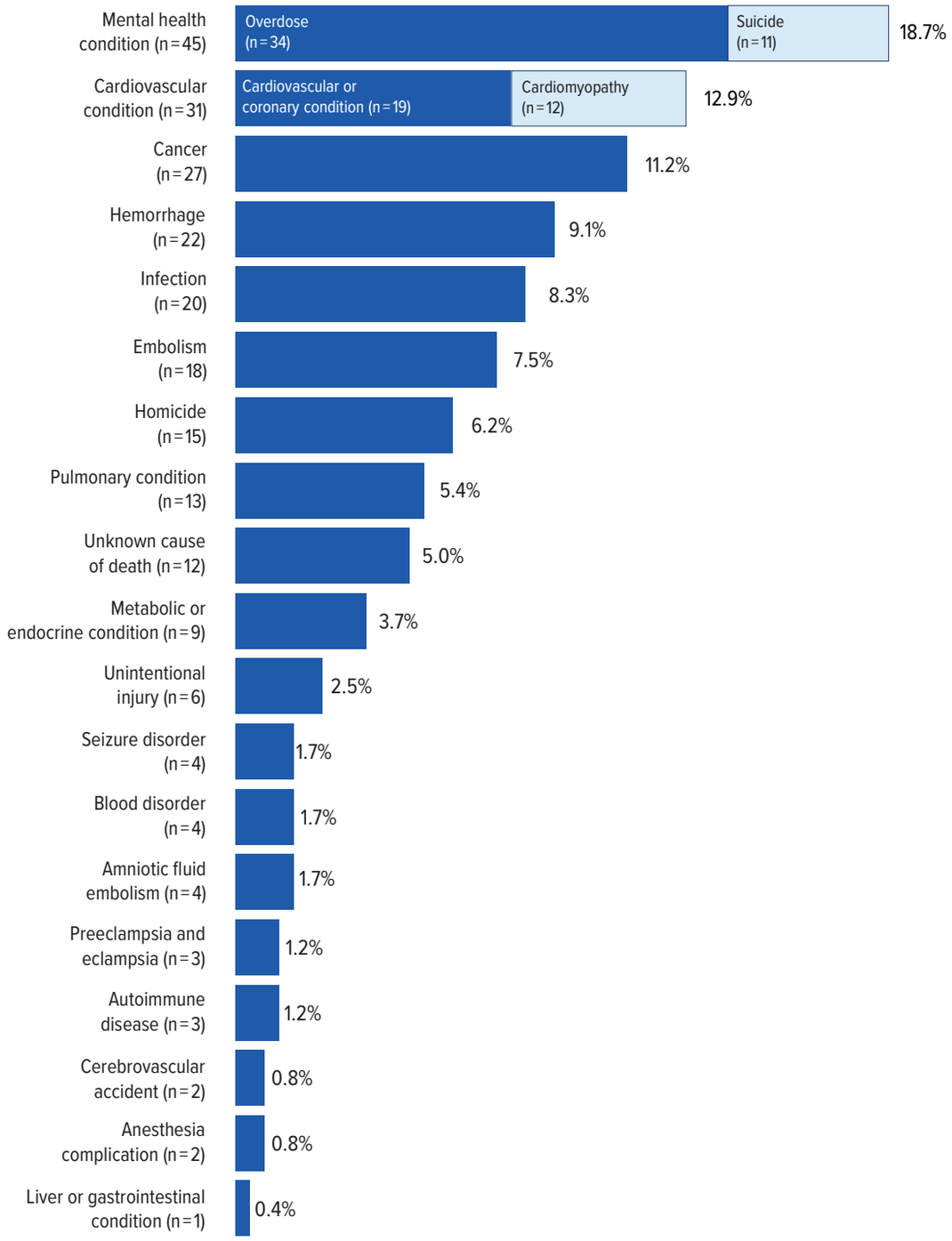
Pregnancy-Associated Deaths

A pregnancy-associated death is a death of a woman or birthing person from any cause during pregnancy or within one year from the end of pregnancy, regardless of the outcome of the pregnancy.

In 2016-2020, there were 241 pregnancy-associated deaths in NYC. In the following pages, key information is provided about the deaths by underlying cause of death, location and timing of death, demographic characteristics, prenatal and clinical characteristics, and social services.

Underlying Causes of Death

Figure 4. Underlying Cause of Pregnancy-Associated Death, NYC, 2016-2020



- The leading underlying causes of pregnancy-associated deaths in 2016-2020 were mental health conditions (18.7%), followed by cardiovascular conditions (12.9%), cancer (11.2%), hemorrhage (9.1%) and infection (8.3%), which includes six deaths due to COVID-19 that occurred in 2020.
- Overdoses alone accounted for 75.6% of the deaths due to mental health conditions (34 of the 45 deaths). Among the 34 overdose deaths, 26 (76.5%) involved an opioid.

Table 1. Underlying Cause of Pregnancy-Associated Death by Maternal Race and Ethnicity, NYC, 2016-2020

	All		Black non-Hispanic		Hispanic		White non-Hispanic		Asian or Pacific Islander		Other	
Cause of death	n	%	n	%	n	%	n	%	n	%	n	%
Mental health conditions	45	18.7	12	11.4	15	23.1	15	31.9	3	15.0	0	0.0
Overdose[18]	34		10		12		12		0		0	
Suicide	11		2		3		3		3		0	
Cardiovascular conditions	31	12.9	20	19.0	4	6.2	4	7.8	3	15.0	0	0.0
Cardiovascular or coronary condition	19		13		2		2		2		0	
Cardiomyopathy	12		7		2		2		1		0	
Cancer	27	11.2	6	5.7	4	6.2	12	25.5	4	20.0	1	25.0
Hemorrhage	22	9.1	6	5.7	10	15.4	3	6.4	3	15.0	0	0.0
Infection	20	8.3	9	8.6	5	7.7	3	6.4	2	10.0	1	25.0
Embolism	18	7.5	12	11.4	4	6.2	2	4.3	0	0.0	0	0.0
Homicide	15	6.2	7	6.7	6	9.2	1	2.1	0	0.0	1	25.0
Pulmonary conditions	13	5.4	8	7.6	4	6.2	0	0.0	0	0.0	1	25.0
Unknown	12	5.0	4	3.8	1	1.5	4	8.5	3	15.0	0	0.0
Metabolic or endocrine condition	9	3.7	4	3.8	4	6.2	1	2.1	0	0.0	0	0.0
Unintentional injury	6	2.5	4	3.8	2	3.1	0	0.0	0	0.0	0	0.0
Amniotic fluid embolism	4	1.7	2	1.9	0	0.0	1	2.1	1	5.0	0	0.0
Blood disorders	4	1.7	3	2.9	0	0.0	0	0.0	1	5.0	0	0.0
Seizure disorders	4	1.7	2	1.9	2	3.1	0	0.0	0	0.0	0	0.0
Autoimmune diseases	3	1.2	1	1.0	1	1.5	1	2.1	0	0.0	0	0.0
Preeclampsia or eclampsia	3	1.2	1	1.0	2	3.1	0	0.0	0	0.0	0	0.0
Anesthesia complications	2	0.8	2	1.9	0	0.0	0	0.0	0	0.0	0	0.0
Cerebrovascular accidents	2	0.8	1	1.0	1	1.5	0	0.0	0	0.0	0	0.0
Liver or gastrointestinal condition	1	0.4	1	1.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	**241**	**100.0**	**105**	**100.0**	**65**	**100.0**	**47**	**100.0**	**20**	**100.0**	**4**	**100.0**

Note: Here and throughout this report, percentages may not add up to 100.0% due to rounding.

- Pregnancy-associated deaths among Black non-Hispanic women and birthing people were primarily caused by cardiovascular conditions (19.0%), mental health conditions (11.4%) and embolism (11.4%).
- The leading causes[19] of death for Hispanic women and birthing people were mental health conditions (23.1%), hemorrhage (15.4%), and homicide (9.2%).
- Mental health conditions (31.9%) were the leading cause of pregnancy-associated death among white non-Hispanic women and birthing people.
- Cancer (20.0%) was the leading cause of pregnancy-associated death among Asian or Pacific Islander women and birthing people.

[18] Among 34 overdose deaths, 26 (76.5%) involved an opioid. The number of opioid deaths were 4 (40.0%), 10 (83.3%), and 12 (100.0%) for Black non-Hispanic, Hispanic, and white non-Hispanic people, respectively.

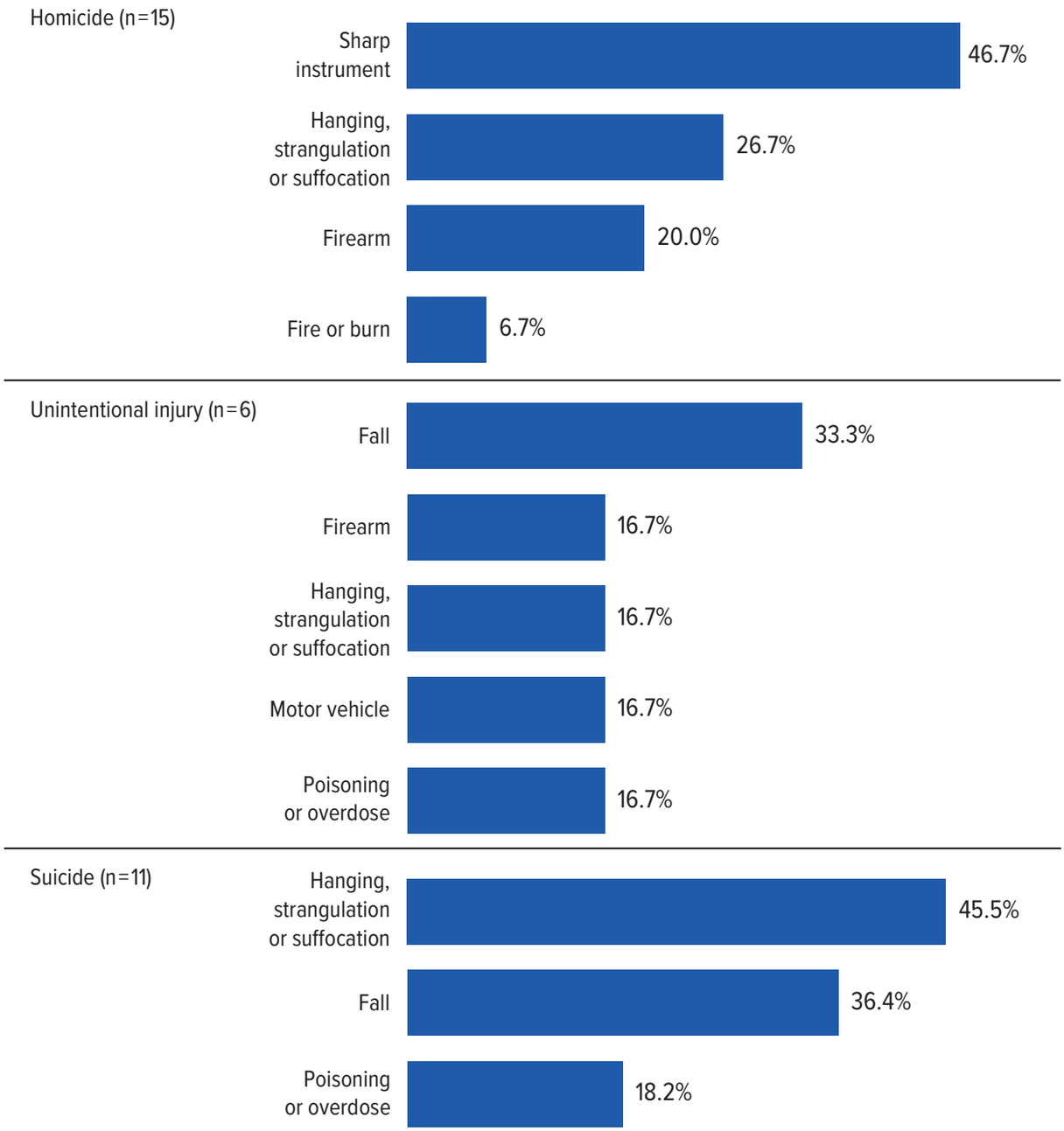
[19] Underlying cause refers to the disease or injury that initiated the chain of events leading to death or the circumstances of the accident or violence that produced the fatal injury.

Table 2. Type of Cancer Causing Pregnancy-Associated Deaths, NYC, 2016-2020

Cancer type	n	%
Breast	7	25.9
Liver and intrahepatic bile duct	5	18.5
Stomach	4	14.8
Non-Hodgkin lymphoma	3	11.1
Other — unspecified	2	7.4
Brain and other nervous system	2	7.4
Colon and rectum	2	7.4
Pancreas	1	3.7
Lung	1	3.7
Total	**27**	**100.0**

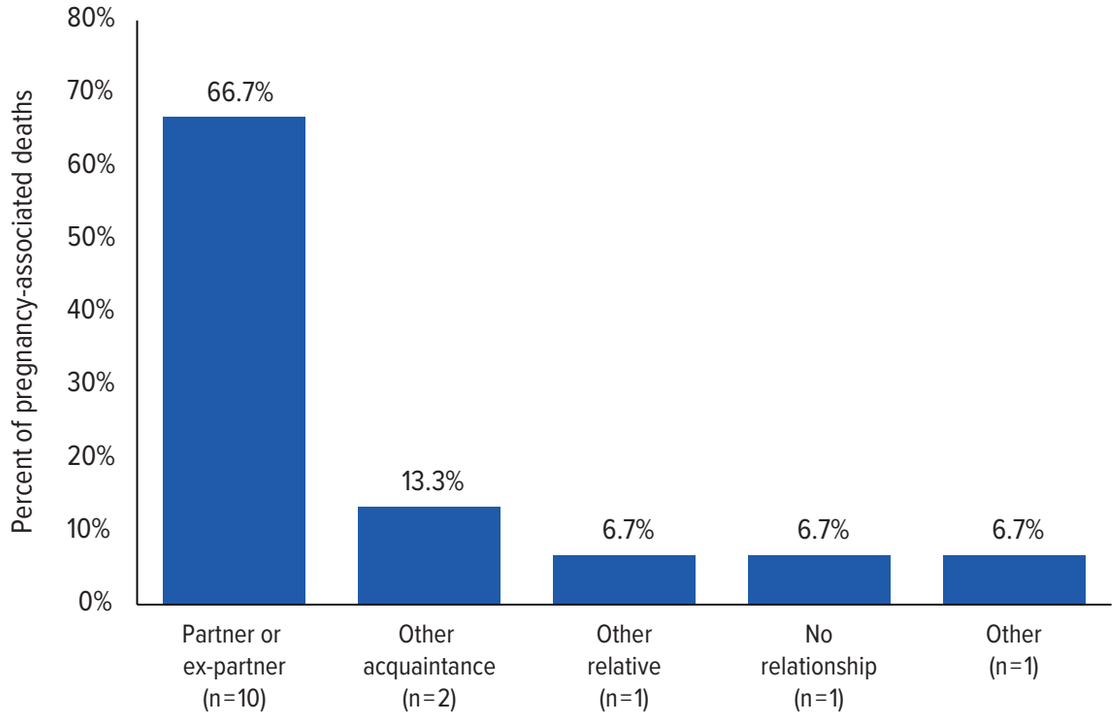
- Among pregnancy-associated cancer deaths, the leading causes were breast cancer (25.9%) and liver and intrahepatic bile duct cancers (18.5%).

Figure 5. Means of Fatal Injury Among Deaths Due to Homicide, Unintentional Injury and Suicide, NYC, 2016-2020



- Among pregnancy-associated deaths resulting from homicide, unintentional injury and suicide, the most common means of fatal injury were sharp instrument (46.7%) for homicide; falls (33.3%) for unintentional injury; and hanging, strangulation or suffocation (45.5%) for suicide.

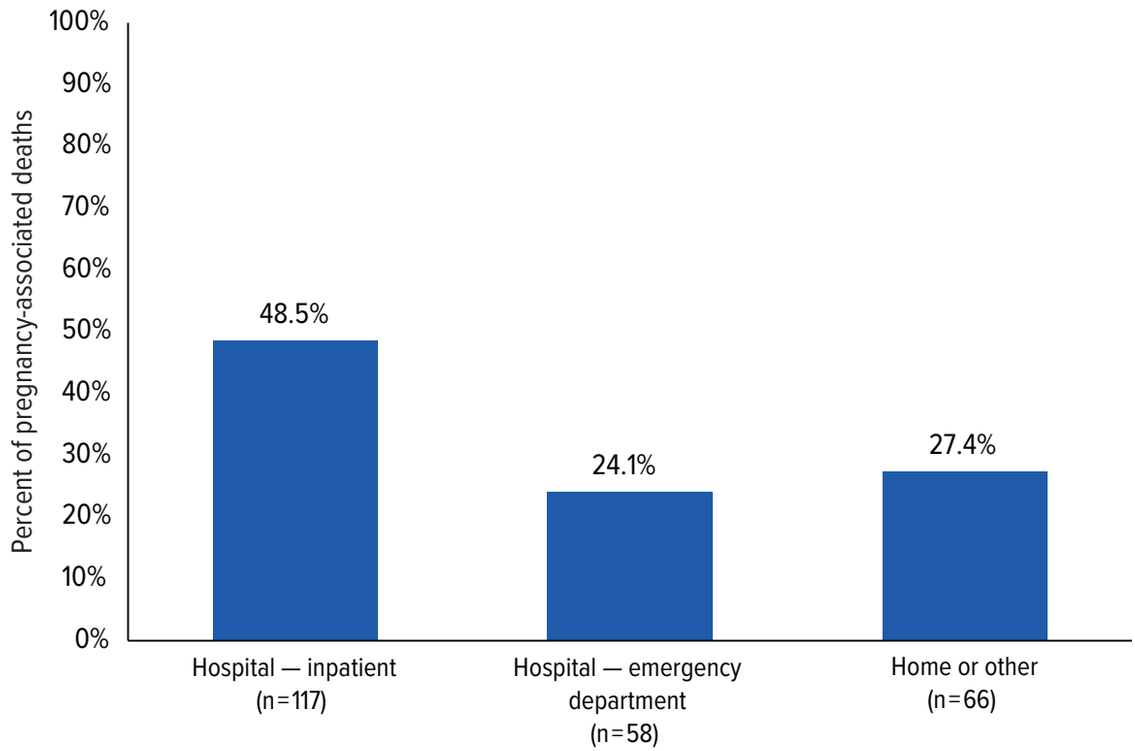
Figure 6. Relationship of Perpetrator to Decedent Among Pregnancy-Associated Deaths Due to Homicide, NYC, 2016-2020



- Among the pregnancy-associated deaths due to homicide, partners or ex-partners were identified as the perpetrators in two-thirds of the cases.

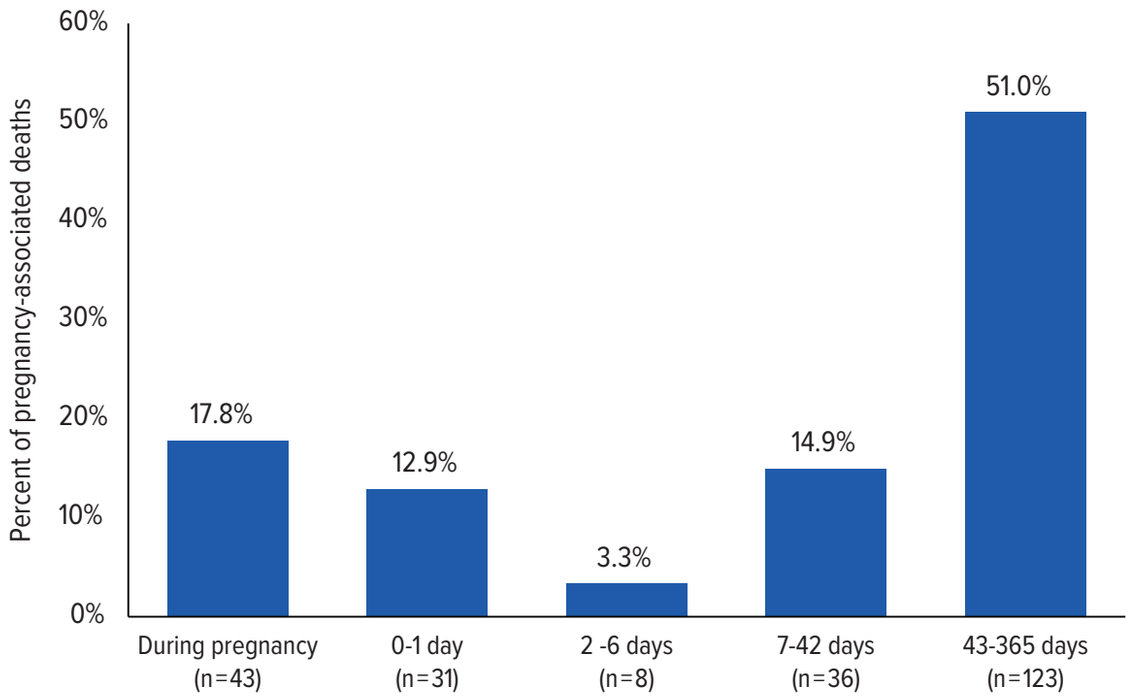
Location and Timing of Death

Figure 7. Percent Distribution of Pregnancy-Associated Deaths by Location of Death, NYC, 2016-2020



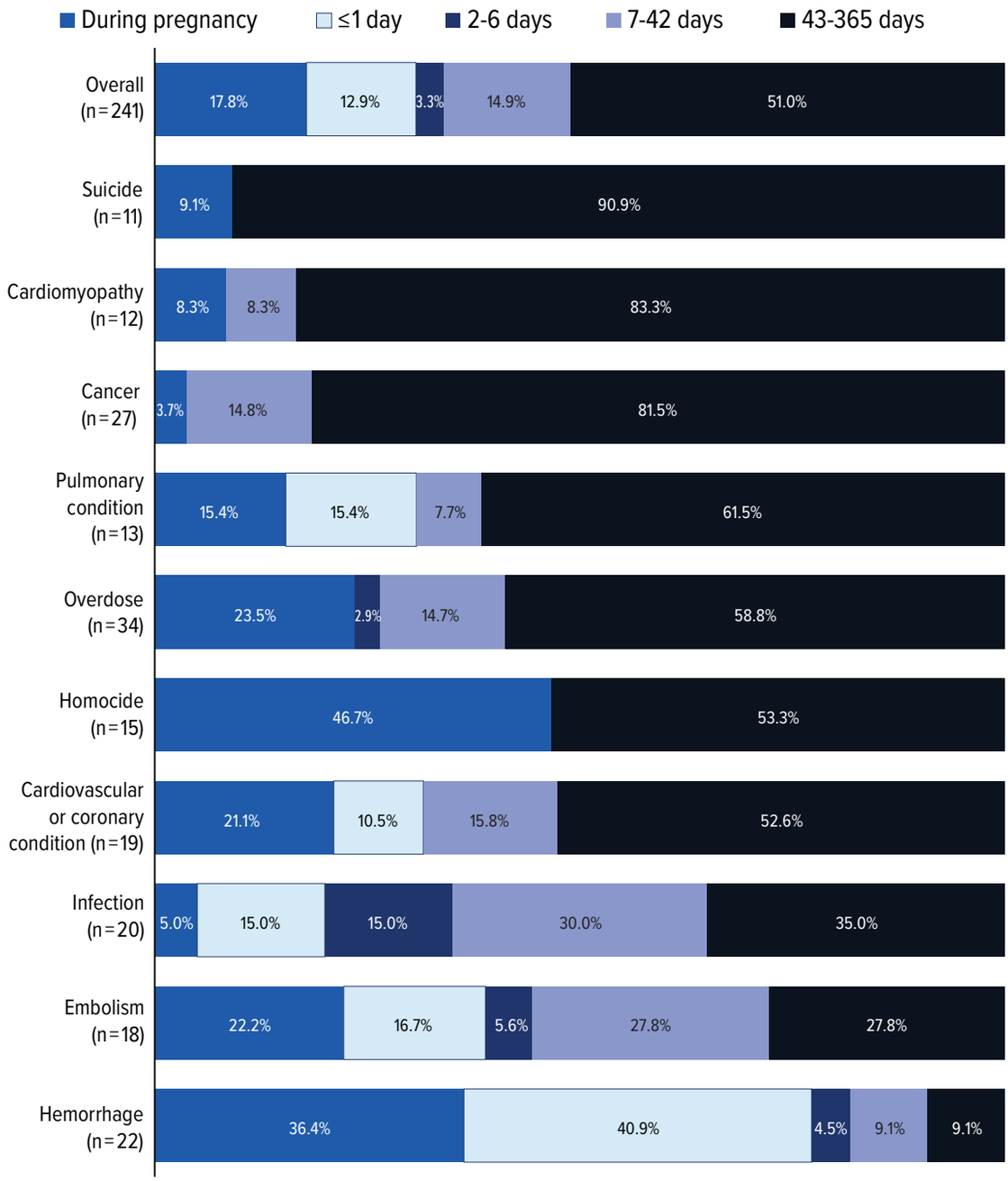
- Most pregnancy-associated deaths (72.6%) occurred in the hospital, either in the inpatient facility or in the emergency department, while 27.4% occurred outside the hospital, including at home or another location.

