

INFANT MORTALITY IN NEW YORK STATE, 2016-2019



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Section 1: Executive Summary

Infant mortality is an important marker of the overall health of a society and gives us key information about the health of pregnant people and infants. Infant mortality is defined as the death of an infant before the age of one. Neonatal mortality is defined as death within 27 days of birth, and postneonatal mortality is defined as death between 28 and 364 days of birth. The infant mortality rate is the number of infant deaths for every 1,000 live births. In 2019, the infant mortality rate in the United States (US) was 5.6 deaths per 1,000 live births.¹ In 2019, infant mortality rates in the US by race and ethnicity per 1,000 live births were as follows: Non-Hispanic Black 10.62; Non-Hispanic Native Hawaiian/Pacific Islander 8.19; Non-Hispanic American Indian/Alaskan Native 7.87; Hispanic 5.58; Non-Hispanic White 4.49; and Non-Hispanic Asian 3.38.² Nationally, the top five causes of infant mortality in 2019 were birth defects; pre-term birth and low birth weight; unintentional injuries; sudden infant death syndrome (SIDS); and maternal complications of pregnancy.²

Compared nationally in 2020, New York State (NYS) ranked 4th overall in infant mortality.³ Between 2016 and 2019, the number of NYS infant deaths declined by 12% from 4.36 deaths per 1,000 live births in 2016 to 3.85 deaths per 1,000 live births in 2019. The decline in infant mortality in NYS exceeded the overall national decline of 5% during the same period.² The NYS infant mortality rate remains below the Healthy People (HP) 2030 target of 5.0 deaths per 1,000 live births, but there is still opportunity for improvement.¹

Despite national and NYS efforts to combat and eliminate racial and ethnic disparities in infant mortality, these disparities continue to persist. In the United States, in 2019, Non-Hispanic Black infants (10.62) were 2.4 times as likely to die in infancy as Non-Hispanic White infants (4.49). Furthermore, Non-Hispanic Native Hawaiian/Other Pacific Islander (8.19) and Non-Hispanic American Indian/Alaska Native (7.87) infants were both 1.8 times as likely to die in infancy as Non-Hispanic White infants (4.49).^{2,4} These disparities have increased marginally since 2016 when the infant mortality rates for Non-Hispanic Black, Non-Hispanic American Indian/Alaskan Native, and Non-Hispanic White infants were 11.21, 8.61, and 4.87 deaths per 1,000 live births respectively.⁴ In NYS, from 2016 to 2019, infant mortality rates declined for all racial/ethnic groups except for Non-Hispanic Black infants. The infant mortality rate for Non-Hispanic Black infants increased slightly from 8.37 to 8.46 deaths per 1,000 live births. In contrast, infant mortality rates declined for Hispanic (3.93 vs. 3.41), Non-Hispanic White (3.52 vs. 3.07), Non-Hispanic Asian (3.03 vs. 1.66), and Non-Hispanic Other (6.99 vs. 6.44) infants.

The factors driving disparities in infant health are multifactorial and complex. These factors include employment status, income, housing, transportation, food security, access to healthy foods, stress, social supports, healthcare coverage, and quality of medical care received which negatively affect the birthing person.⁵ Historic and persistent racism and discrimination also play a role in driving racial disparities in infant health. Even controlling for insurance status, income, age, and severity of conditions, people of color are less likely to receive routine medical procedures and experience a lower quality of care overall.⁶ Prioritizing equity in healthcare will be paramount in preventing the widening of disparities and advancing infant health.⁵

This statewide report was prepared in response to Chapter 46 of the Laws of 2021 which requires the New York State Department of Health (NYSDOH) to conduct a study of the effects of racial and ethnic disparities on infant mortality, discuss with an expert workgroup, and prepare a report to share the findings from the comprehensive review of infant mortality in NYS from 2016-2019, as well as

recommendations from the expert workgroup to reduce infant mortality. This report provides information on infant mortality risk factors, includes recommendations to reduce infant mortality and describes current actions the NYSDOH has taken to address this public health issue.

Key Findings from the Comprehensive Review of Infant Mortality Data

- NYS consistently had infant mortality rates well below the national