Figure 8. Percent Distribution of Pregnancy-Associated Deaths by Interval Between End of Pregnancy and Death, NYC, 2016-2020



- Over half (51.0%) of pregnancy-associated deaths occurred between 43 and 365 days after the end of pregnancy, while 17.8% of deaths occurred during pregnancy and 12.9% occurred within one day after the end of pregnancy.

Figure 9. Percent Distribution of Timing of Death by Leading Causes of Pregnancy-Associated Death, NYC, 2016-2020

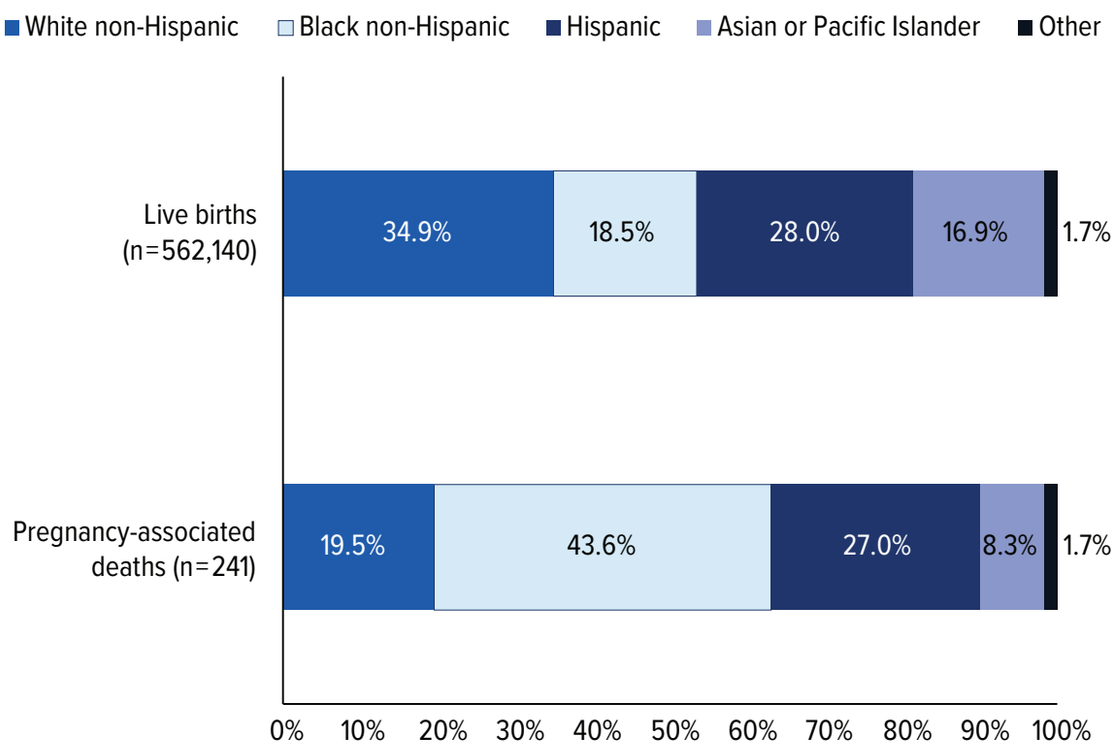


- Almost all deaths due to suicide (90.9%), cardiomyopathy (83.3%) and cancer (81.5%) occurred between 43 and 365 days after the end of pregnancy.
- Among hemorrhage deaths, 77.3% occurred during pregnancy (36.4%) or within one day after the end of pregnancy (40.9%).

Data not shown: Hemorrhage and overdose each accounted for 18.6% of the deaths that occurred during pregnancy. Hemorrhage was the leading cause of death within one day after the end of pregnancy (29.0%). In the subsequent periods of 2 to 6 days and 7 to 42 days after the end of pregnancy, infection was the leading cause of death, accounting for 37.5% and 16.7% of deaths in the respective periods. Cancer was the leading cause of death during the period of 43 to 365 days after the end of pregnancy, at 17.9%.

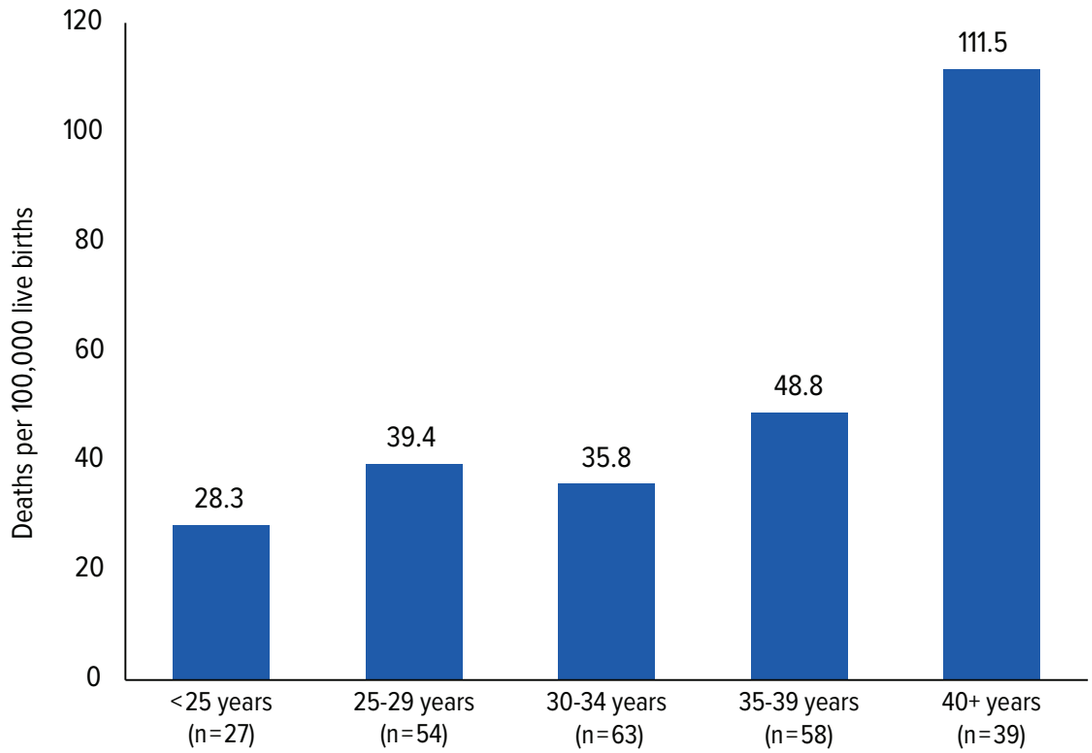
Demographic Characteristics

Figure 10. Percent Distribution of Pregnancy-Associated Deaths and Live Births by Maternal Race and Ethnicity, NYC, 2016-2020



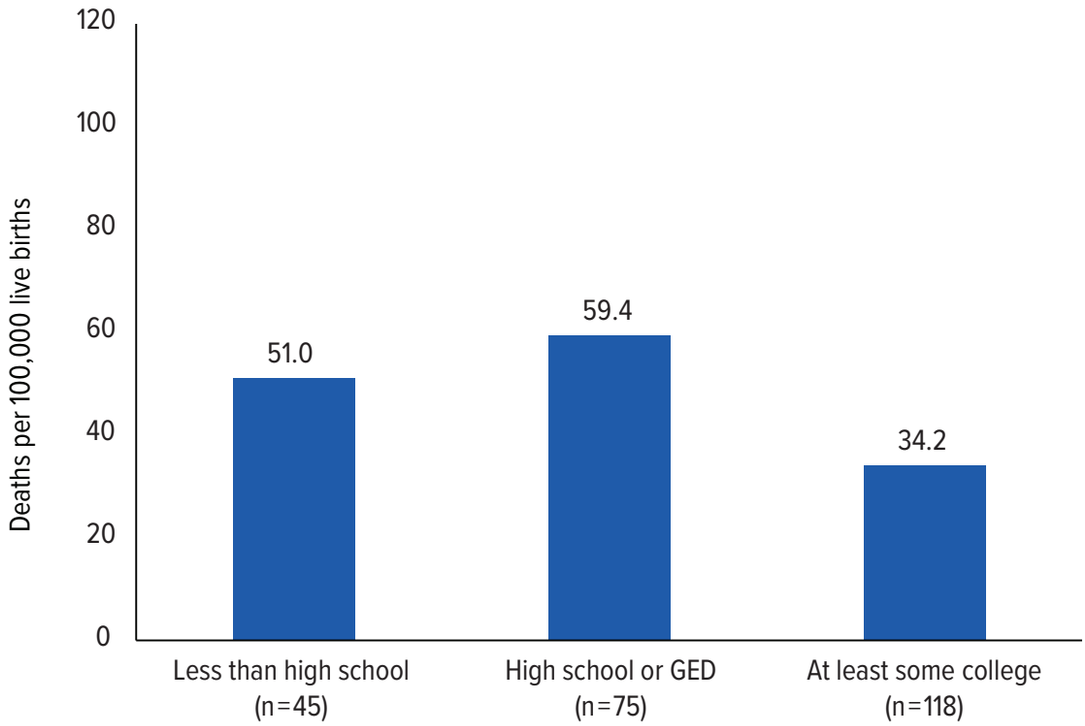
- Of the total 241 pregnancy-associated deaths, 43.6% (n=105) were to Black non-Hispanic women and birthing people, and 27.0% (n=65) to Hispanic, 19.5% (n=47) to white non-Hispanic, and 8.3% (n=20) to Asian or Pacific Islander women and birthing people.
- From 2016 to 2020, the percentage of pregnancy-associated deaths (43.6%) among Black non-Hispanic women and birthing people was higher than their representation among live births (18.5%).
- Conversely, white non-Hispanic and Asian or Pacific Islander women and birthing people accounted for 34.9% and 16.9% of live births in NYC during this period, respectively, yet their representations in pregnancy-associated deaths were notably lower, at 19.5% and 8.3%.

Figure 11. Pregnancy-Associated Mortality Ratio by Maternal Age, NYC, 2016-2020



- The PAMR among women and birthing people age 40 and older was significantly higher than that of women and birthing people in any other age group.

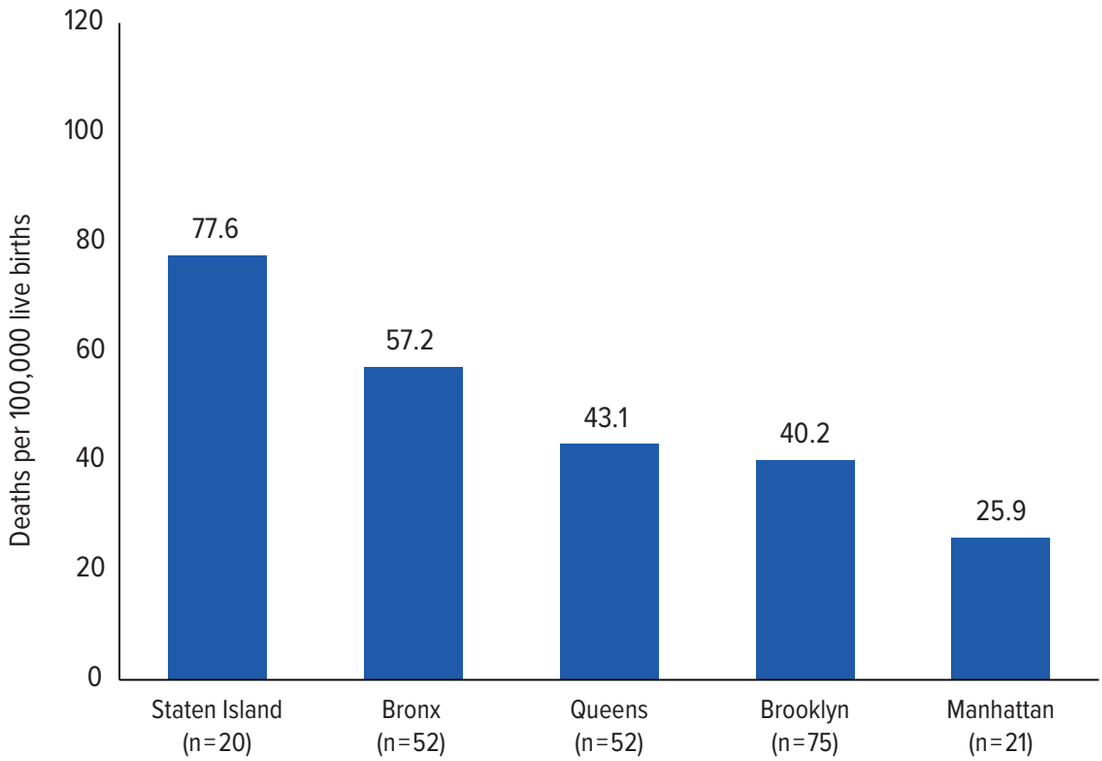
Figure 12. Pregnancy-Associated Mortality Ratio by Maternal Education, NYC, 2016-2020



Note: Out of the 241 pregnancy-associated deaths in NYC in 2016-2020, three were among people who had no education information on either their birth or their death certificate and are not shown.

- The PAMR was significantly lower among women and birthing people with at least some college (34.2 deaths per 100,000 live births) compared to those who had a high school or GED degree. We cannot further disaggregate by race and ethnicity due to small numbers.

Figure 13. Pregnancy-Associated Mortality Ratio by Maternal Borough of Residence, NYC, 2016-2020



Note: Out of the 241 pregnancy-associated deaths that occurred in NYC in 2016-2020, 21 were among NYS residents and are not shown.

- Staten Island and the Bronx had significantly higher PAMRs (77.6 and 57.2 deaths per 100,000 live births) compared with Manhattan (25.9 deaths per 100,000 live births). The elevated PAMR in Staten Island was primarily due to overdose deaths, which accounted for 30% of pregnancy-associated deaths among women and birthing people who were residents of the borough (six out of 20 pregnancy-associated deaths [data not shown]).

Table 3. Pregnancy-Associated Mortality Ratio by Community District, NYC, 2016-2020

Community district	Borough	PAMR*	Pregnancy-associated deaths	Live births
Brownsville (316)	Brooklyn	146.9	9	6,128
Crown Heights (308)	Brooklyn	114.5	7	6,115
Rockaway/Broad Channel (414)	Queens	113.6	7	6,163
Red Hook/Gowanus (306)	Brooklyn	113.2	9	7,950
East New York/Starrett City (305)	Brooklyn	95.4	12	12,584
Mott Haven/Melrose (201)	Bronx	82.9	6	7,238
Belmont/East Tremont (206)	Bronx	82.7	5	6,046
Howland Hook/Rosebank (501)	Staten Island	81.4	9	11,063
East Flatbush (317)	Brooklyn	80.0	7	8,751
Tottenville/Oakwood Beach (503)	Staten Island	78.4	6	7,656
Williamsbridge/Baychester (212)	Bronx	74.0	6	8,113
Morrisania/Crotona (203)	Bronx	73.2	5	6,834
Willowbrook (502)	Staten Island	71.4	5	7,003
Central Harlem (110)	Manhattan	69.5	5	7,191
Kew Gardens/Richmond Hill (409)	Queens	67.9	6	8,837
Queens Village (413)	Queens	64.4	5	7,763
Laconia/Pelham (211)	Bronx	61.2	4	6,534
East Harlem (111)	Manhattan	57.4	4	6,971
Bedford-Stuyvesant (303)	Brooklyn	55.3	6	10,842
Elmhurst/Corona (404)	Queens	54.6	6	10,982
Soundview/Parkchester (209)	Bronx	52.4	6	11,450
Jamaica/Hollis (412)	Queens	49.7	7	14,089
Fordham/University Heights (205)	Bronx	48.9	5	10,222
Jamaica Estates/Fresh Meadows (408)	Queens	47.8	4	8,361
Fort Greene/Brooklyn Heights (302)	Brooklyn	47.8	4	8,364
Flatlands/Canarsie (318)	Brooklyn	47.4	5	10,547
Clearview/Flushing (407)	Queens	40.6	5	12,327
Highbridge/Concourse (204)	Bronx	35.7	4	11,210
Hunts Point/Longwood (202)	Bronx	-	3	3,850
Bayside/Douglaston (411)	Queens	-	2	2,904
Manhattanville/Hamilton Heights (109)	Manhattan	-	3	4,717
Throggs Neck/Co-op City (210)	Bronx	-	3	4,761
Riverdale/Kingsbridge (208)	Bronx	-	3	5,022
Bushwick (304)	Brooklyn	-	3	5,532
S. Crown Heights/Prospect (309)	Brooklyn	-	3	6,984

Table 3. Pregnancy-Associated Mortality Ratio by Community District, NYC, 2016-2020 (Continued)

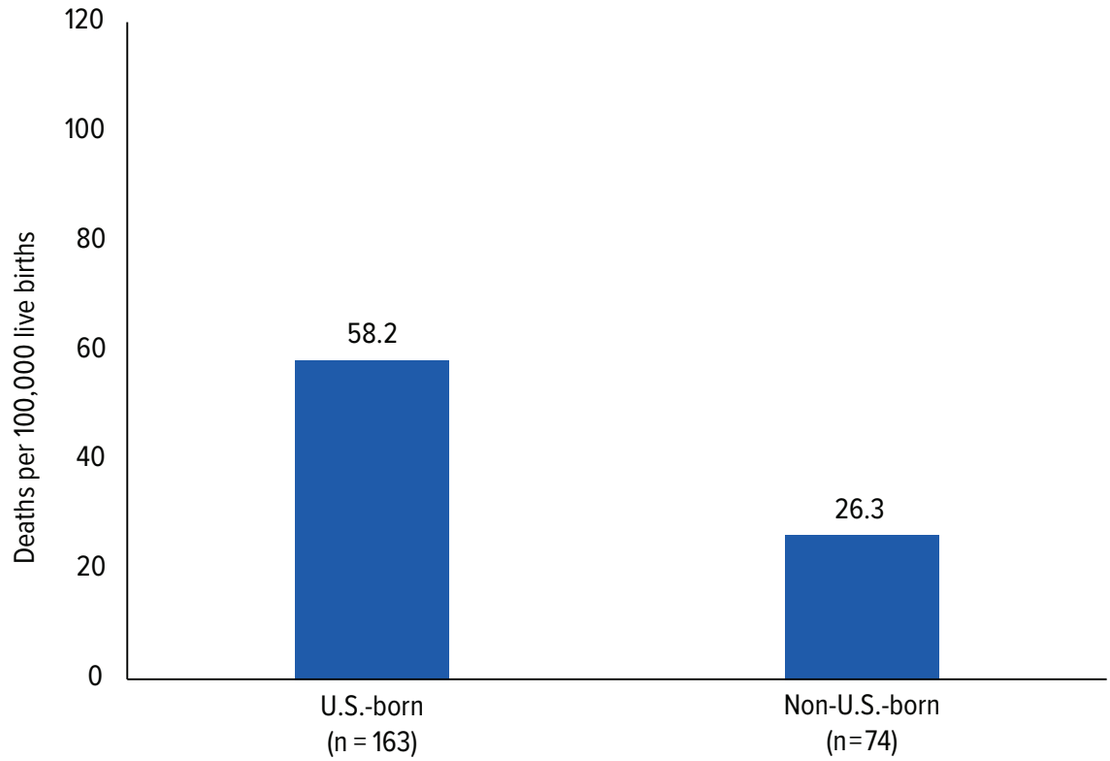
Community district	Borough	PAMR*	Pregnancy-associated deaths	Live births
Lower East Side (103)	Manhattan	-	2	5,638
Ozone Park/Howard Beach (410)	Queens	-	2	6,219
Upper East Side (108)	Manhattan	-	3	12,268
Bensonhurst (311)	Brooklyn	-	3	12,578
Astoria (401)	Queens	-	2	9,268
Sunset Park/Windsor Terrace (307)	Brooklyn	-	2	10,063
Norwood/Bedford Park (207)	Bronx	-	2	10,069
Jackson Heights/N. Corona (403)	Queens	-	2	10,699
Upper West Side (107)	Manhattan	-	2	11,483
Coney Island (313)	Brooklyn	-	1	5,865
Greenpoint/Williamsburg (301)	Brooklyn	-	3	17,875
Murray Hill (106)	Manhattan	-	1	6,320
Rego Park/Forest Hills (406)	Queens	-	1	6,503
Sunnyside/Woodside (402)	Queens	-	1	7,938
Glendale/Ridgewood (405)	Queens	-	1	8,559
Washington Heights/Inwood (112)	Manhattan	-	1	9,538
Borough Park (312)	Brooklyn	-	2	25,198
Missing†		-	21	
Total			**241**	

*PAMRs with deaths under 4 are suppressed (-) due to the statistical instability. PAMRs based on fewer than 10 deaths should be interpreted with caution due to possible limitations in data accuracy and stability.

†Out of the 241 pregnancy-associated deaths in NYC in 2016-2020, 21 were among NYS residents.

- Within community districts, the highest PAMRs were seen in Brownsville (146.9 deaths per 100,000 live births), Crown Heights (114.5) and Red Hook-Gowanus (113.2) in Brooklyn, and Rockaway-Broad Channel (113.6) in Queens.

Figure 14. Pregnancy-Associated Mortality Ratio by Maternal Nativity, NYC, 2016-2020



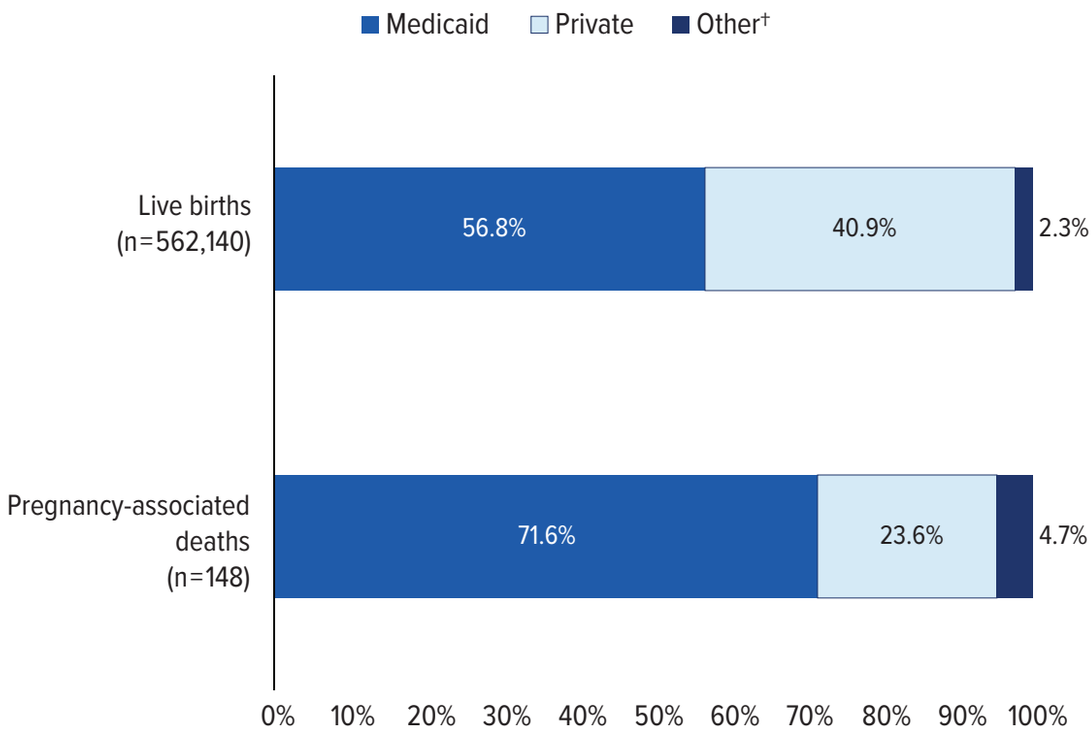
Note: Out of the 241 pregnancy-associated deaths in NYC in 2016-2020, four were among people who had no country-of-birth information on their birth or death certificate and are not shown.

- In 2016-2020, the PAMR for women and birthing people born in the U.S. was significantly higher (58.2 deaths per 100,000 live births) than for people born outside the U.S. (26.3 deaths per 100,000 live births).
- The low number of deaths recorded per non-U.S. country limits the analysis of PAMR based on woman and birthing person's country of birth. Among the countries with four deaths or more, Haiti had the highest PAMR (93.7 deaths per 100,000 live births), followed by Jamaica (87.7), Guyana (47.9), the Dominican Republic (26.9) and China (20.9) (data not shown).[20]

[20] The number of pregnancy-associated deaths among women and birthing people from Haiti, Jamaica, Guyana, the Dominican Republic and China were 6, 9, 4, 10 and 7, respectively; the number of live births to women and birthing people from these countries were 6,404; 10,263; 8,343; 37,118 and 33,520, respectively. The PAMRs based on fewer than 10 deaths should be interpreted with caution due to possible limitations in data accuracy and stability.

Prenatal and Clinical Characteristics

Figure 15. Percent Distribution of Pregnancy-Associated Deaths and Live Births by Insurance Type,* NYC, 2016-2020



*In 2016-2020, out of a total of 241 pregnancy-associated deaths, 161 had a live birth. Among these deaths, 148 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which recorded their insurance type.

†Other includes other government type, self-pay and unknown.

- In 2016-2020, most pregnancy-associated deaths with a live birth outcome (n=148) were listed as having Medicaid coverage (71.6%). During the same period, 56.8% of all live births were listed as having Medicaid coverage.

Table 4. Distribution of Pregnancy Outcomes Among Pregnancy-Associated Deaths, NYC, 2016-2020

Pregnancy outcome	Pregnancy-associated deaths	%
Live birth*	161	66.8
Vaginal	67	-
Cesarean	81	-
Unknown	13	-
Undelivered	36	14.9
Induced termination (ITOP)	11	4.6
Spontaneous termination (STOP)	17	7.1
Stillbirth (>20 weeks gestation)	9	3.7
Ectopic pregnancy	7	2.9
Total	**241**	**100.0**

*In 2016-2020, out of a total of 241 pregnancy-associated deaths, 161 had a live birth. Among these, 148 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which recorded the method of birth. The method of birth for the remaining 13 deaths was unknown.

- The most common pregnancy outcome among pregnancy-associated deaths was a live birth (66.8%).
- Among women and birthing people who had a live birth, 41.6% (67 out of 161) gave birth vaginally and 50.3% (81 out of 161) had a cesarean birth.

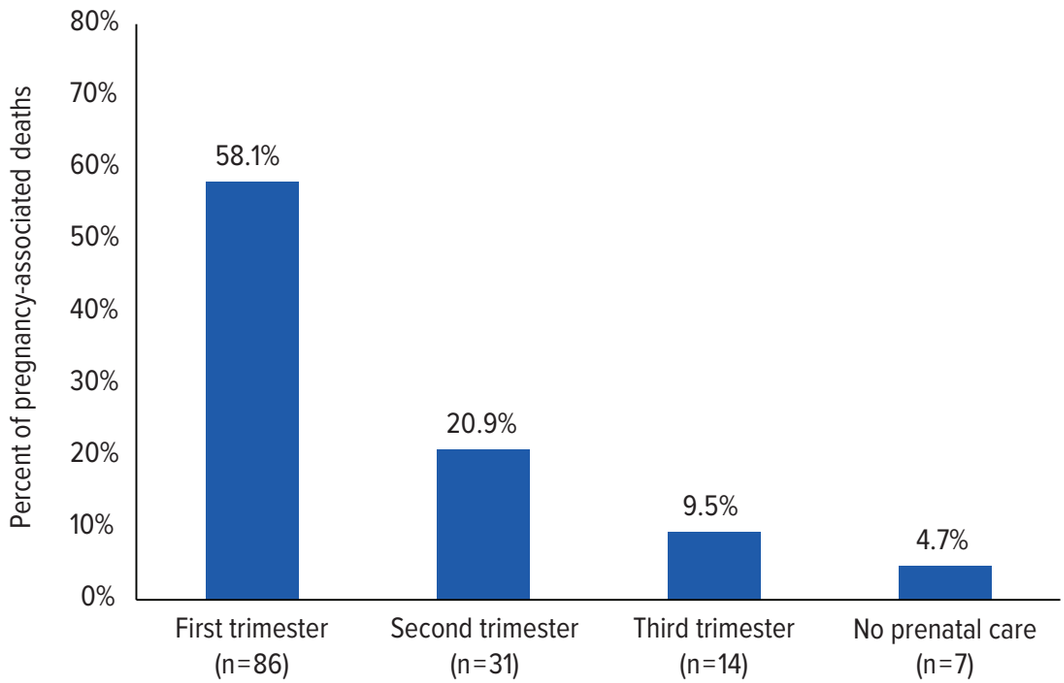
Table 5. Percent Distribution of Pregnancy-Associated Deaths That Resulted in a Live Birth* by Number of Previous Live Births, NYC, 2016-2020

Number of previous live births	Pregnancy-associated deaths	%
None	51	34.5
One	43	29.1
Two	28	18.9
Three or more	24	16.2
Unknown	2	1.4
Total	**148**	**100.0**

*In 2016-2020, out of a total of 241 pregnancy-associated deaths, 161 had a live birth. Among these, 148 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which recorded the number of their previous live births.

- Among pregnancy-associated deaths with a live birth outcome, 34.5% had no previous live births, 29.1% had one previous live birth, 18.9% had two previous live births and 16.2% had three or more previous live births.

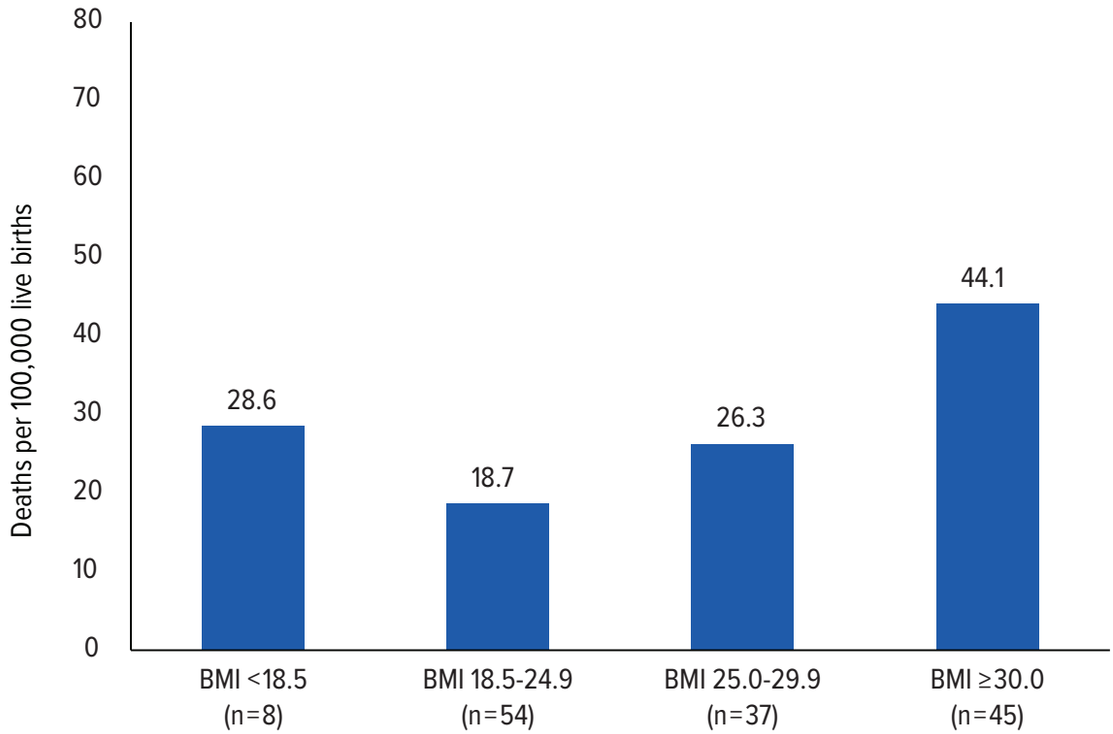
Figure 16. Percent Distribution of Pregnancy-Associated Deaths With a Live Birth* by Trimester of Prenatal Care Initiation, NYC, 2016-2020



*In 2016-2020, out of a total of 241 pregnancy-associated deaths, 161 had a live birth. Among these, 148 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which included information about the trimester when prenatal care was initiated. Out of these 148, 10 (6.9%) had missing information for prenatal care initiation and are not shown.

- Among pregnancy-associated deaths with a live birth outcome, 58.1% had initiated prenatal care within the first trimester and 79.0% had initiated prenatal care by the end of the second trimester.

Figure 17. Pregnancy-Associated Mortality Ratio by Prepregnancy Body Mass Index (BMI), NYC, 2016-2020*



*In 2016-2020, out of a total of 241 pregnancy-associated deaths, 161 had a live birth. Among these, 148 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death. These birth certificates contained recorded information about prepregnancy weight and height, which were used to calculate prepregnancy BMI. Out of these 148, four had missing information for prepregnancy weight or height and are not shown.

- Among pregnancy-associated deaths with a live birth, women and birthing people with a BMI of 30.0 or higher had a PAMR more than double that of women and birthing people with a BMI from 18.5 to 24.9 (44.1 deaths per 100,000 live births compared with 18.7 deaths per 100,000 live births). This difference was statistically significant.

Social Services

Table 6. Involvement With ACS and DHS Shelters Among Pregnancy-Associated Deaths, NYC, 2016-2020

ACS, DHS	n	%
Neither	185	76.8
Any ACS	32	13.3
Any DHS	34	14.1
Both ACS and DHS	15	6.2
Total	**241**	**100.0***

*Percentages do not add up to 100.0% because 6.2% (n=15) of the women and birthing people experienced both ACS and DHS.

- Involvement with Administration for Children's Services is defined as evidence in the records where ACS was involved in the life of the birthing person and their family before, during or after the incident pregnancy that preceded the death.
- Any DHS is defined as evidence in the medical record of the woman or birthing person living in a Department of Homeless Services (DHS) shelter before, during or after the incident pregnancy.
- Among all pregnancy-associated deaths, records indicated that 13.3% of the women or birthing people experienced involvement with ACS, 14.1% were housed through DHS and 6.2% (n=15) experienced both.

Pregnancy-Related Deaths

A pregnancy-related death is a death of a woman or birthing person during pregnancy or within one year from the end of pregnancy that is caused by a pregnancy complication, a chain of events initiated by pregnancy, or the aggravation of an unrelated condition by the pregnancy.

In 2016-2020, there were 114 pregnancy-related deaths in NYC. In the following pages, key information is provided about the deaths by underlying cause of death, location and timing of death, demographic characteristics, and prenatal and clinical characteristics.

Underlying Cause of Death

Table 7. Underlying Cause of Pregnancy-Related Death by Maternal Race and Ethnicity, NYC, 2016-2020

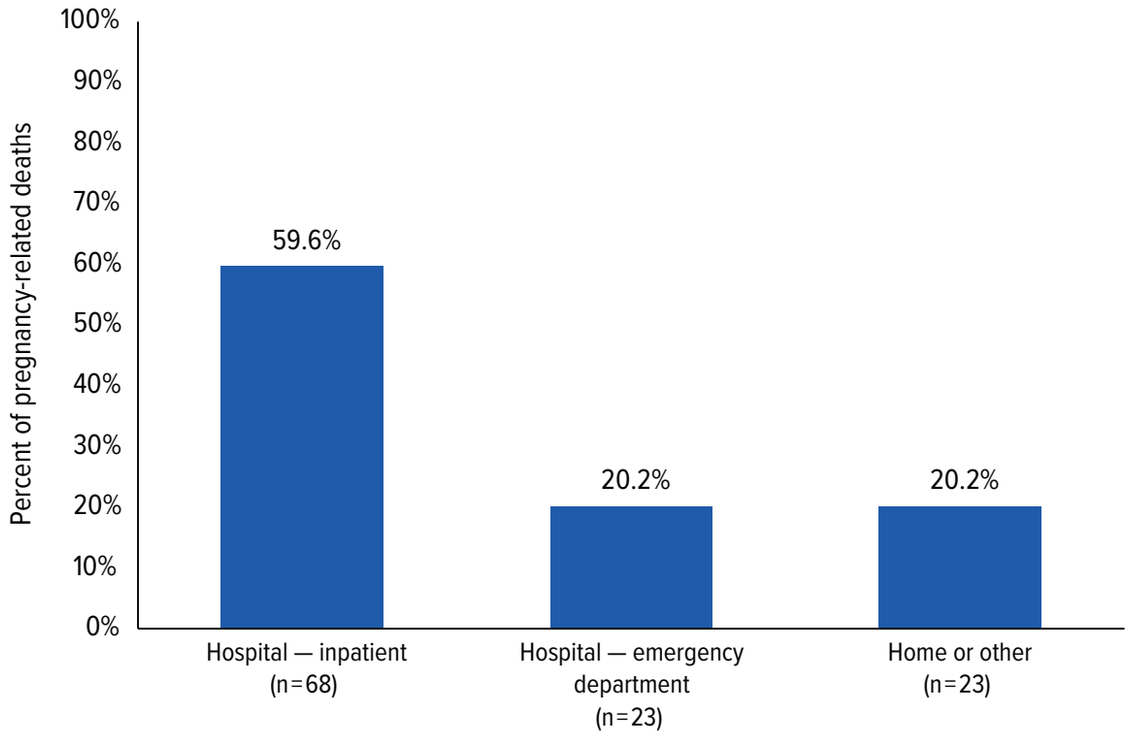
	All		Black non-Hispanic		Hispanic		Asian or Pacific Islander		White non-Hispanic		Other	
Cause of death	n	%	n	%	n	%	n	%	n	%	n	%
Hemorrhage	21	18.4	6	11.1	10	31.3	3	30.0	2	11.8	0	0.0
Cardiovascular conditions	19	16.7	12	22.2	3	9.4	2	20.0	2	11.8	0	0.0
Cardiomyopathy	11		7		2		1		1		0	
Cardiovascular or coronary condition	8		5		1		1		1		0	
Mental health conditions	18	15.8	3	5.6	9	28.1	2	20.0	4	23.5	0	0.0
Overdose[21]	9		1		7		0		1		0	
Suicide	9		2		2		2		3		0	
Embolism	16	14.0	10	18.5	4	12.5	0	0.0	2	11.8	0	0.0
Infection	10	8.8	5	9.3	2	6.3	0	0.0	2	11.8	1	100.0
Metabolic or endocrine condition	5	4.4	4	7.4	1	3.1	0	0.0	0	0.0	0	0.0
Amniotic fluid embolism	4	3.5	2	3.7	0	0.0	1	10.0	1	5.9	0	0.0
Cancer	4	3.5	1	1.9	0	0.0	0	0.0	3	17.6	0	0.0
Unknown	4	3.5	1	1.9	0	0.0	2	20.0	1	5.9	0	0.0
Blood disorder	3	2.6	3	5.6	0	0.0	0	0.0	0	0.0	0	0.0
Preeclampsia or eclampsia	3	2.6	1	1.9	2	6.3	0	0.0	0	0.0	0	0.0
Anesthesia complications	2	1.8	2	3.7	0	0.0	0	0.0	0	0.0	0	0.0
Pulmonary condition	2	1.8	2	3.7	0	0.0	0	0.0	0	0.0	0	0.0
Homicide	1	0.9	0	0.0	1	3.1	0	0.0	0	0.0	0	0.0
Liver or gastrointestinal condition	1	0.9	1	1.9	0	0.0	0	0.0	0	0.0	0	0.0
Unintentional injury	1	0.9	1	1.9	0	0.0	0	0.0	0	0.0	0	0.0
Total	**114**	**100.0**	**54**	**100.0**	**32**	**100.0**	**10**	**100.0**	**17**	**100.0**	**1**	**100.0**

- The top three causes of pregnancy-related deaths in 2016-2020 were hemorrhage (18.4%), cardiovascular conditions (16.7%) and mental health conditions (15.8%).
- Pregnancy-related deaths among Black non-Hispanic women and birthing people were primarily caused by cardiovascular conditions (22.2%), followed by embolism (18.5%) and hemorrhage (11.1%).
- Hemorrhage was the leading cause of pregnancy-related deaths for Hispanic and Asian or Pacific Islander women and birthing people, accounting for 31.3% and 30.0% of total pregnancy-related deaths, respectively.
- Mental health conditions were the leading cause of pregnancy-related deaths for white non-Hispanic women and birthing people.

[21] Among the nine overdose deaths, six (66.7%) involved an opioid. The number of opioid deaths were 0 (0.0%), 5 (71.4%) and 1 (100.0%) for Black non-Hispanic, Hispanic, and white women and birthing people, respectively.

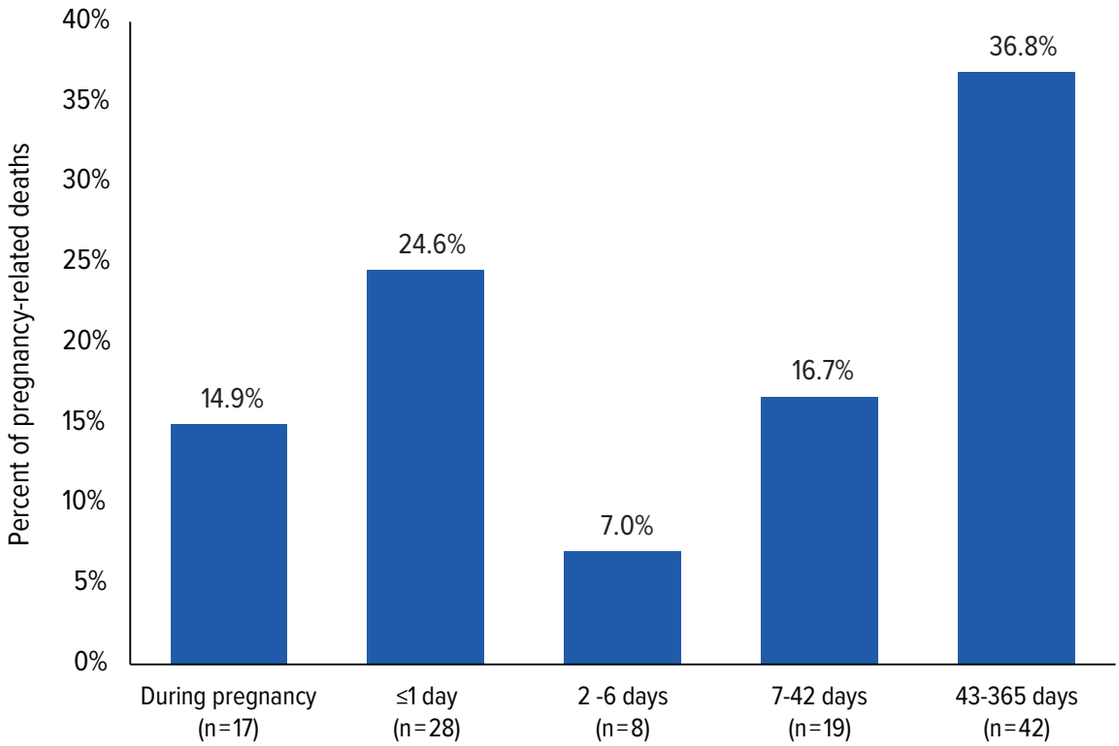
Location and Timing of Death

Figure 18. Percent Distribution of Pregnancy-Related Deaths by Location of Death, NYC, 2016-2020



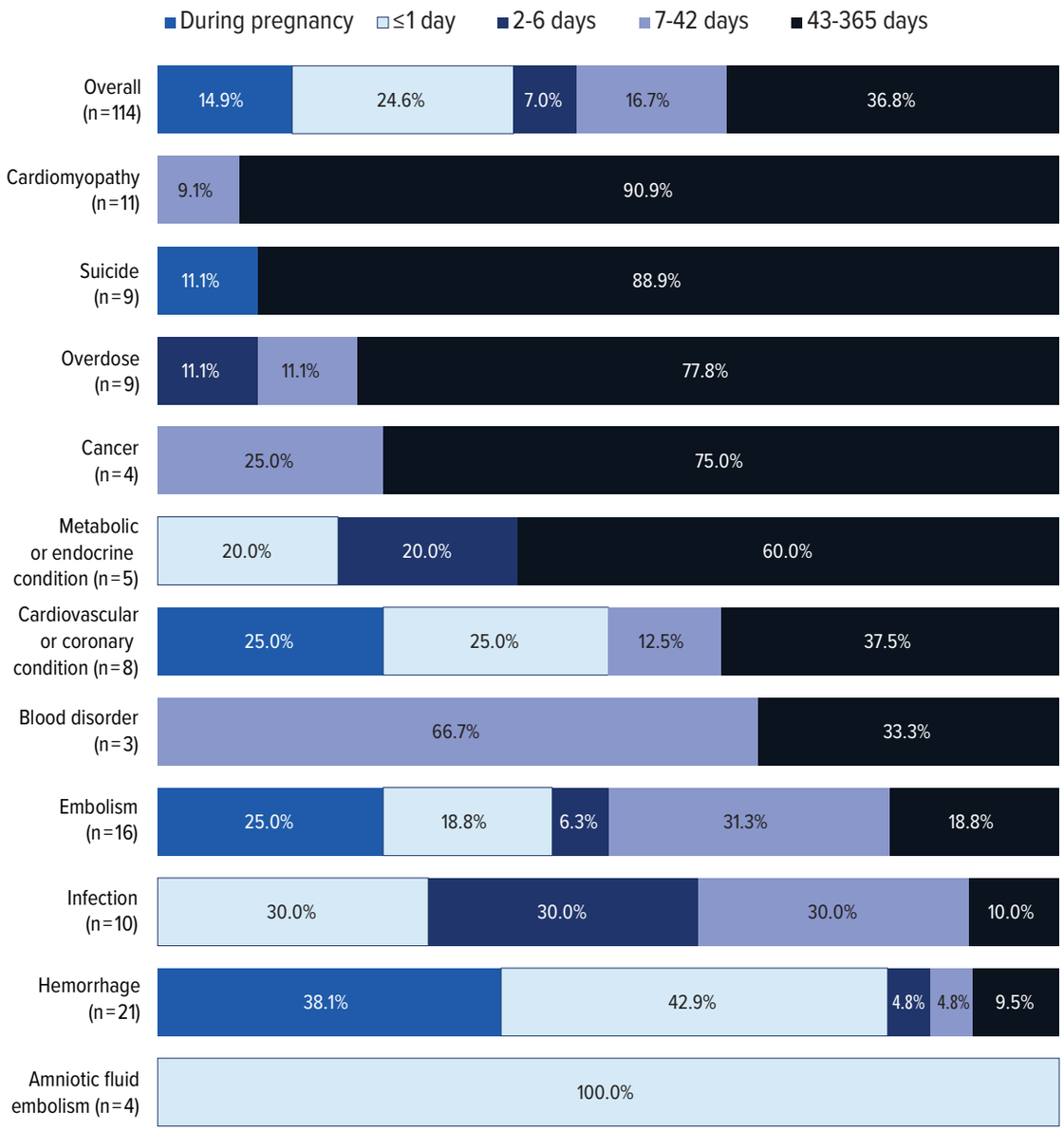
- The majority of pregnancy-related deaths occurred in the hospital (79.8%), either in the inpatient facility (59.6%) or in the emergency department (20.2%), while 20.2% occurred outside the hospital, either at home or at another location.

Figure 19. Percent Distribution of Pregnancy-Related Deaths by Interval Between End of Pregnancy and Death, NYC, 2016-2020



- Among all pregnancy-related deaths, 36.8% occurred 43 to 365 days after the end of pregnancy, 14.9% occurred during pregnancy and 24.6% occurred within one day after the end of pregnancy.

Figure 20. Percent Distribution of Timing of Death by Leading Causes of Pregnancy-Related Death, NYC, 2016-2020

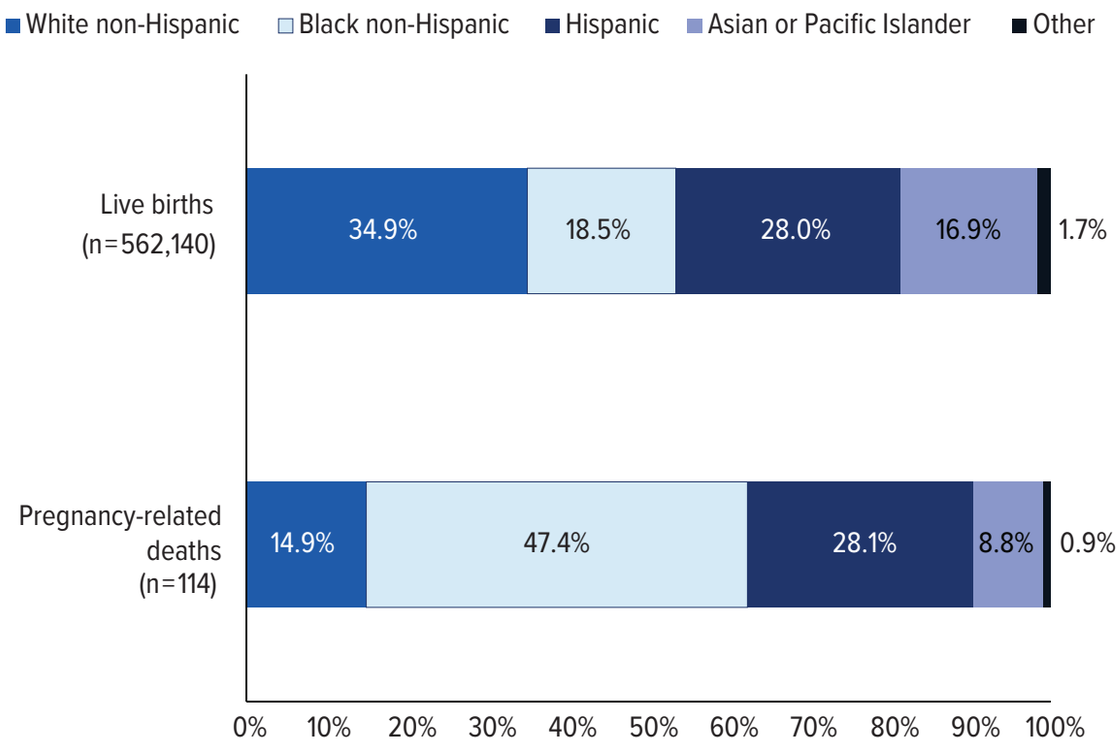


- Over three-quarters of pregnancy-related deaths due to cardiomyopathy (90.9%), suicide (88.9%), overdose (77.8%) and cancer (75.0%) occurred between 43 and 365 days after the end of pregnancy.
- Among hemorrhage deaths, 81.0% occurred during pregnancy (38.1%) or within one day after the end of pregnancy (42.9%).

Data not shown: During pregnancy and within one day after the end of pregnancy, hemorrhage accounted for 47.1 % and 32.1% of the pregnancy-related deaths, respectively. Infection was the leading cause of pregnancy-related deaths that occurred 2 to 6 days after the end of pregnancy, accounting for 37.5% of deaths. Embolism was the leading cause of pregnancy-related deaths that occurred 7 to 42 days after the end of pregnancy, at 26.3%. Cardiomyopathy was the leading cause of pregnancy-related deaths that occurred 43 to 365 days after the end of pregnancy, at 23.8%.

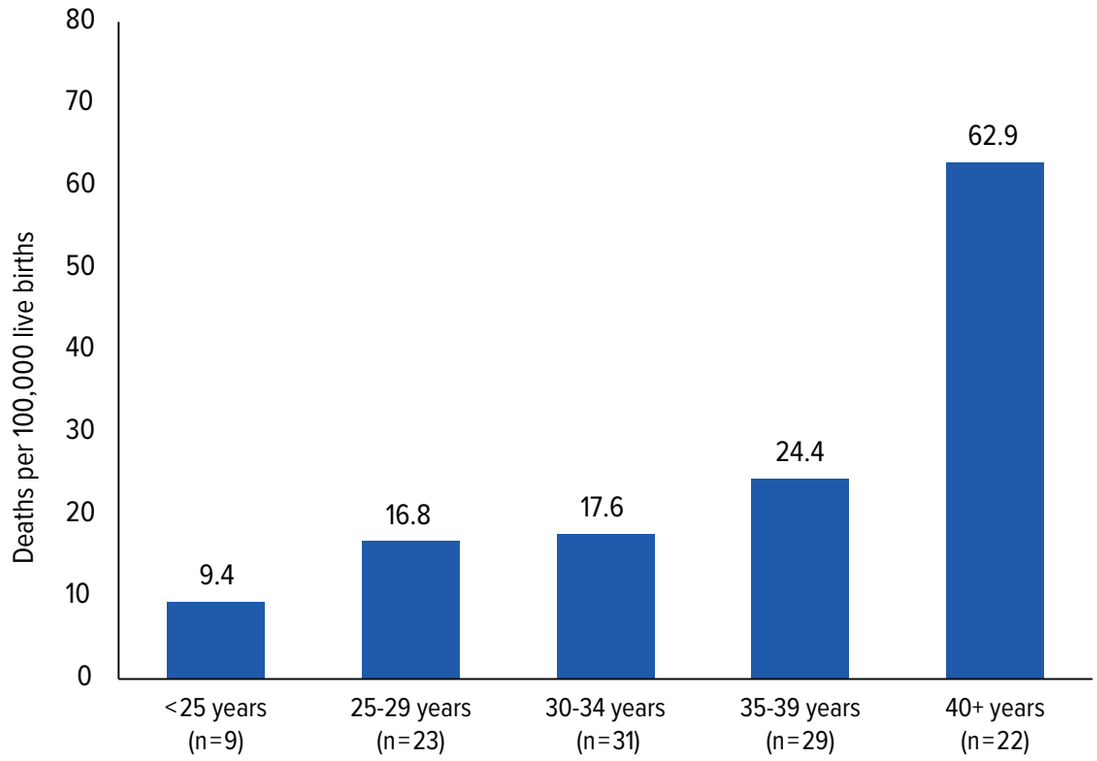
Demographic Characteristics

Figure 21. Percent Distribution of Pregnancy-Related Deaths and Live Births by Maternal Race and Ethnicity, NYC, 2016-2020



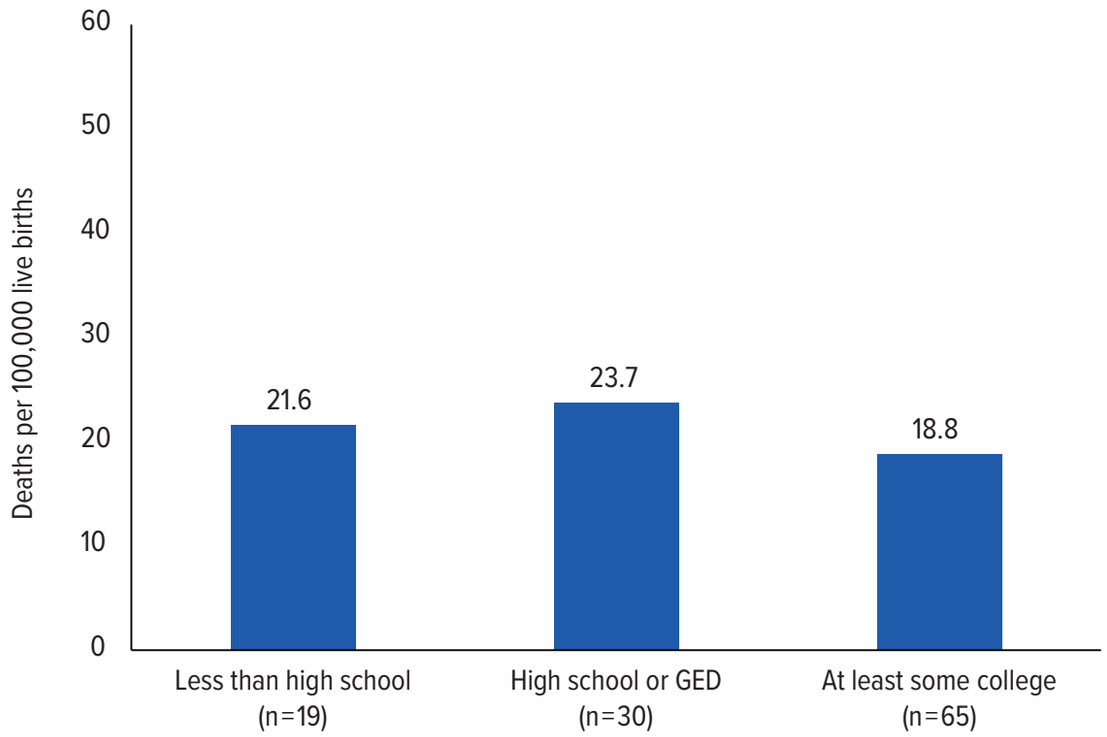
- In 2016-2020, Black non-Hispanic women and birthing people accounted for a disproportionately high percentage of pregnancy-related deaths (47.4%) compared with the percentage of live births (18.5%). By contrast, white non-Hispanic women and birthing people accounted for 34.9% of live births but only 14.9% of pregnancy-related deaths.

Figure 22. Pregnancy-Related Mortality Ratio by Maternal Age, NYC, 2016-2020



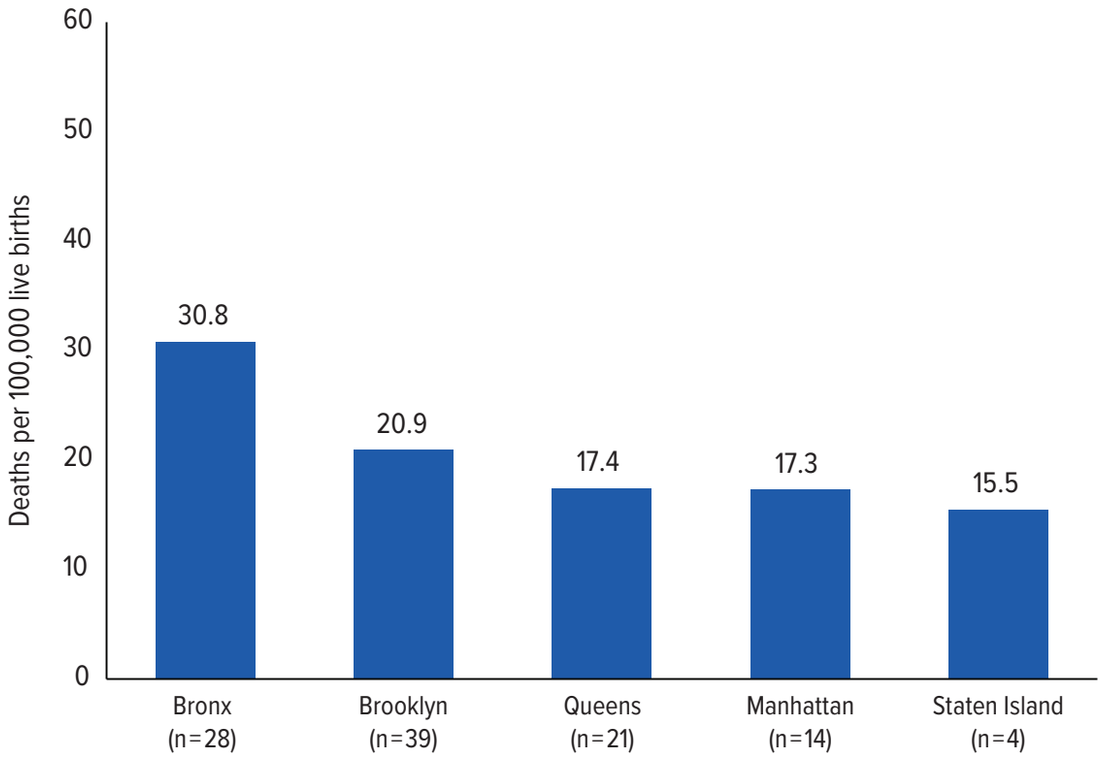
- The PRMR among women and birthing people age 40 and older was significantly higher than that of women and birthing people in any other age group.

Figure 23. Pregnancy-Related Mortality Ratio by Maternal Education, NYC, 2016-2020



- In 2016-2020, the PRMR among women and birthing people with at least some college was lowest (18.8 deaths per 100,000 live births). However, the differences among these categories were not statistically significant.

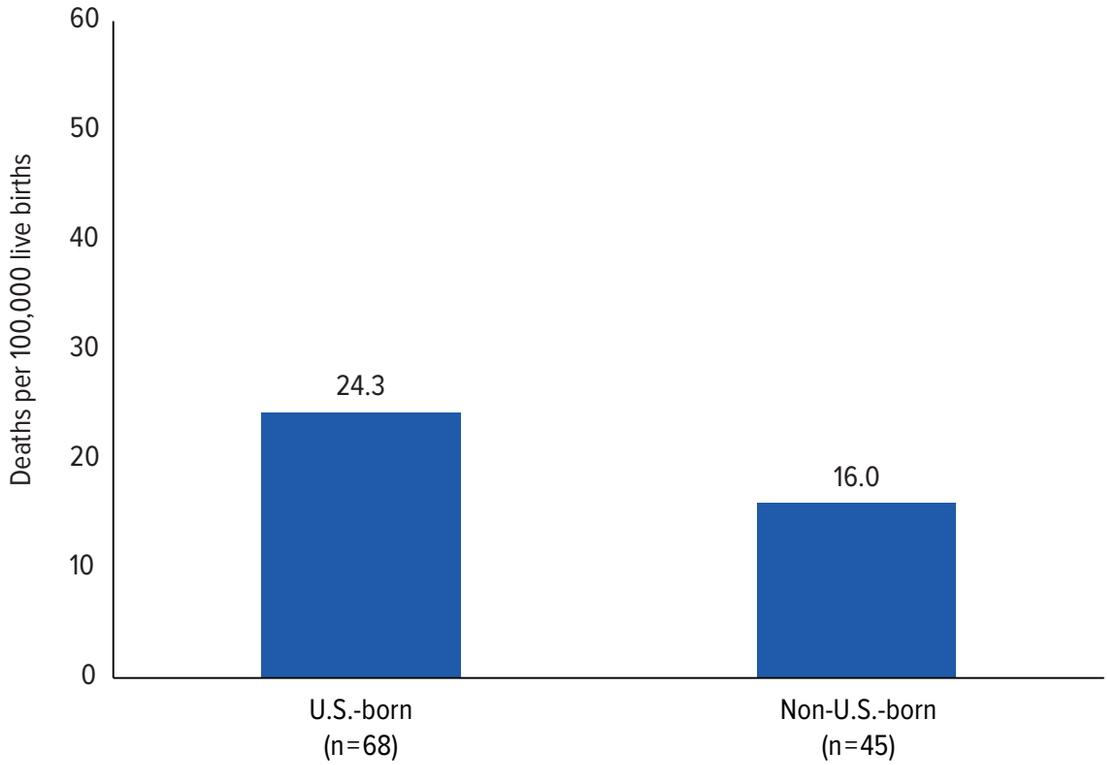
Figure 24. Pregnancy-Related Mortality Ratio by Maternal Borough of Residence, NYC, 2016-2020



Note: Out of the 114 pregnancy-related deaths that occurred in NYC in 2016-2020, eight were among NYS residents and are not shown.

- The Bronx had the highest PRMR (30.8 deaths per 100,000 live births), followed by Brooklyn (20.9), Queens (17.4), Manhattan (17.3) and Staten Island (15.5). However, there was no statistically significant difference in PRMRs across different boroughs of residence.

Figure 25. Pregnancy-Related Mortality Ratio by Maternal Nativity, NYC, 2016-2020

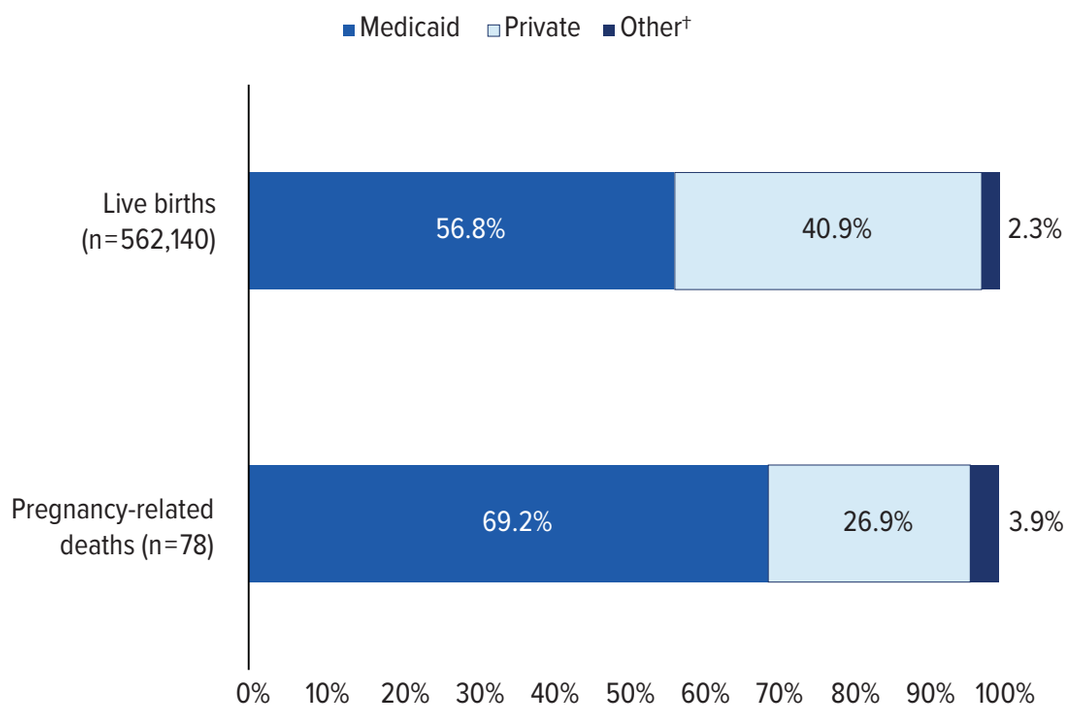


Note: Out of the 114 pregnancy-related deaths that occurred in 2016-2020, one decedent had no country-of-birth information on their birth or death certificate and is not shown.

- In 2016-2020, the PRMRs for U.S.-born women and birthing people and non-U.S.-born women and birthing people were 24.3 and 16.0 deaths per 100,000 live births, respectively. The difference was not statistically significant.

Prenatal and Clinical Characteristics

Figure 26. Percent Distribution of Pregnancy-Related Deaths and Live Births* by Insurance Type, NYC, 2016-2020



*In 2016-2020, out of a total of 114 pregnancy-related deaths, 84 had a live birth. Among these, 78 were linked to a corresponding birth certificate issued to the decedent in the year prior to death, which recorded their insurance type.

†Other Includes other government type, self-pay and unknown.

- In 2016-2020, the majority of pregnancy-related deaths with a live birth outcome (69.2%) were listed as having Medicaid coverage. During the same period, 56.8% of all live births were listed as having Medicaid coverage.

Table 8. Distribution of Pregnancy Outcomes Among Pregnancy-Related Deaths, NYC, 2016-2020

Pregnancy outcome	Pregnancy-related deaths	%
Live birth*	84	73.7
Vaginal	52	-
Cesarean	26	-
Unknown	6	-
Undelivered	11	9.6
Induced termination (ITOP)	3	2.6
Spontaneous termination (STOP)	6	5.3
Stillbirth (>20 weeks gestation)	4	3.5
Ectopic pregnancy	6	5.3
Total	**114**	**100.0**

*In 2016-2020, out of a total of 114 pregnancy-related deaths, 84 had a live birth. Among these, 78 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which recorded the method of birth. The method of birth for the remaining six deaths was unknown.

- The most common pregnancy outcome among pregnancy-related deaths was a live birth (73.7%).
- Among women and birthing people who had a live birth, 61.9% (52 out of 84) gave birth vaginally and 31.0% (26 out of 84) had a cesarean birth.

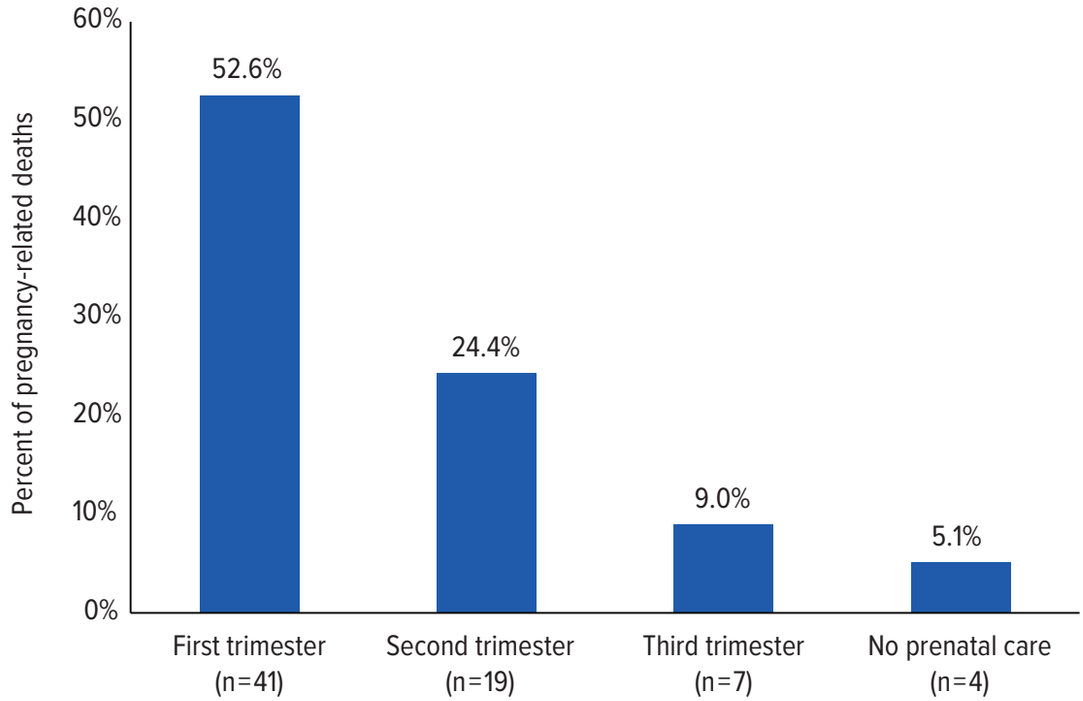
Table 9. Percent Distribution of Pregnancy-Related Deaths That Resulted in a Live Birth* by Number of Previous Live Births, NYC, 2016-2020

Number of previous live births	Pregnancy-related deaths	%
None	22	28.2
One	25	32.1
Two	15	19.2
Three or more	15	19.2
Unknown	1	1.3
Total	**78**	**100.0**

*In 2016-2020, out of a total of 114 pregnancy-related deaths, 84 had a live birth. Among these, 78 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which recorded the number of their previous live births.

- Among pregnancy-related deaths with a live birth outcome, 28.2% were to women and birthing people who had no previous live births, 32.1% were to women and birthing people who had one previous live birth, 19.2% were to women and birthing people who had two previous live births and 19.2% were to women and birthing people who had three or more previous live births.

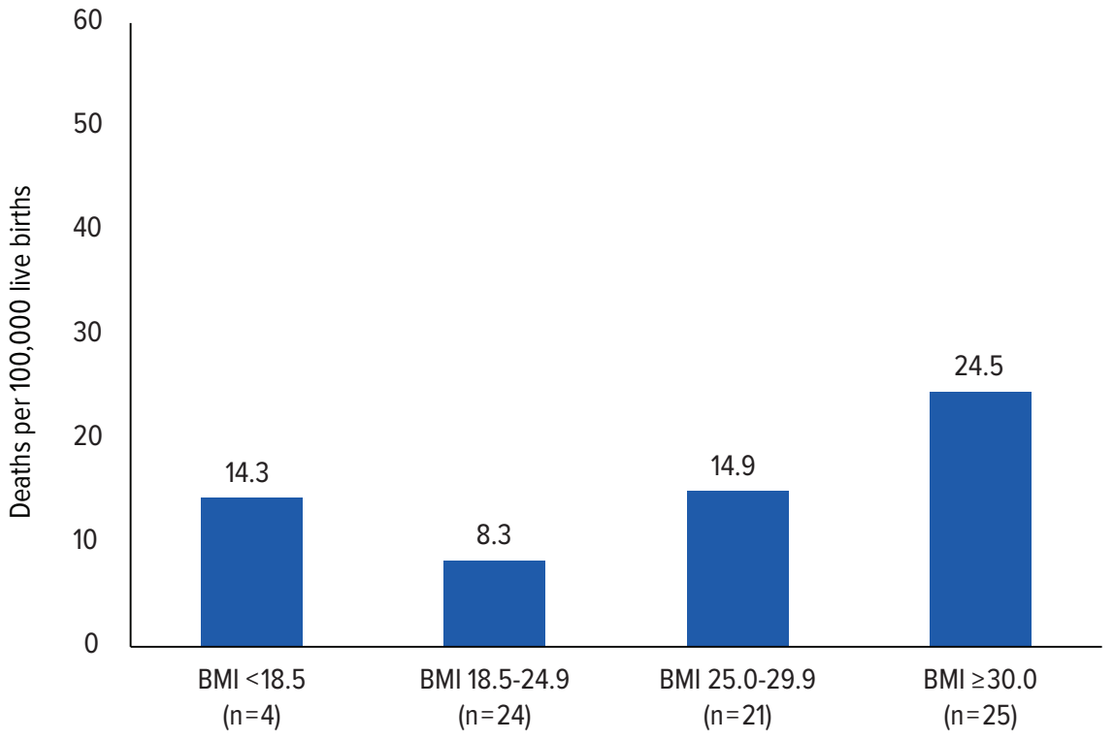
Figure 27. Percent Distribution of Pregnancy-Related Deaths With a Live Birth* by Trimester of Prenatal Care Initiation, NYC, 2016-2020



*In 2016-2020, out of a total of 114 pregnancy-related deaths, 84 had a live birth. Among these, 78 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death, which included information about the trimester when prenatal care was initiated. Out of these, seven (9%) had missing information for prenatal care initiation and are not shown.

- Among pregnancy-related deaths with a live birth outcome, 52.6% had initiated prenatal care within the first trimester and 77.0% had initiated prenatal care by the end of the second trimester.

Figure 28. Pregnancy-Related Mortality Ratio by Prepregnancy Body Mass Index (BMI), NYC, 2016-2020*



*In 2016-2020, out of a total of 114 pregnancy-related deaths, 84 had a live birth. Among these, 78 were linked to a corresponding birth certificate issued to the decedent in the year prior to their death. These birth certificates contained recorded information about pre-pregnancy weight and height, which were used to calculate pre-pregnancy BMI. Out of these, four had missing information for pre-pregnancy weight or height and are not shown.

- Among pregnancy-related deaths with a live birth, women and birthing people with a BMI of 30.0 or higher had a PAMR three times as high as those with a BMI from 18.5 to 24.9 (24.5 deaths per 100,000 live births compared with 8.3 per 100,000 live births). This difference was statistically significant.

Maternal Mortality Review Committee Findings

The NYC MMRC conducts in-depth reviews of case histories for each woman or birthing person's pregnancy-associated death (see Page 22 for more details), which are prepared in advance by clinical abstractors. Each case is read and discussed in detail, and the Committee determines whether the death was causally related to pregnancy, the underlying cause of death and whether there was a chance to alter the outcome (preventability). For preventable deaths, the Committee identifies key contributing factors to the death and specific feasible recommendations for action that should be taken to prevent future deaths. Additionally, for all pregnancy-associated deaths, the Committee determines whether any of four factors contributed to the death: discrimination, substance use disorder, mental health conditions and obesity.

Circumstances Contributing to Pregnancy-Associated Deaths

Table 10. Committee Determination on Discrimination as a Circumstance Contributing to Pregnancy-Associated Deaths by Maternal Race and Ethnicity, NYC, 2018-2020*

	Pregnancy-associated deaths (n=150)	Black non-Hispanic (n=69)	Hispanic (n=40)	White non-Hispanic (n=29)	Asian or Pacific Islander (n=11)
Yes	22.0%	29.0%	22.5%	10.3%	9.1%
Probably	28.0%	30.4%	27.5%	34.5%	0.0%
No	29.3%	18.8%	35.0%	34.5%	63.6%
Unknown	20.7%	21.7%	15.0%	20.7%	27.3%

*The Committee began assessing discrimination as a circumstance contributing to death in 2020, and it was therefore applied only to cases from 2018 onward, as deaths are reviewed with a two-year time lag.

Note: One out of 150 women or birthing people was classified as Other or unknown race and is not shown.

- Discrimination is defined as treating someone less or more favorably based on the group, class or category they belong to, resulting from biases, prejudices or stereotyping. The Committee included in their deliberations discussions of discrimination related to racism as well as other forms of discrimination such as ableism, and bias due to substance use or weight.
- Of the 150 pregnancy-associated deaths where discrimination was assessed, the Committee determined that discrimination contributed to 50.0% (Yes or Probably).
- Among Black non-Hispanic women and birthing people, the Committee determined that discrimination was a contributing factor in 59.4% (Yes or Probably) of deaths, compared with 44.8% (Yes or Probably) among white non-Hispanic women and birthing people.

Table 11. Committee Determination on Obesity as a Circumstance Contributing to Pregnancy-Associated Deaths by Maternal Race and Ethnicity, NYC, 2016-2020

	Pregnancy-associated deaths (n=241)	Black non-Hispanic (n=105)	Hispanic (n=65)	White non-Hispanic (n=47)	Asian or Pacific Islander (n=20)
Yes	12.9%	20.0%	10.8%	6.4%	0.0%
Probably	5.4%	8.6%	4.6%	2.1%	0.0%
No	78.4%	66.7%	81.5%	89.4%	100.0%
Unknown	3.3%	4.8%	3.1%	2.1%	0.0%

Note: Four out of 241 women and birthing people were classified as Other or unknown race and are not shown.

- Among the 241 pregnancy-associated deaths overall, the MMRC determined that obesity contributed to 18.3% (Yes or Probably).
- The Committee determines whether obesity contributed to the death, and not just whether the person was obese.
- The Committee determines that obesity contributed to the death when the condition directly compromised an individual's health or health care.

Table 12. Committee Determination on Substance Use Disorder as a Circumstance Contributing to Pregnancy-Associated Deaths by Maternal Race and Ethnicity, NYC, 2016-2020

	Pregnancy-associated deaths (n=241)	Black non-Hispanic (n=105)	Hispanic (n=65)	White non-Hispanic (n=47)	Asian or Pacific Islander (n=20)
Yes	15.4%	9.5%	15.4%	36.2%	0.0%
Probably	2.9%	3.8%	3.1%	2.1%	0.0%
No	77.6%	81.9%	76.9%	57.4%	100.0%
Unknown	4.1%	4.8%	4.6%	4.3%	0.0%

Note: Four out of 241 women and birthing people were classified as Other or unknown race and are not shown.

- Among the 241 pregnancy-associated deaths overall, the MMRC determined that substance use disorder contributed to 18.3% (Yes or Probably).
- The Committee determines whether substance use disorder contributed to the death, and not just whether the individual had substance use disorder.
- Substance use disorder is characterized by recurrent use of alcohol or drugs causing clinically and functionally significant impairment.
- The Committee determines that substance use disorder contributed to the death when it directly compromised an individual's health or health care.

Table 13. Committee Determination on Mental Health Conditions Other Than Substance Use Disorder as a Circumstance Contributing to Pregnancy-Associated Deaths by Maternal Race and Ethnicity, NYC, 2016-2020

	Pregnancy-associated deaths (n=241)	Black non-Hispanic (n=105)	Hispanic (n=65)	White non-Hispanic (n=47)	Asian or Pacific Islander (n=20)
Yes	19.9%	15.2%	21.5%	31.9%	15.0%
Probably	5.4%	8.6%	1.5%	6.4%	0.0%
No	63.5%	64.8%	63.1%	51.1%	85.0%
Unknown	11.2%	11.4%	13.8%	10.6%	0.0%

Note: Four out of 241 women and birthing people were classified as Other or unknown race and are not shown.

- Among the 241 pregnancy-associated deaths overall, the MMRC determined that mental health conditions other than substance use disorder contributed to 25.3% (Yes or Probably).
- The Committee determines whether a mental health condition other than substance use disorder contributed to the death, and not just whether the person had a mental health condition.
- Mental health conditions are defined as present when the individual had a documented diagnosis of a psychiatric disorder. This includes depressive, anxiety, psychotic and bipolar disorders. If documented diagnosis is not available, the Committee consults subject matter experts to determine whether the criteria for diagnosis of a mental health condition was met.
- The Committee determines that a mental health condition is a circumstance that contributed to the death when the condition directly compromised an individual's health or health care.

Preventability

A death is considered preventable by the Committee if there was at least some chance of the death being averted by one or more reasonable changes to factors at any of five levels:

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

Table 14. Pregnancy-Associated Death Preventability by Maternal Race and Ethnicity, NYC, 2016-2020

	Pregnancy-associated deaths		Pregnancy-related deaths	
	n	%	n	%
Preventable	151	62.7	85	74.6
Good chance	57		33	
Some chance	94		52	
Not preventable	50	20.7	14	12.3
Unable to determine	40	16.6	15	13.2
Total	**241**	**100.0**	**114**	**100.0**

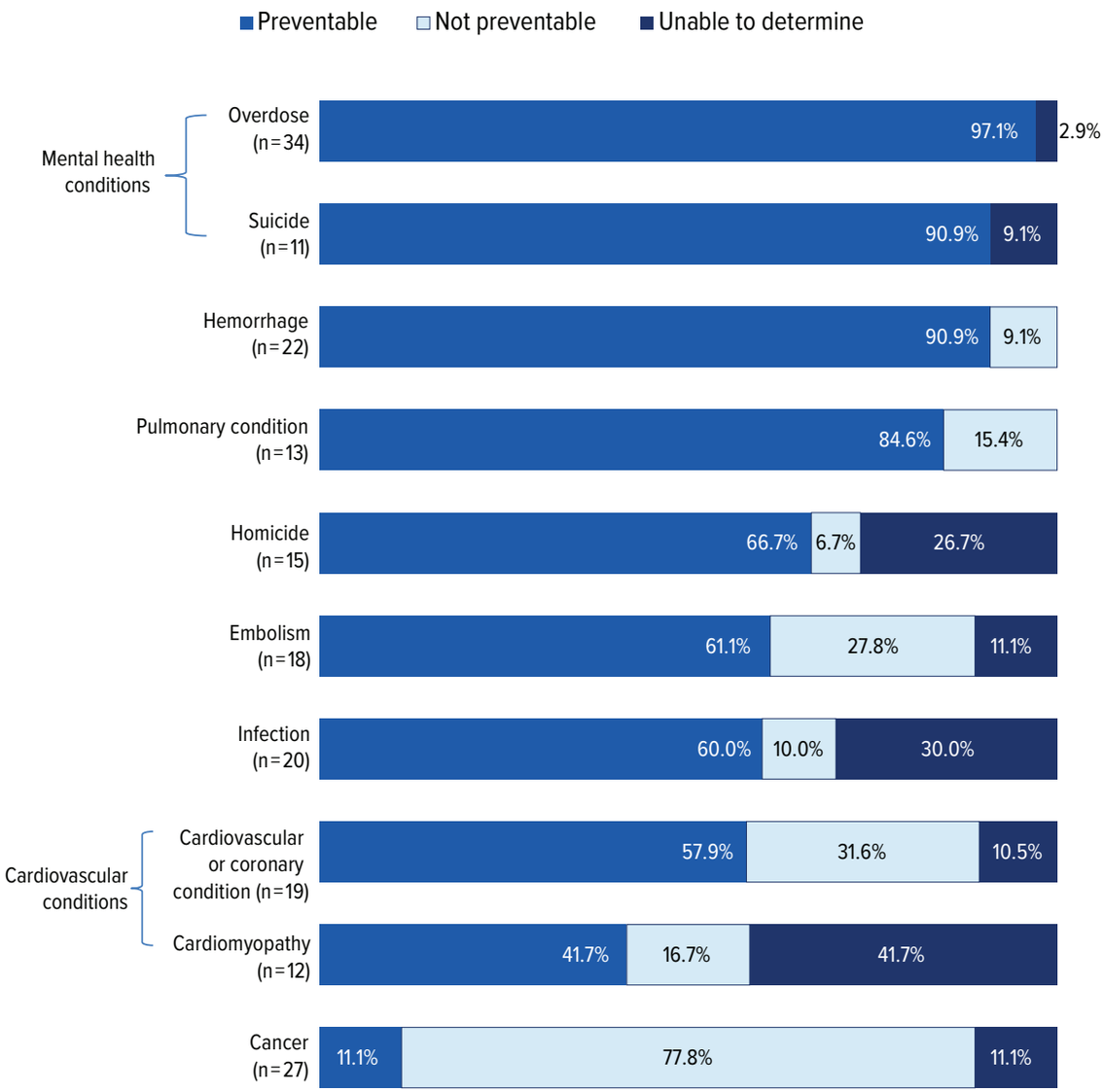
Table 14. Pregnancy-Associated Death Preventability by Maternal Race and Ethnicity, NYC, 2016-2020 (Continued)

	Black non-Hispanic		Hispanic		White non-Hispanic		Asian or Pacific Islander	
	n	%	n	%	n	%	n	%
Preventable	72	68.6	46	70.8	24	51.1	6	30.0
Good chance	28		18		7		2	
Some chance	44		28		17		4	
Not preventable	15	14.3	10	15.4	16	34.0	8	40.0
Unable to determine	18	17.1	9	13.8	7	14.9	6	30.0
Total	**105**	**100.0**	**65**	**100.0**	**47**	**100.0**	**20**	**100.0**

Note: Four out of 241 women and birthing people were classified as Other or unknown race and are not shown.

- Overall, the MMRC determined that 62.7% of pregnancy-associated deaths and 74.6% of pregnancy-related deaths were preventable.

Figure 29. Leading Causes of Death by Preventability Among Pregnancy-Associated Deaths, NYC, 2016-2020



- A death is considered preventable by the Committee if there was at least some chance of the death being averted by one or more reasonable changes to factors at any of five levels: system, facility, provider, patient or family, and community.
- Over 90% of deaths due to mental health conditions (overdose or suicide) and hemorrhage were considered preventable by the Committee.
- Among deaths due to pulmonary conditions (n=13), 84.6% were considered preventable. Among the 11 preventable deaths due to pulmonary conditions, 9 were due to asthma.

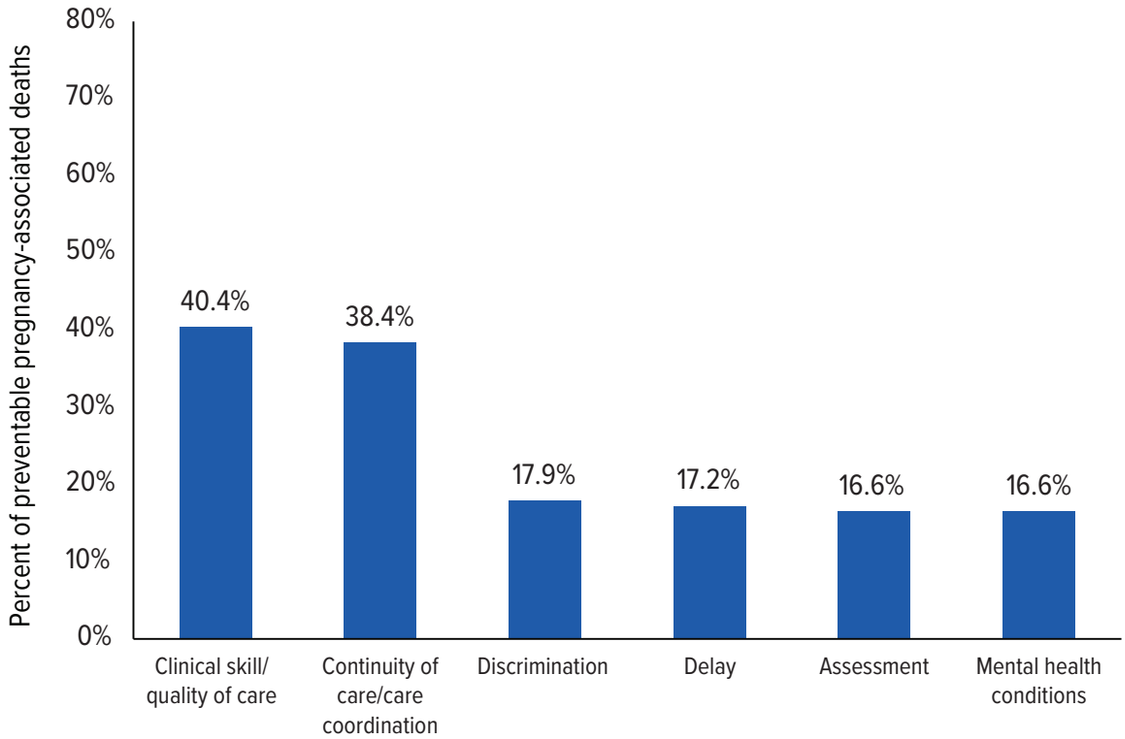
Contributing Factors for Preventable Pregnancy-Associated Deaths

When the MMRC determines that a death is preventable, they identify key contributing factors that led to the death. This section focuses only on these contributing factors to preventable deaths. A list of contributing factors considered by the Committee is available in Appendix A (see Table 16 on Page 87). In May 2020, the CDC added three new contributing factors: discrimination, interpersonal racism and structural racism. Therefore, these factors may be seen only in deaths that were reviewed after that date.

In 2016-2020, the Committee chose from a list of 28 contributing factors. A single pregnancy-associated death may be associated with multiple contributing factors.[22] The contributing factors below are presented by level as well as leading cause of death, with a focus on the top causes of preventable deaths: mental health conditions, cardiovascular conditions, hemorrhage, embolism, pulmonary conditions and infection.

Class of Contributing Factors for Preventable Pregnancy-Associated Deaths

Figure 30. Contributing Factors Among Preventable Pregnancy-Associated Deaths, NYC, 2016-2020

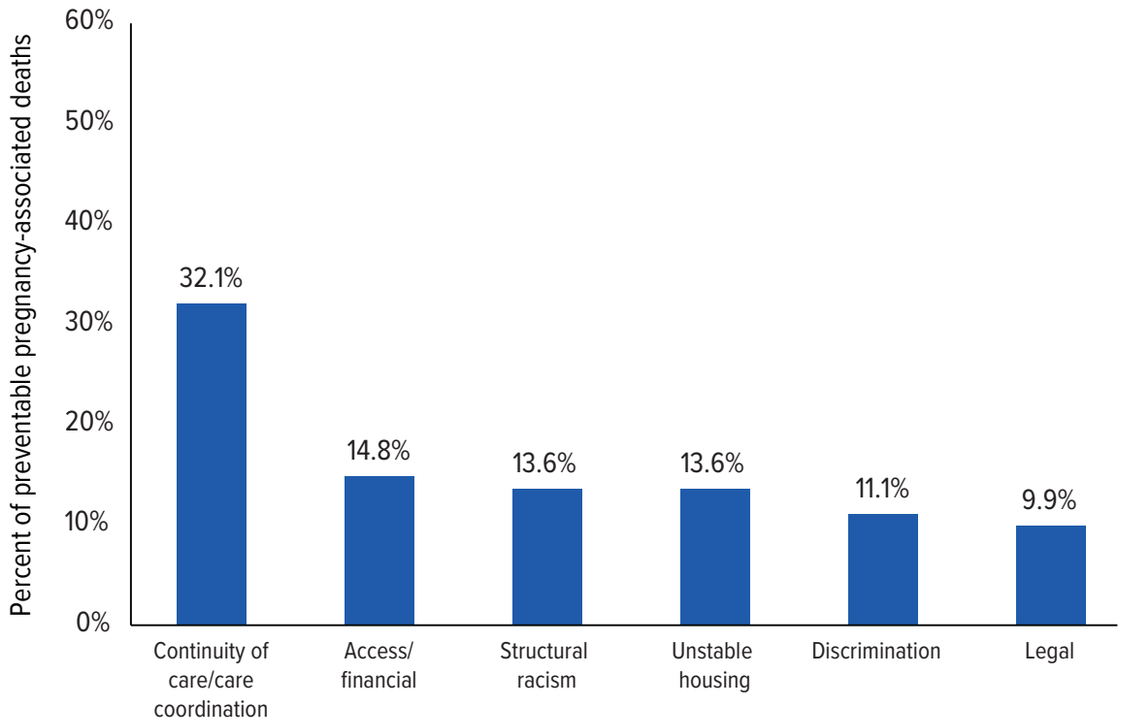


Note: Each pregnancy-associated death may be associated with multiple contributing factors. See Appendix A, Table 16 on Page 87 for descriptions of contributing factors.

- The top contributing factors across all 151 preventable deaths were clinical skill/quality of care (40.4%) and lack of continuity of care/care coordination (38.4%).
- Discrimination was named as a contributing factor in nearly one-fifth of all preventable deaths (17.9%). This could be an underestimate, as this was only added as a factor in May 2020.

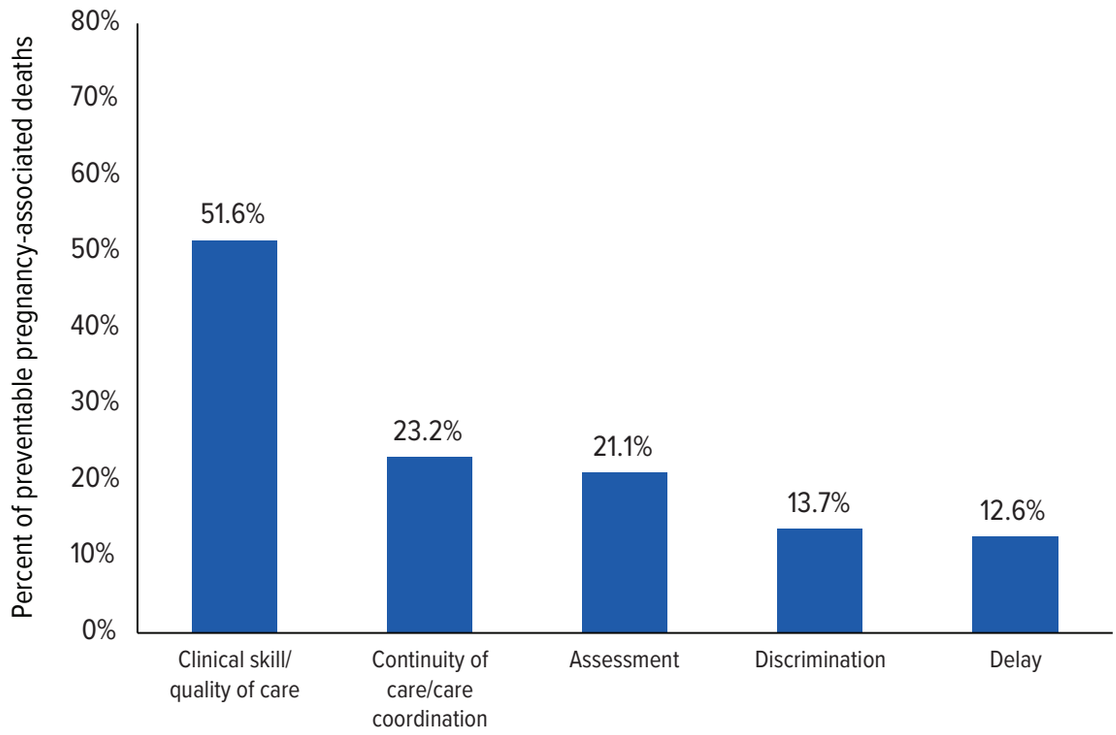
[22] See Appendix A, Table 16 on Page 87: CDC Contributing Factor Descriptions for Maternal Mortality Review Committee Decision Form.

Figure 31. System-Level Contributing Factors Among Preventable Pregnancy-Associated Deaths, NYC, 2016-2020



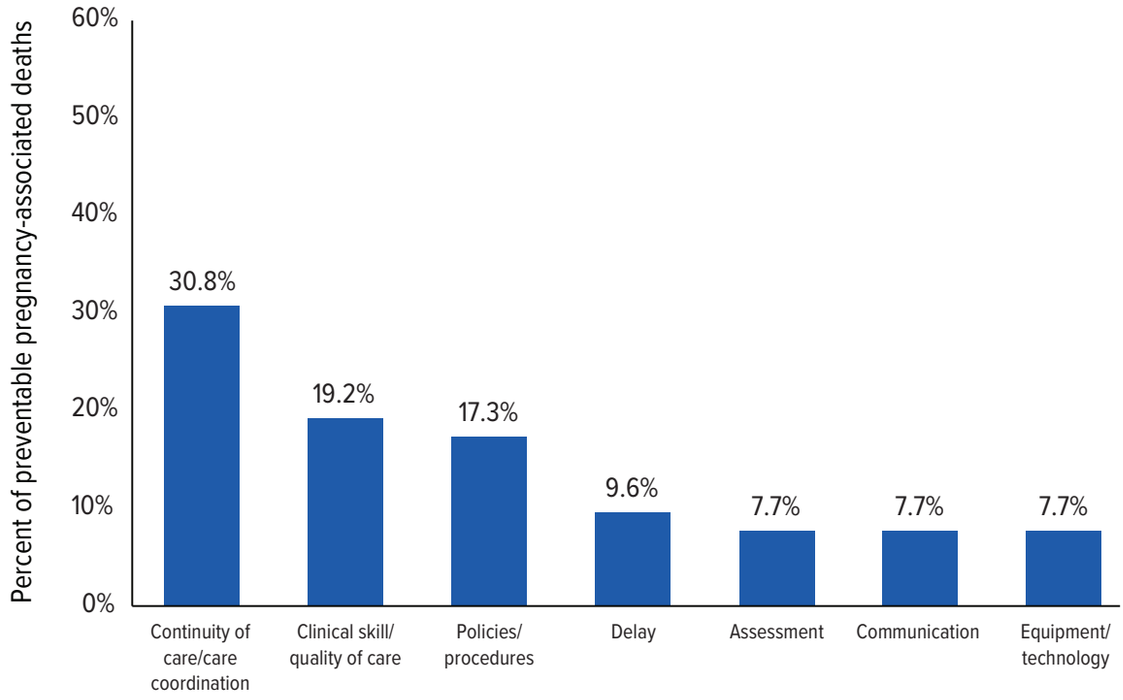
- There were 81 preventable deaths with contributing factors at the system level. The most prominent contributing factor among these was lack of continuity of care/care coordination, which was present in 32.1% of the 81 deaths.
- Examples of lack continuity of care/care coordination at the system level that contributed to these deaths include: lack of continuity of care and communication between substance use, mental health and medical treatment providers; missed opportunity to discuss reproductive life goals in the context of chronic condition; and lack of case coordination across multiple ER visits.
- The percentages of cases where structural racism and discrimination were identified could be underestimates as these were only added as contributing factors in May 2020.

Figure 32. Provider-Level Contributing Factors Among Preventable Pregnancy-Associated Deaths, NYC, 2016-2020



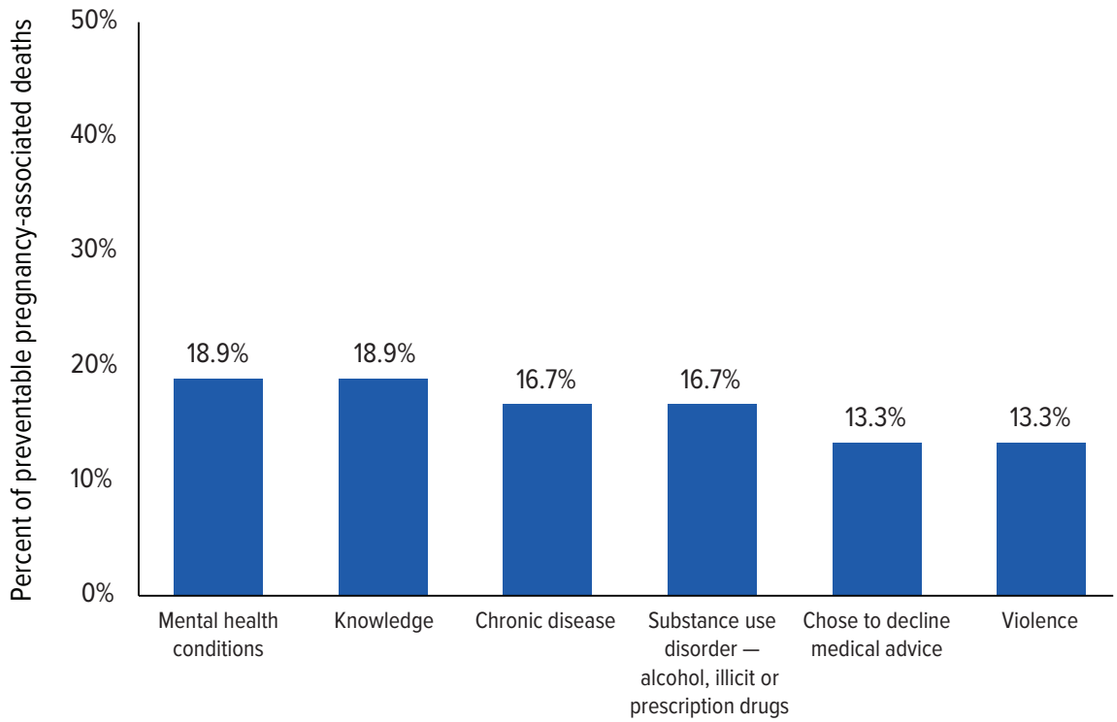
- There were 95 preventable deaths with contributing factors at the provider level.
- Clinical skill/quality of care was a contributing factor in half (51.6%) of these 95 preventable deaths.
- Examples of clinical skill/quality of care issues at the provider level that contributed to these deaths include: failure to recognize signs and symptoms of pulmonary embolism; delay of timing of interventions (transfusion, hysterectomy); multiple negative interactions with medical staff, reinforcing barriers to accessing care; neglect of woman or birthing person's symptoms.
- The percentage of cases where discrimination was identified could be an underestimate as this was only added as a factor in May 2020.

Figure 33. Facility-Level Contributing Factors Among Preventable Pregnancy-Associated Deaths, NYC, 2016-2020



- There were 52 preventable deaths identified with contributing factors at the facility level.
- Lack of continuity of care or care coordination was the top factor, contributing to 30.8% of the deaths.
- Examples of lack of continuity of care or care coordination at the facility level that contributed to these deaths include: uncoordinated care from multiple hospitals after hospital discharge; lack of provider access to full medical record; lack of chronic disease management; inadequate follow-up on mental health or substance use issues after discharge.

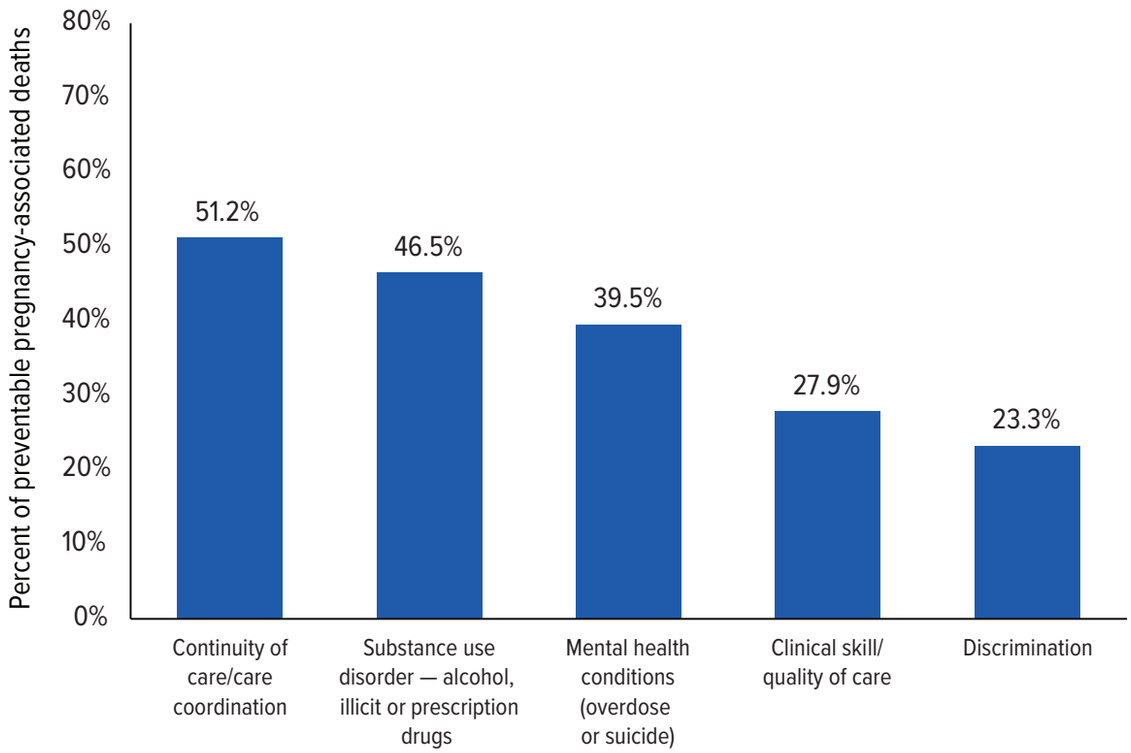
Figure 34. Patient/Family- or Community-Level Contributing Factors Among Preventable Pregnancy-Associated Deaths, NYC, 2016-2020



- There were 90 preventable deaths identified with contributing factors at the patient, family or community level.
- Mental health conditions and gaps in knowledge were identified as the top contributors, each observed in 18.9% of the 90 deaths.
- Examples of gaps in knowledge at the patient, family or community level that contributed to these deaths included: woman or birthing person may not have been aware of or educated about warning signs of ectopic pregnancy, preeclampsia, DVT (deep vein thrombosis) or pulmonary embolism or safety around using medications for mental health conditions during pregnancy.

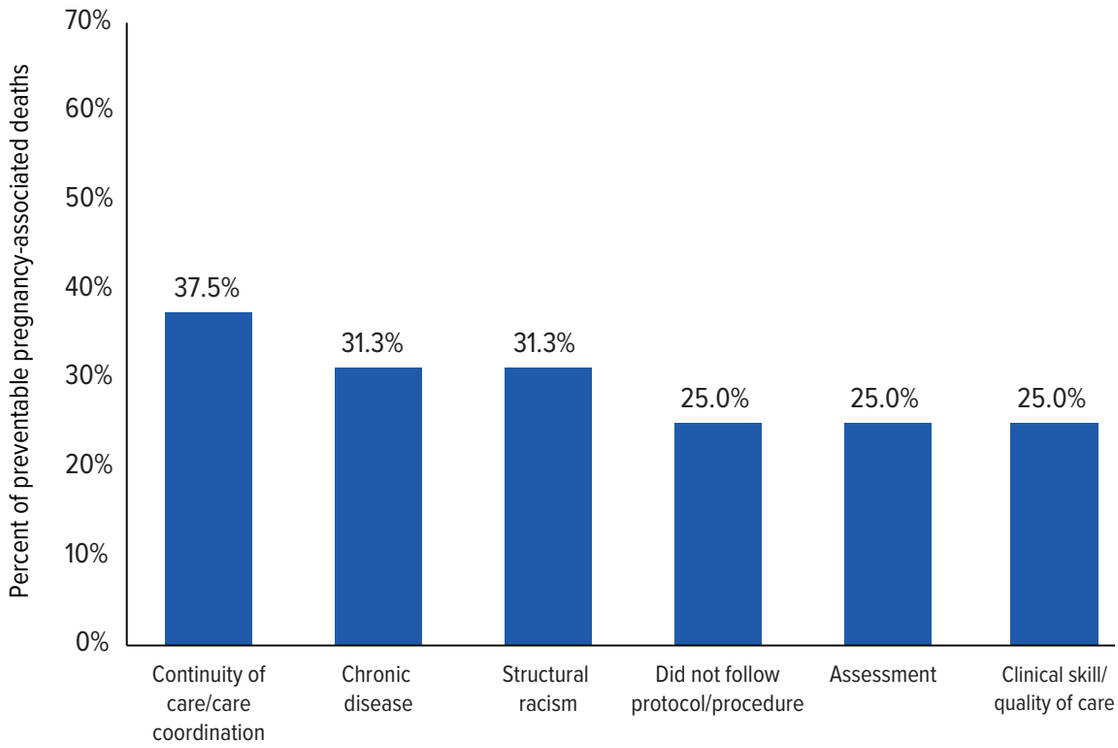
Class of Contributing Factors by Top Causes of Preventable Deaths

Figure 35. Contributing Factors Among Preventable Deaths Due to Mental Health Conditions, NYC, 2016-2020



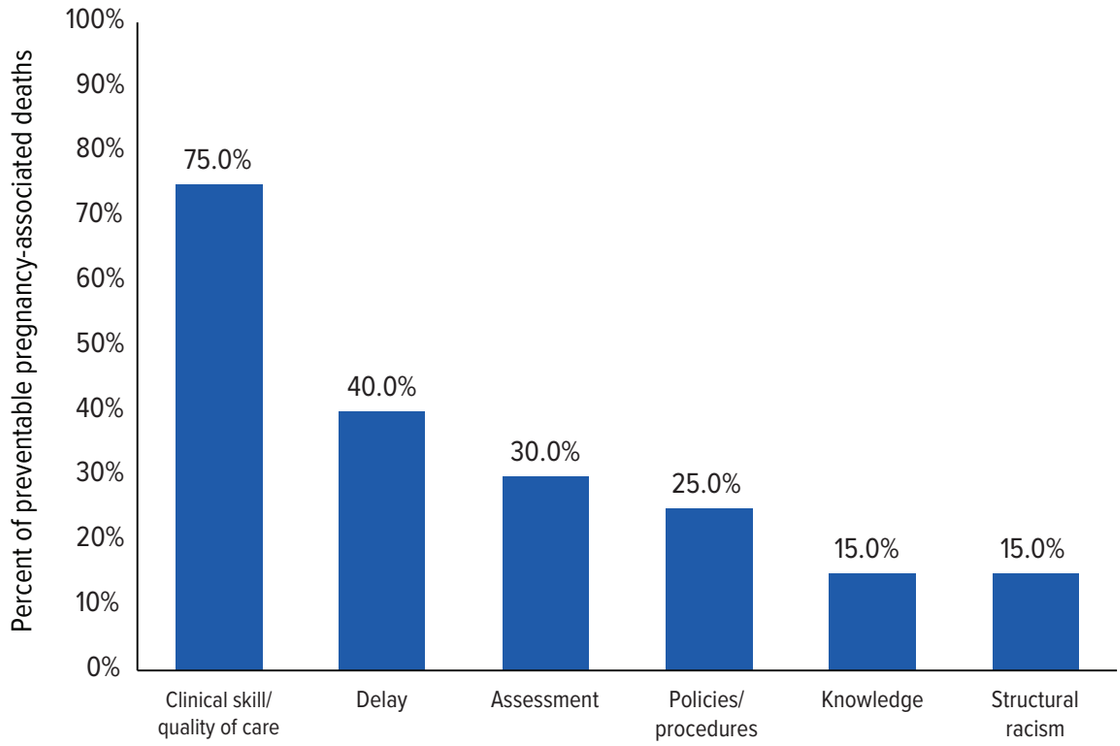
- Among the 43 preventable deaths due to mental health conditions, the top contributing factor was lack of continuity of care/care coordination, observed in over half of these deaths (51.2%), followed closely by substance use disorder (46.5%).
- The percentage of cases where discrimination was identified could be an underestimate as this was only added as a factor in May 2020.

Figure 36. Contributing Factors Among Preventable Deaths Due to Cardiovascular Conditions, NYC, 2016-2020



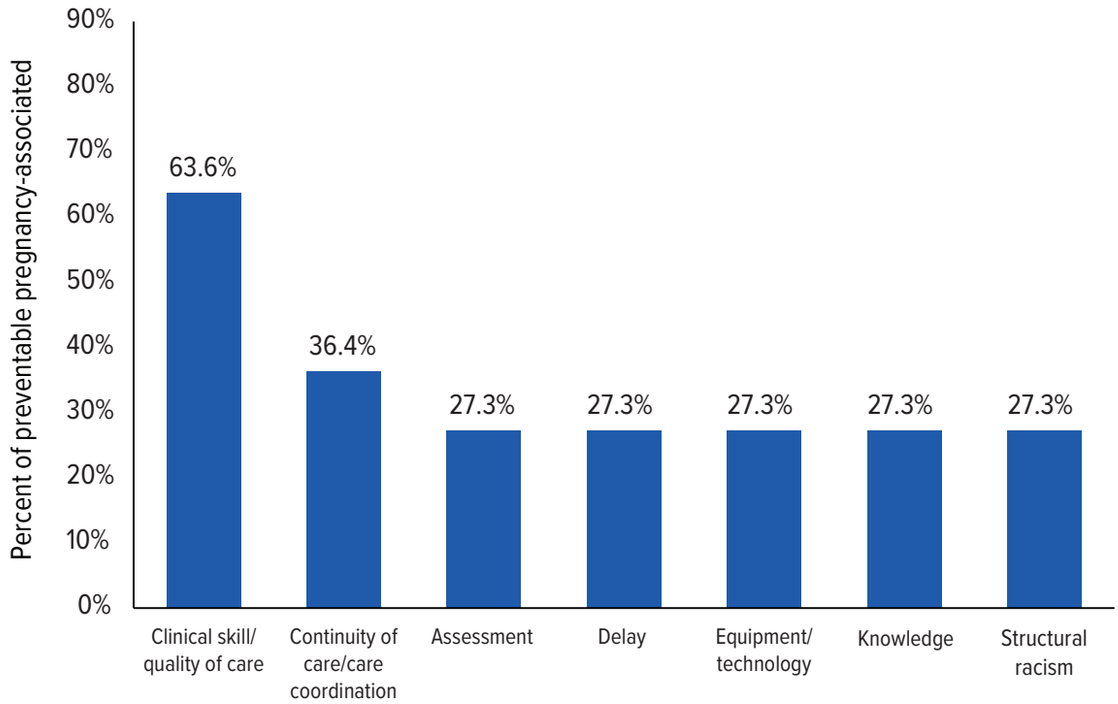
- Among the 16 preventable deaths due to cardiovascular conditions, the primary contributing factor was lack of continuity of care/care coordination, observed in 37.5% of these deaths. Chronic disease and structural racism each contributed to 31.3% of the deaths.
- The percentage of cases where structural racism was identified could be an underestimate as this was only added as a factor in May 2020.

Figure 37. Contributing Factors Among Preventable Deaths Due to Hemorrhage, NYC, 2016-2020



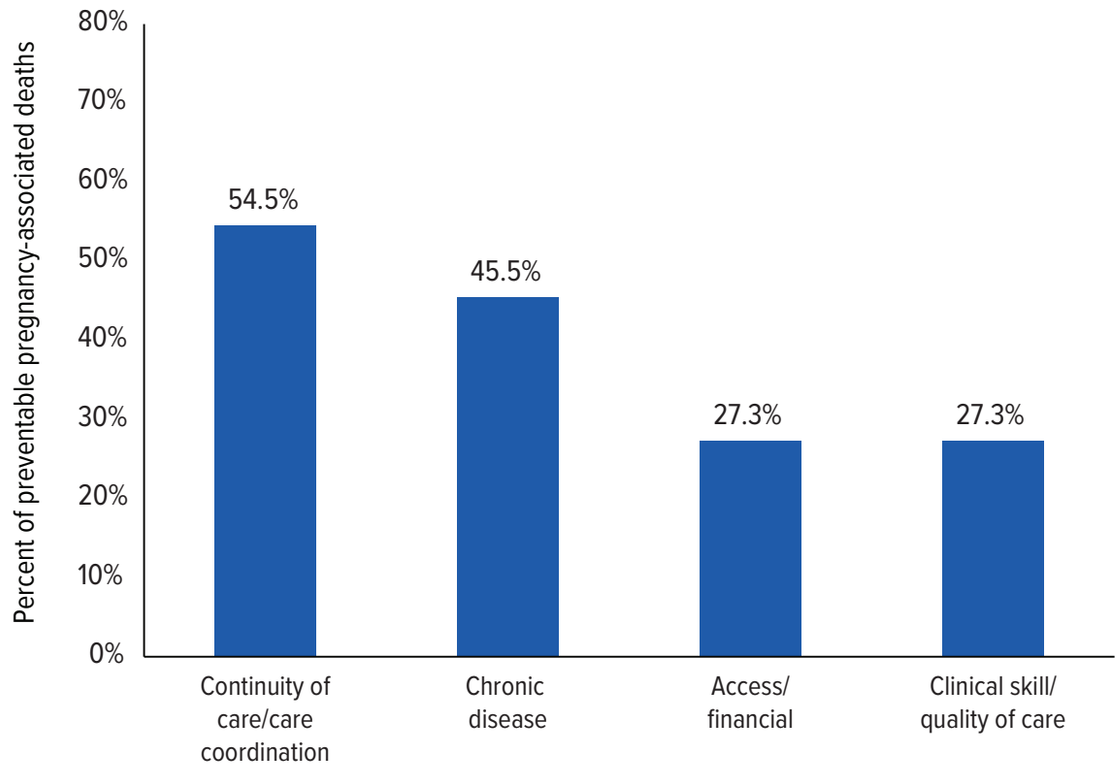
- Among the 20 preventable deaths attributed to hemorrhage, clinical skill/quality of care was a contributing factor in 75.0% of deaths, while delay contributed to 40.0%.
- The percentage of cases where structural racism was identified could be an underestimate as this was only added as a factor in May 2020.

Figure 38. Contributing Factors Among Preventable Deaths Due to Embolism, NYC, 2016-2020



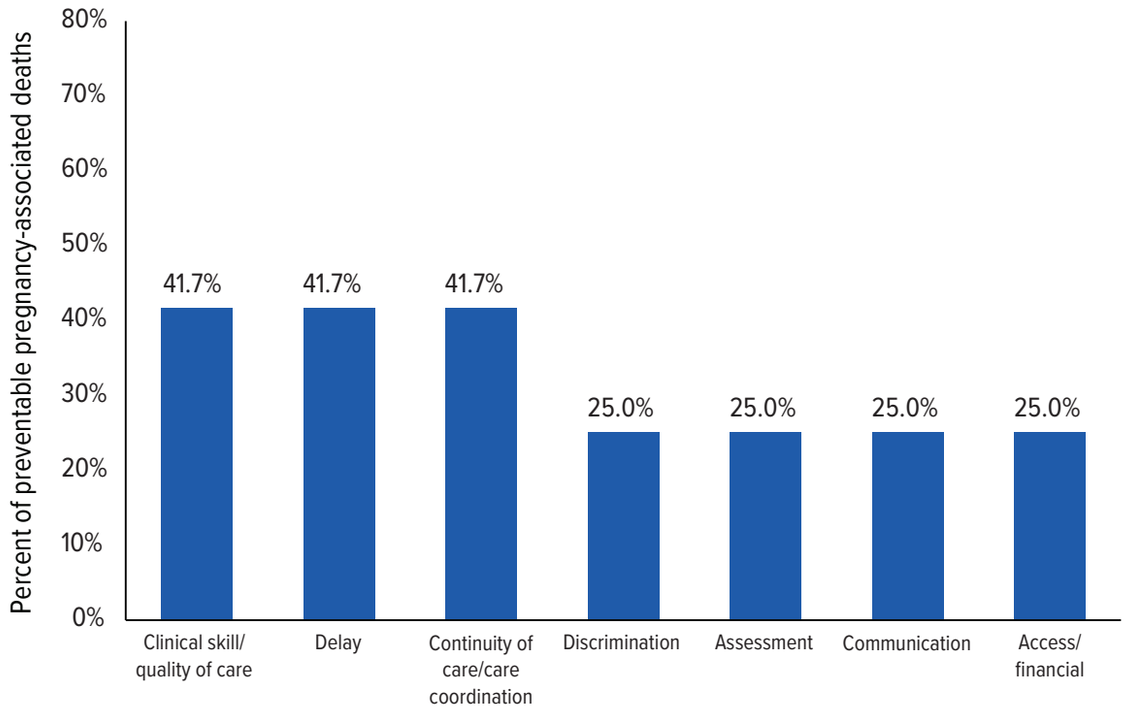
- Among the 11 preventable deaths due to embolism, clinical skill/quality of care was identified as a contributing factor in 63.6% of deaths.
- The percentage of cases where structural racism was identified could be an underestimate as this was only added as a factor in May 2020.

Figure 39. Contributing Factors Among Preventable Deaths Due to Pulmonary Conditions, NYC, 2016-2020



- Among the 11 preventable deaths due to pulmonary conditions, lack of continuity of care/care coordination was the most common contributing factor, contributing to 54.5% of these deaths, while chronic disease contributed to 45.5%.

Figure 40. Contributing Factors Among Preventable Deaths Due to Infections, NYC, 2016-2020



- Among 12 preventable deaths from infection, the top contributing factors were clinical skill/quality of care, delay, and lack of continuity of care/care coordination, each contributing to 41.7% of these deaths.
- The percentage of cases where discrimination was identified could be an underestimate as this was only added as a factor in May 2020.

Conclusion

This report is the first five-year maternal mortality report created in collaboration with the NYC Health Department's citywide, multidisciplinary, multiracial Maternal Mortality Review Committee. The Committee is composed of clinical and nonclinical experts, representing all five NYC boroughs and a wide range of experience — community activists, doulas, midwives, nurses, maternal-fetal medicine specialists, cardiologists, oncologists, psychiatrists, ob-gyns, first responders, and human rights and reproductive justice advocates.

The work of the Committee enabled the NYC Health Department to publish this report based on the review of 241 deaths that occurred in 2016-2020. For the first time, this report includes key Committee determinations about these deaths, including preventability, and key contributing factors, as well as determinations around whether discrimination, substance use disorder, obesity and mental health conditions contributed to the deaths and key recommendations to prevent future deaths. The deep and thorough work of the Committee allowed for this new level of detail, which represents an advance in the surveillance and reporting of this crucial problem.

Most importantly, based on their careful, painstaking review of all 241 deaths that occurred in 2016-2020, the Committee made 36 recommendations, plus an additional 12 recommendations related to mental health conditions based on the review of 58 deaths that occurred in 2021. These 48 recommendations are a call to action for all people in NYC working to end preventable maternal mortality and eliminate racial and ethnic disparities in these deaths. The 48 recommendations are for a wide variety of stakeholders — governments, health departments, professional organizations, hospital systems, birthing facilities, insurers and community-based organizations — and are a blueprint for all who are developing programs and policies to reduce maternal mortality.

It is necessary to make these 48 recommendations actionable and implement them across the city. We must keep in mind the goal of eliminating racial, ethnic and other inequities and focus on Black non-Hispanic people and other communities who disproportionately carry the burden of the deaths, such as those who are unstably housed or those with substance use disorder. We hope the detail and wide range of the recommendations will allow the city to create a clear plan to begin to move forward with this important work.

Appendix A. Methodology Notes

Table 15. Pregnancy Mortality Surveillance System Codes (PMSS)

CDC underlying cause of death category	PMSS code and cause of death description
Hemorrhage	10.1 - Hemorrhage – Uterine Rupture
	10.2 - Placental Abruption
	10.3 - Placenta Previa
	10.4 - Ruptured Ectopic Pregnancy
	10.5 - Hemorrhage – Uterine Atony/Postpartum Hemorrhage
	10.6 - Placenta Accreta/Increta/Percreta
	10.7 - Hemorrhage due to Retained Placenta
	10.10 - Hemorrhage – Laceration/Intra-Abdominal Bleeding
	10.9 - Other Hemorrhage/NOS
Infection	20.1 - Postpartum Genital Tract (for example, of the Uterus/Pelvis/Perineum/Necrotizing Fasciitis)
	20.2 - Sepsis/Septic Shock
	20.4 - Chorioamnionitis/Antepartum Infection
	20.6 - Urinary Tract Infection
	20.7 - Influenza
	20.8 - COVID-19
	20.10 - Pneumonia
	20.11 - Other Non-pelvic Infection (for example, TB, Meningitis, HIV)
	20.9 - Other Infection/NOS
Embolism	30.1 - Embolism – Thrombotic (Non-cerebral)
	30.9 - Other Embolism (Excludes Amniotic Fluid Embolism)/NOS Amniotic Fluid Embolism
	31.1 - Embolism - Amniotic Fluid

Table 15. Pregnancy Mortality Surveillance System Codes (PMSS) (Continued)

CDC underlying cause of death category	PMSS code and cause of death description
Hypertensive Disorders of Pregnancy	40 - Preeclampsia*
	40.1 - Preeclampsia
	50 - Eclampsia*
	50.1 - Eclampsia
	60.1 - Chronic Hypertension with Superimposed Preeclampsia Anesthesia Complications
	70.1 - Anesthesia Complications Cardiomyopathy
	80 - Cardiomyopathy*
	80.1 - Postpartum/Peripartum Cardiomyopathy
	80.2 - Hypertrophic Cardiomyopathy
	80.9 - Other Cardiomyopathy/NOS
Hematologic	82.1 - Sickle Cell Anemia
	82.9 - Other Hematologic Conditions including Thrombophilias/TTP/HUS/NOS
Collagen Vascular/Autoimmune Diseases	83 - Collagen vascular/autoimmune diseases*
	83.1 - Systemic Lupus Erythematosus (SLE)
	83.9 - Other Collagen Vascular Diseases/NOS
Conditions Unique to Pregnancy	85.1 - Conditions Unique to Pregnancy (for example, Gestational Diabetes, Hyperemesis, Liver Disease of Pregnancy)
Injury	88.1 - Intentional (Homicide)
	88.2 - Unintentional
	88.9 - Unknown Intent/NOS

Table 15. Pregnancy Mortality Surveillance System Codes (PMSS) (Continued)

CDC underlying cause of death category	PMSS code and cause of death description
Cancer	89 - Cancer*
	89.1 - Gestational Trophoblastic Disease (GTD)
	89.3 - Malignant Melanoma
	89.9 - Other Malignancies/NOS
Cardiovascular Conditions	90.1 - Coronary Artery Disease/Myocardial Infarction (MI)/Atherosclerotic Cardiovascular Disease
	90.2 - Pulmonary Hypertension
	90.3 - Valvular Heart Disease Congenital and Acquired
	90.4 - Vascular Aneurysm/Dissection (Non-cerebral)
	90.5 - Hypertensive Cardiovascular Disease
	90.6 - Marfan Syndrome
	90.7 - Conduction Defects/Arrhythmias
	90.8 - Vascular Malformations Outside Head and Coronary Arteries
	90.9 - Other Cardiovascular Disease, including CHF, Cardiomegaly, Cardiac Hypertrophy, Cardiac Fibrosis, Non-acute Myocarditis/NOS
Pulmonary Conditions	91.1 - Chronic Lung Disease
	91.2 - Cystic Fibrosis 91.3 - Asthma
	91.9 - Other Pulmonary Disease/NOS
Neurologic/Neurovascular Conditions	92.1 - Epilepsy/Seizure Disorder
	92.9 - Other Neurologic Diseases/NOS

Table 15. Pregnancy Mortality Surveillance System Codes (PMSS) (Continued)	
CDC underlying cause of death category	PMSS code and cause of death description
Renal Disease	93.1 - Chronic Renal Failure/End-Stage Renal Disease (ESRD)
	93.9 - Other Renal Disease/NOS
Cerebrovascular Accident not Secondary to HDP	95.1 - Cerebrovascular Accident (Hemorrhage/ Thrombosis/Aneurysm/Malformation) not Secondary to Hypertensive Disorders of Pregnancy
Metabolic/Endocrine	96.2 - Diabetes Mellitus
	96.9 - Other Metabolic/Endocrine Disorders/NOS
Gastrointestinal Disorders	97.1 - Crohn's Disease/Ulcerative Colitis
	97.2 - Liver Disease/Failure/Transplant
	97.9 - Other Gastrointestinal Diseases/NOS
Mental Health Conditions	100 - Mental Health Conditions*
	100.1 - Depressive Disorder
	100.2 - Anxiety Disorder (including Post-Traumatic Stress Disorder)
	100.3 - Bipolar Disorder
	100.4 - Psychotic Disorder
	100.5 - Substance Use Disorder
	100.9 - Other Psychiatric Conditions/NOS
Unknown COD	999 - Unknown COD*
	999.1 - Unknown COD

*CDC PMSS code from a previous edition of Maternal Mortality Review Committee Decisions Form (V18).

Table 16. CDC Contributing Factor Descriptions for Maternal Mortality Review Committee Decision Form	
Lack of Access/ Financial Resources	Systemic barriers, such as lack or loss of health care insurance or other financial duress, as opposed to noncompliance, impacted their ability to care for themself (for example, did not seek services because unable to miss work or afford postpartum visits after insurance expired). Other barriers to accessing care include insurance non-eligibility, provider shortage in their geographical area, and lack of public transportation.
Following Medical Recommendations	The provider or patient did not follow protocol or standard procedures.
Failure to Screen/ Inadequate Assessment of Risk	Factors placing the individual at risk for a poor clinical outcome recognized, and they were not transferred/transported to a provider able to give a higher level of care.
Chronic Disease	Occurrence of one or more significant pre-existing medical conditions (for example, obesity, cardiovascular disease, or diabetes).
Clinical Skill/Quality of Care (Provider or Facility Perspective)	Personnel were not appropriately skilled for the situation or did not exercise clinical judgment consistent with standards of care (for example, error in the preparation or administration of medication or unavailability of translation services).
Poor Communication/ Lack of Case Coordination or Management/Lack of Continuity of Care (System Perspective)	Care was fragmented (uncoordinated or not comprehensive) among or between health care facilities or units (for example, records not available between inpatient and outpatient or among units within the hospital, such as Emergency Department and Labor and Delivery).
Lack of Continuity of Care (Provider or Facility Perspective)	Care providers did not have access to individual's complete records or did not communicate their status sufficiently. Lack of continuity can be between prenatal, labor and delivery, and postpartum providers.

Table 16. CDC Contributing Factor Descriptions for Maternal Mortality Review Committee Decision Form (Continued)

Cultural/Religious or Language Factors	The provider or patient demonstrated that any of these factors was a barrier to care due to lack of understanding or refusal of therapy due to beliefs (or belief systems).
Delay	The provider or patient was delayed in referring or accessing care, treatment, or follow-up care/action.
Discrimination	Treating someone less or more favorably based on the group, class or category they belong to, resulting from biases, prejudices, and stereotyping. It can manifest as differences in care, clinical communication and shared decision-making
Environmental Factors	Factors related to weather or social environment.
Inadequate or Unavailable Equipment/Technology	Equipment was missing, unavailable, or not functional, (for example, absence of blood tubing connector).
Interpersonal Racism	Discriminatory interactions between individuals based on differential assumptions about the abilities, motives, and intentions of others, resulting in differential actions toward others based on their race. It can be conscious as well as unconscious, and it includes acts of commission and acts of omission. It manifests as lack of respect, suspicion, devaluation, scapegoating, and dehumanization.
Knowledge — Lack of Knowledge Regarding Importance of Event or of Treatment or Follow-Up	The provider or patient did not receive adequate education or lacked knowledge or understanding regarding the significance of a health event (for example, shortness of breath as a trigger to seek immediate care) or lacked understanding about the need for treatment/follow-up after evaluation for a health event (for example, needed to keep appointment for psychiatric referral after an ED visit for exacerbation of depression).

Table 16. CDC Contributing Factor Descriptions for Maternal Mortality Review Committee Decision Form (Continued)	
Inadequate Law Enforcement Response	Law enforcement response was not timely or was not appropriate or thorough in scope.
Legal	Legal considerations that impacted outcome.
Mental Health Conditions	The patient had a documented diagnosis of a psychiatric disorder. This includes postpartum depression. If a formal diagnosis is not available, refer to your review Committee subject matter experts (for example, psychiatrist, psychologist, licensed counselor) to determine whether the criteria for a diagnosis of substance use disorder or another mental health condition are met based on the available information.
Inadequate Community Outreach/Resources	Lack of coordination between health care system and other outside agencies/organizations in the geographic/cultural area that work with maternal health issues.
Lack of Standardized Policies/ Procedures	The facility lacked basic policies or infrastructure germane to the individual's needs (for example, response to high blood pressure, or a lack of or outdated policy or protocol).
Lack of Referral or Consultation	Specialists were not consulted or did not provide care; referrals to specialists were not made.
Social Support/Isolation — Lack of Family/Friend or Support System	Social support from family, partner, or friends was lacking, inadequate, and/or dysfunctional.
Structural Racism	The systems of power based on historical injustices and contemporary social factors that systematically disadvantage people of color and advantage white people through inequities in housing, education, employment, earnings, benefits, credit, media, health care, criminal justice, etc.

Table 16. CDC Contributing Factor Descriptions for Maternal Mortality Review Committee Decision Form (Continued)	
Substance Use Disorder — Alcohol, Illicit/Prescription Drugs	Substance use disorder is characterized by recurrent use of alcohol and/or drugs causing clinically and functionally significant impairment, such as health problems or disability. The Committee may determine that substance use disorder contributed to the death when the disorder directly compromised their health status (for example, acute methamphetamine intoxication exacerbating pregnancy- induced hypertension, increased vulnerability to infections or medical conditions).
Tobacco Use	The patient's use of tobacco directly compromised the patient's health status (for example, long-term smoking led to underlying chronic lung disease).
Trauma	The individual experienced trauma, such as loss of child (death or loss of custody), rape, molestation, or one or more of the following: sexual exploitation during childhood plus persuasion, inducement, or coercion of a child to engage in sexually explicit conduct; or other physical or emotional abuse other than that related to sexual abuse during childhood.
Unstable Housing	Individual lived "on the street," in a homeless shelter, or in transitional or temporary circumstances with family or friends.
Violence and Intimate Partner Violence (IPV)	Physical or emotional abuse perpetrated by current or former intimate partner, family member, friend, acquaintance, or stranger.
Other	Contributing factor not otherwise mentioned. Please provide description.

Methodology

Demographic and Clinical Variables

- **Maternal race and ethnicity** is primarily derived from self-reported information recorded on the birth or fetal death certificate. If there was no corresponding birth or fetal death certificate, or the data were missing, information recorded on the death certificate was used to fill the missing value.
- **Maternal age** is based on the age of death at the time of death as listed on the death certificate.
- **Maternal education** is based on the total years of education completed at the time of death as self-reported on the birth or fetal death certificate, where available. If there was no corresponding birth or fetal death certificate, or the data were missing, information recorded on the death certificate was used to fill the missing value.
- **Maternal borough of residence** is based on the usual borough of residence at the time of death as listed on the death certificate. If this information was missing, the borough of residence listed on the birth or fetal death certificate was used to fill the missing value.
- **Maternal nativity** is primarily derived from data recorded on the birth or fetal death certificate. If there is no corresponding birth or fetal death certificate for the maternal death, or these data were missing, information recorded on the death certificate was used to fill the missing value.
- **Location of death** is based on the location where the death occurred as listed on the death certificate.
- **Interval between the end of pregnancy and death** was tabulated based on the number of days from date of death as listed on the death certificate to the birth or fetal death date as listed on the birth or fetal death certificate. If there was no corresponding birth or fetal death certificate, the date of outcome listed on the death certificate was used, or the interval from pregnancy outcome to death was derived from reviewing medical or autopsy records.
- **Pregnancy outcome** is primarily derived from the presence of a birth or fetal death certificate corresponding to the maternal death and, if not available, from the pregnancy outcome listed on the death certificate. In some cases, further review of medical or autopsy records was needed to ascertain this information.
- **Cause of death** is based on the underlying cause of death as determined by the Committee and coded using the CDC Pregnancy Mortality Surveillance System (PMSS). Cause of death codes were further grouped according to the categorizations listed in Appendix B, Table 21 on Page 99, for purposes of this report.
- **Live birth order** is available for maternal deaths where the pregnancy outcome was a live birth and is derived from information recorded on the birth certificate.
- **Prenatal care initiation** is available for maternal deaths where the pregnancy outcome was a live birth and is derived from information recorded on the birth certificate.

Data Analysis

Pregnancy-associated mortality ratios (PAMR) and pregnancy-related mortality ratios (PRMR) are presented as the number of deaths per 100,000 live births that occurred during the year of the woman or birthing person's death.

While mortality data presented in this report are not subject to sampling error, they are subject to random variation especially when numbers of deaths are small. Caution is needed in interpreting ratios based on small numbers of deaths. To this end, the NYC Health Department typically suppresses rates or ratios based on fewer than five deaths, or the equivalent of a relative standard error (RSE) of 50% or more. However, this report at times presents PAMRs and PRMRs based on small number of deaths; these estimates are footnoted and should be interpreted with caution.

The lower and upper 95% confidence limits for PAMRs or PRMRs were calculated using the gamma method when the number of deaths is small (under 100).[23] The 95% confidence intervals are presented in Appendix B. The difference between two ratios is statistically significant if the confidence intervals do not overlap across groups or levels.

Missing Data

Some records were not complete and were missing demographic or other information. Cases with missing data were recorded as "not reported or unknown" and were not included in the presentation of the data for that variable.

Methodological Updates Since Previous Reports

Comparing the classification of maternal deaths as "pregnancy-related", "pregnancy-associated but not -related" and "undetermined" between the periods 2011-2015 and 2016-2020 presents challenges due to changes in methodology.

In the case of maternal deaths in 2011-2015, determinations of pregnancy-relatedness were made by abstractors and ob-gyns from the NYC Department of Health in collaboration with the OCME and the medical director from the Bureau of Maternal, Infant and Reproductive Health within the Division of Family and Child Health. This classification followed the guidelines outlined in the CDC's Pregnancy Mortality Surveillance Coding Manual. All injury-related deaths, including those resulting from substance use, homicide and suicide, were all categorized as pregnancy-associated but not pregnancy-related deaths.

For maternal deaths occurring in 2016-2020, a Committee review process was employed to determine pregnancy-relatedness. This involved in-depth discussions and deliberations for each case's classification, based on the CDC definition of pregnancy-related death: The death of a woman or birthing person 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. During this period, injury-related deaths, such as those associated with substance use, homicide and suicide, could be classified as pregnancy-related or pregnancy-associated but not -related deaths.

[23] Krieger N, Waterman PD, Spasojevic J, Li W, Maduro G, Van Wye G. Public health monitoring of privilege and deprivation with the index of concentration at the extremes. Am J Public Health. 2016;106(2):256-263. doi:**10.2105/AJPH.2015.302955**

Appendix B. Supplemental Data Tables

Table 17. Yearly Live Births and Classification of Pregnancy-Associated Deaths and Mortality Ratios With a 95% Confidence Interval (CI), NYC, 2016-2020

	Live births	Pregnancy-associated deaths	PAMR (95% CI)	Pregnancy-related deaths	PRMR (95% CI)	Pregnancy-associated but not -related deaths	Undetermined
2016	120,367	36	29.9 (20.9, 41.4)	15	12.5 (7.0, 20.6)	17	4
2017	117,013	55	47.0 (35.4,61.2)	19	16.2 (9.8,25.4)	29	7
2018	114,296	42	36.7 (26.5,49.7)	23	20.1 (12.8, 30.2)	11	8
2019	110,442	57	51.6 (39.1,66.9)	28	25.4 (16.8, 36.6)	19	10
2020	100,022	51	51.0 (38.0, 67.0)	29	29.0 (19.4, 41.6)	12	10
Total	**562,140**	**241**	**42.9 (37.5,48.3)**	**114**	**20.3 (16.6, 24.0)**	**88**	**39**

Table 18. Yearly Live Births, Classification of Pregnancy-Associated Deaths and Mortality Ratios Overall and by Select Racial and Ethnic Groups, NYC, 2016-2020

	NYC overall								
	Live births	Pregnancy-associated deaths	PAMR	95% CI LL	95% CI UL	Pregnancy-related deaths	PRMR	95% CI LL	95% CI UL
2001	124,023	63	50.8	39.0	65.0	42	33.9	24.4	45.8
2002	122,937	46	37.4	27.4	49.9	27	22.0	14.5	32.0
2003	124,345	52	41.8	31.2	54.8	26	20.9	13.7	30.6
2004	124,099	50	40.3	29.9	53.1	35	28.2	19.6	39.2
2005	122,725	55	44.8	33.7	58.3	31	25.3	17.2	35.9
2006	125,506	52	41.4	30.9	54.3	35	27.9	19.4	38.8
2007	128,961	48	37.2	27.4	49.3	24	18.6	11.9	27.7
2008	127,680	53	41.5	31.1	54.3	31	24.3	16.5	34.5
2009	126,774	55	43.4	32.7	56.5	27	21.3	14.0	31.0
2010	124791	44	35.3	25.6	47.4	22	17.6	11.0	26.6
2011	123,029	59	48.0	36.5	61.9	24	19.5	12.5	29.0
2012	123,231	49	39.8	29.4	52.6	26	21.1	13.8	30.9
2013	120,457	54	44.8	33.7	58.5	26	21.6	14.1	31.6
2014	122,084	45	36.9	26.9	49.3	16	13.1	7.5	21.3
2015	121,673	66	54.2	42.0	69.0	23	18.9	12.0	28.4
2016	120,367	36	29.9	20.9	41.4	15	12.5	7.0	20.6
2017	117,013	55	47.0	35.4	61.2	19	16.2	9.8	25.4
2018	114,296	42	36.7	26.5	49.7	23	20.1	12.8	30.2
2019	110,442	57	51.6	39.1	66.9	28	25.4	16.8	36.6
2020	100,022	51	51.0	38.0	67.0	29	29.0	19.4	41.6

Note: LL: the lower limit of the confidence interval; UL: the upper limit of the confidence interval.

Table 18. Yearly Live Births, Classification of Pregnancy-Associated Deaths and Mortality Ratios Overall and by Select Racial and Ethnic Groups, NYC, 2016-2020 (Continued)

	Black non-Hispanic			White non-Hispanic		
	Pregnancy-associated deaths	Pregnancy-related deaths	Live births	Pregnancy-associated deaths	Pregnancy-related deaths	Live births
2001	37	28	32,123	7	2	36,581
2002	22	13	30,690	10	6	36,445
2003	28	17	29,646	9	3	38,018
2004	24	17	29,449	3	1	37,659
2005	29	18	28,935	9	4	37,340
2006	28	20	29,077	3	1	38,231
2007	27	12	29,268	4	3	39,351
2008	25	18	27,917	7	3	38,383
2009	26	17	27,405	8	1	38,438
2010	19	12	26,635	4	1	37,780
2011	23	10	25,825	15	5	38,573
2012	22	14	24,758	5	2	39,112
2013	24	15	24,108	13	3	39,573
2014	22	10	23,680	8	2	40,443
2015	25	13	23,116	9	1	40,607
2016	15	6	22,465	8	1	40,633
2017	21	10	21,992	10	1	40,345
2018	20	13	21,145	10	5	40,327
2019	26	13	20,053	11	6	39,278
2020	23	12	18,162	8	4	35,812

Table 19. Five-Year Live Births, Classification of Pregnancy-Associated Deaths and Mortality Ratios With a 95% Confidence Interval (CI), NYC, 2001-2005, 2006-2010, 2011-2015, and 2016-2020

	Live births	Pregnancy-associated deaths	PAMR (95% CI)	Pregnancy-related deaths	PRMR (95% CI)
2001-2005	618,129	266	43.0 (37.8, 48.2)	161	26.0 (22.0, 30.0)
2006-2010	633,712	252	39.8 (34.9, 44.7)	139	21.9 (18.3, 25.5)
2011-2015	610,474	273	44.7 (39.4, 50.0)	115	18.8 (15.4, 22.2)
2016-2020	562,140	241	42.9 (37.5, 48.3)	114	20.3 (16.6, 24.0)

Table 20. Five-Year Live Births, Classification of Pregnancy-Associated Deaths and Mortality Ratios With a 95% Confidence Interval (CI) Among Black Non-Hispanic and White Non-Hispanic People, NYC, 2001-2005, 2006-2010, 2011-2015 and 2016-2020

	Black non-Hispanic					White non-Hispanic					Black-white disparity	
	PAMR (95% CI)	PRMR (95% CI)	Pregnancy-associated deaths	Pregnancy-related deaths	Live births	PAMR (95% CI)	PRMR (95% CI)	Pregnancy-associated deaths	Pregnancy-related deaths	Live births	Disparity in PAMR	Disparity in PRMR
2001-2005	92.8 (77.4, 108.2)	61.7 (49.8, 75.6)	140	93	150,843	20.4 (14.4, 28.0)	8.6 (4.9, 14.0)	38	16	186,043	5	7
2006-2010	89.1 (73.5, 104.7)	56.3 (44.6, 70.2)	125	79	140,302	13.5 (8.8, 19.8)	4.7 (2.1, 8.9)	26	9	192,183	7	12
2011-2015	95.5 (78.1, 112.9)	51.0 (39.1, 65.4)	116	62	121,487	25.2 (18.7, 33.2)	6.6 (3.5, 11.3)	50	13	198,308	4	8
2016-2020	101.1 (81.8, 120.4)	52.0 (39.1, 67.8)	105	54	103,817	23.9 (17.6, 31.8)	8.7 (5.1, 13.9)	47	17	196,395	4	6

Table 21. Underlying Cause of Death by CDC PMSS Code

CDC underlying cause of death category	PMSS code and cause of death description	Number
Hemorrhage	10.1 - Hemorrhage – Uterine Rupture	4
	10.2 - Placental Abruption	2
	10.3 - Placenta Previa	
	10.4 - Ruptured Ectopic Pregnancy	6
	10.5 - Hemorrhage – Uterine Atony/Postpartum Hemorrhage	2
	10.6 - Placenta Accreta/Increta/Percreta	2
	10.7 - Hemorrhage due to Retained Placenta	
	10.10 - Hemorrhage – Laceration/Intra-Abdominal Bleeding	4
	10.9 - Other Hemorrhage/NOS	2
Infection	20.1 - Postpartum Genital Tract (for example, of the Uterus/ Pelvis/Perineum/Necrotizing Fasciitis)	
	20.2 - Sepsis/Septic Shock	8
	20.4 - Chorioamnionitis/Antepartum Infection	1
	20.5 - Non-pelvic Infections (for Example, Pneumonia, TB, Meningitis, HIV)*	2
	20.6 - Urinary Tract Infection	
	20.7 - Influenza	
	20.8 - COVID-19	6
	20.10 - Pneumonia	
	20.11 - Other Non-pelvic Infection (for example, TB, Meningitis, HIV)	1
	20.9 - Other Infection/NOS	2
Embolism	30.1 - Embolism – Thrombotic (Non-cerebral)	17
	30.9 - Other Embolism (Excludes Amniotic Fluid Embolism)/NOS Amniotic Fluid Embolism	1
Amniotic fluid embolism	31.1 - Embolism – Amniotic Fluid	4

Table 21. Underlying Cause of Death by CDC PMSS Code (Continued)

CDC underlying cause of death category	PMSS code and cause of death description	Number
Preeclampsia and eclampsia	40 - Preeclampsia*	1
	40.1 - Preeclampsia	
	50 - Eclampsia*	2
	50.1 - Eclampsia	
	60.1 - Chronic Hypertension with Superimposed Preeclampsia Anesthesia Complications	
Anesthesia complications	70.1 - Anesthesia Complications Cardiomyopathy	2
Cardiomyopathy	80 - Cardiomyopathy*	4
	80.1 - Postpartum/Peripartum Cardiomyopathy	5
	80.2 - Hypertrophic Cardiomyopathy	
	80.9 - Other Cardiomyopathy/NOS	3
Blood disorders	82.1 - Sickle Cell Anemia	2
	82.9 - Other Hematologic Conditions including Thrombophilias/ TTP/HUS/NOS	2
Autoimmune diseases	83 - Collagen vascular/autoimmune diseases*	2
	83.1 - Systemic Lupus Erythematosus (SLE)	1
	83.9 - Other Collagen Vascular Diseases/NOS	
Conditions unique to pregnancy	85.1 - Conditions Unique to Pregnancy (for example, Gestational Diabetes, Hyperemesis, Liver Disease of Pregnancy)	
Homicide	88.1 - Intentional (Homicide)	15
Unintentional injury	88.2 - Unintentional	5
	88.9 - Unknown Intent/NOS	1
Cancer	89 - Cancer*	6
	89.1 - Gestational Trophoblastic Disease (GTD)	
	89.3 - Malignant Melanoma	
	89.9 - Other Malignancies/NOS	21

Table 21. Underlying Cause of Death by CDC PMSS Code (Continued)

CDC underlying cause of death category	PMSS code and cause of death description	Number
Cardiovascular and coronary conditions	90.1 - Coronary Artery Disease/Myocardial Infarction (MI)/ Atherosclerotic Cardiovascular Disease	6
	90.2 - Pulmonary Hypertension	2
	90.3 - Valvular Heart Disease Congenital and Acquired	1
	90.4 - Vascular Aneurysm/Dissection (Non-cerebral)	2
	90.5 - Hypertensive Cardiovascular Disease	3
	90.6 - Marfan Syndrome	
	90.7 - Conduction Defects/Arrhythmias	5
	90.8 - Vascular Malformations Outside Head and Coronary Arteries	
	90.9 - Other Cardiovascular Disease, including CHF, Cardiomegaly, Cardiac Hypertrophy, Cardiac Fibrosis, Non-acute Myocarditis/NOS	
Pulmonary conditions	91.1 - Chronic Lung Disease	
	91.2 - Cystic Fibrosis	
	91.3 - Asthma	10
	91.9 - Other Pulmonary Disease/NOS	3
Seizure disorders	92.1 - Epilepsy/Seizure Disorder	3
	92.9 - Other Neurologic Diseases/NOS	1
Renal disease	93.1 - Chronic Renal Failure/End-Stage Renal Disease (ESRD)	
	93.9 - Other Renal Disease/NOS	
Cerebrovascular accidents	95.1 - Cerebrovascular Accident (Hemorrhage/Thrombosis/ Aneurysm/Malformation) not Secondary to Hypertensive Disorders of Pregnancy	2
Metabolic or endocrine conditions	96.2 - Diabetes Mellitus	5
	96.9 - Other Metabolic/Endocrine Disorders/NOS	4
Liver and gastrointestinal conditions	97.1 - Crohn's Disease/Ulcerative Colitis	1
	97.2 - Liver Disease/Failure/Transplant	
	97.9 - Other Gastrointestinal Diseases/NOS	

Table 21. Underlying Cause of Death by CDC PMSS Code (Continued)

CDC underlying cause of death category	PMSS code and cause of death description	Number
Mental health conditions	100 Mental Health Conditions*	16
	100.1 - Depressive Disorder	5
	100.2 - Anxiety Disorder (including Post-Traumatic Stress Disorder)	1
	100.3 - Bipolar Disorder	
	100.4 - Psychotic Disorder	
	100.5 - Substance Use Disorder	14
	100.9 - Other Psychiatric Conditions/NOS	9
Unknown cause of death	999 Unknown COD†	12
	999.1 - Unknown COD	

*Underlying cause refers to the disease or injury that initiated the chain of events leading to death or the circumstances of the accident or violence which produced the fatal injury.

†CDC PMSS code from a previous edition of Maternal Mortality review Committee Decisions Form (V18).

Table 22. Causes of Pregnancy-Associated Deaths by Year, NYC, 2016-2020

	Overall		2016		2017		2018		2019		2020	
	n	%	n	%	n	%	n	%	n	%	n	%
Mental health conditions	45	18.7	6	16.7	10	18.2	8	19.0	10	17.5	11	21.6
Overdose[24]	34	-	6	-	9	-	3	-	7	-	-	-
Suicide	11	-	0	-	1	-	5	-	3	-	2	-
Cardiovascular conditions	31	12.9	9	25.0	4	7.3	8	19.0	6	10.5	4	7.8
Cardiomyopathy	12	-	3	-	2	-	2	-	3	-	2	-
Cardiovascular or coronary condition	19	-	6	-	2	-	6	-	3	-	2	-
Cancer	27	11.2	5	13.9	10	18.2	4	9.5	6	10.5	2	3.9
Hemorrhage	22	9.1	4	11.1	2	3.6	5	11.9	5	8.8	6	11.8
Infection[25]	20	8.3	2	5.6	4	7.3	2	4.8	3	5.3	9	17.6
Embolism	18	7.5	1	2.8	7	12.7	3	7.1	4	7.0	3	5.9
Homicide	15	6.2	3	8.3	4	7.3	-	-	4	7.0	4	7.8
Pulmonary condition	13	5.4	1	2.8	4	7.3	1	2.4	5	8.8	2	3.9
Unknown cause of death	12	5.0	2	5.6	2	3.6	3	7.1	3	5.3	2	3.9
Metabolic or endocrine condition	9	3.7	-	-	1	1.8	1	2.4	3	5.3	4	7.8
Unintentional injury	6	2.5	-	-	-	-	3	7.1	2	3.5	1	2.0
Amniotic fluid embolism	4	1.7	-	-	-	-	1	2.4	2	3.5	1	2.0
Seizure disorder	4	1.7	-	-	1	1.8	-	-	3	5.3	-	-
Blood disorder	4	1.7	-	-	2	3.6	2	4.8	-	-	-	-
Preeclampsia or eclampsia	3	1.2	2	5.6	-	-	1	2.4	-	-	-	-
Autoimmune disease	3	1.2	1	2.8	2	3.6	-	-	-	-	-	-
Anesthesia complications	2	0.8	-	-	1	1.8	-	-	-	-	1	2.0
Cerebrovascular accident	2	0.8	-	-	1	1.8	-	-	1	1.8	-	-
Liver or gastrointestinal condition	1	0.4	-	-	-	-	-	-	-	-	1	2.0
Total	**241**	**100.0**	**36**	**100.0**	**55**	**100.0**	**42**	**100.0**	**57**	**100.0**	**51**	**100.0**

[24] The yearly counts of overdose deaths involving an opioid were 5, 6, 2, 5 and 7 in 2016-2020, accounting for 83.3%, 66.7%, 66.7%, 71.3% and 77.8% of the yearly overdose deaths.

[25] Infection was the second-leading cause of death in 2020. Out of nine deaths due to infection, six were due to COVID-19. Of these six deaths, three were to Hispanic women and birthing people, two to Black non-Hispanic women and birthing people, and one to a white woman.

Table 23. Causes of Pregnancy-Associated but Not -Related Deaths, NYC, 2016-2020

Cause of death	2016-2020	%
Cancer	23	26.1
Mental health conditions	16	18.2
Overdose*	16	
Pulmonary condition	10	11.4
Infection	9	10.2
Cardiovascular condition	6	6.8
Cardiovascular or coronary condition	6	
Homicide	5	5.7
Metabolic or endocrine condition	4	4.5
Seizure disorder	3	3.4
Unintentional injury	3	3.4
Autoimmune disease	2	2.3
Cerebrovascular accident	2	2.3
Embolism	2	2.3
Unknown cause of death	2	2.3
Blood disorder	1	1.1
Total	**88**	**100.0**

*Among 16 overdose deaths, 13 (83.1%) involved an opioid.

Table 24. Causes of Undetermined Deaths, NYC, 2016-2020

Cause of death	2016-2020	%
Mental health conditions	11	28.2
Overdose*	9	
Suicide	2	
Homicide	9	23.1
Unknown cause of death	6	15.4
Cardiovascular disease	6	15.4
Cardiomyopathy	1	
Cardiovascular and coronary conditions	5	
Unintentional injury	2	5.1
Autoimmune diseases	1	2.6
Hemorrhage	1	2.6
Infection	1	2.6
Pulmonary conditions	1	2.6
Seizure disorders	1	2.6
Total	**39**	**100.0**

*Among nine overdose deaths, seven (77.8%) involved an opioid.

Table 25. Demographic Characteristics of Pregnancy-Associated and Pregnancy-Related Deaths, NYC, 2016-2020

	Live births		Pregnancy-associated deaths		PAMR	95% CI		Pregnancy-related deaths		PRMR	95% CI	
	n	%	n	%		LL	UL	n	%		LL	UL
Total	562,140	100.0	241	100.0	42.9	37.5	48.3	114	100.0	20.3	16.6	24.0
Maternal age												
<25	95,334	17.0	27	9.5	28.3	18.7	41.2	9	7.9	9.4	4.3	17.9
25-29	137,013	24.4	54	22.4	39.4	29.6	51.4	23	20.2	16.8	10.6	25.2
30-34	175,958	31.3	63	26.1	35.8	27.5	45.8	31	27.2	17.6	12.0	25.0
35-39	118,864	21.1	58	24.1	48.8	37.1	63.1	29	25.4	24.4	16.3	35.0
40+	34,970	6.2	39	16.2	111.5	79.3	152.5	22	19.3	62.9	39.4	95.2
Unknown	1	-	-	-	-	-	-	-	-	-	-	-
Race and ethnicity												
White non-Hispanic	196,395	34.9	47	19.5	23.9	17.6	31.8	17	14.9	8.7	5.0	13.9
Asian or Pacific Islander	95,058	16.9	20	8.3	21.0	12.9	32.5	10	8.8	10.5	5.0	19.3
Hispanic	157,292	28.0	65	27.0	41.3	31.9	52.7	32	28.1	20.3	13.9	28.7
Black non-Hispanic	103,817	18.5	105	43.6	101.1	81.8	120.5	54	47.4	52.0	39.1	67.9
Other and unknown	9,578	1.7	4	1.7	41.8	-	-	1	0.9	10.4	-	-
Education												
Less than HS	88,154	15.7	45	18.7	51.0	37.2	68.3	19	16.7	21.6	13.0	33.7
HS or GED	126,344	22.5	75	31.1	59.4	46.7	74.4	30	26.3	23.7	16.0	33.9
At least some college	347,642	61.8	118	49.0	33.9	27.8	40.1	65	57.0	18.7	14.4	23.8
Unknown	2,139	0.4	3	1	-	-	-	-	-	-	-	-
Borough of residence												
Bronx	90,906	16.2	52	21.6	57.2	42.7	75.0	28	24.6	30.8	20.5	44.5
Brooklyn	186,501	33.2	75	31.1	40.2	31.6	50.4	39	34.2	20.9	14.9	28.6
Manhattan	80,988	14.4	21	8.7	25.9	16.1	39.6	14	12.3	17.3	9.5	29.0
Queens	120,613	21.5	52	21.6	43.1	32.2	56.5	21	18.4	17.4	10.8	26.6
Staten Island	25,788	4.6	20	8.3	77.6	47.4	119.8	4	3.5	15.5	4.2	39.7
Non-NYC	57,317	10.2	21	8.7	-	-	-	8	7.0	-	-	-
Unknown	27	0.0	-	-	-	-	-	-	-	-	-	-

Table 25. Demographic Characteristics of Pregnancy-Associated and Pregnancy-Related Deaths, NYC, 2016-2020 (Continued)

	Live births		Pregnancy-associated deaths		PAMR	95% CI		Pregnancy-related deaths		PRMR	95% CI	
	n	%	n	%		LL	UL	n	%		LL	UL
Nativity												
U.S.-born	279,987	49.8	163	67.6	58.2	49.3	67.2	68	59.6	24.3	18.9	30.8
Non-U.S.-born	281,753	50.1	74	30.7	26.3	20.6	33.0	45	39.5	16.0	11.6	21.4
Unknown	400	0.0	4	1.7	-	-	-	1	0.9	-	-	-
Prepregnancy body mass index (BMI)												
BMI <18.5	27,981	5.0	8	5.4	28.6	12.3	56.3	4	5.1	14.3	3.9	36.6
BMI 18.5-24.9	289,258	51.5	54	36.5	18.7	14.0	24.4	24	30.8	8.3	5.3	12.3
BMI 25.0-29.9	140,616	25.0	37	25.0	26.3	18.5	36.3	21	26.9	14.9	9.2	22.8
BMI ≥30.0	101,935	18.1	45	30.4	44.1	32.2	59.1	25	32.1	24.5	15.9	36.2
Missing	2,350	0.4	4	2.7	-	-	-	4	5.1	-	-	-

Notes: LL: the lower limit of the confidence interval; UL: the upper limit of the confidence interval. There was one record of live birth with unknown or not stated age information. PAMRs and PRMRs are suppressed for Unknown category and where n<4.

Table 26. Location, Timing, and Prenatal and Clinical Characteristics of Pregnancy-Associated and Pregnancy-Related Deaths, NYC, 2016-2020

	Pregnancy-associated deaths	%	Pregnancy-related deaths	%
Location of death				
Hospital — inpatient	117	48.5	68	59.6
Hospital — emergency department	58	24.1	23	20.2
Home or other	66	27.4	23	20.2
Pregnancy outcome				
Live birth	161	66.8	84	73.7
Vaginal	67	-	52	-
Cesarean	81	-	26	-
Unknown	13	-	6	-
Undelivered	36	14.9	11	9.6
Induced termination (ITOP)	11	4.6	3	2.6
Spontaneous termination (STOP)	17	7.1	6	5.3
Stillbirth (>20 weeks gestation)	9	3.7	4	3.5
Ectopic pregnancy	7	2.9	6	5.3
Timing of death				
During pregnancy	43	17.8	17	14.9
0-1 day	31	12.9	28	24.6
2 -6 days	8	3.3	8	7.0
7-42 days	36	14.9	19	16.7
43-365 days	123	51.0	42	36.8
Number of previous live births				
None	51	34.5	22	28.2
One	43	29.1	25	32.1
Two	28	18.9	15	19.2
Three or more	24	16.2	15	19.2
Unknown	2	1.4	1	1.3
Trimester				
First trimester	86	58.1	41	52.6
Second trimester	31	20.9	19	24.4
Third trimester	14	9.5	7	9.0
No prenatal care	7	4.7	4	5.1
Unknown	10	6.8	7	9.0

Table 26. Location, Timing, and Prenatal and Clinical Characteristics of Pregnancy-Associated and Pregnancy-Related Deaths, NYC, 2016-2020 (Continued)

	Pregnancy-associated deaths	%	Pregnancy-related deaths	%
Prepregnancy body mass index (BMI)				
BMI <18.5	8	5.4	4	5.1
BMI 18.5-24.9	54	36.5	24	30.8
BMI 25.0-29.9	37	25.0	21	26.9
BMI ≥30.0	45	30.4	25	32.1
Missing	4	2.7	4	5.1
Insurance type				
Medicaid	106	71.6	54	69.2
Private	35	23.6	21	26.9
Other*	7	4.7	3	3.9

*Other includes other government type, self-pay and unknown.

Notes

Notes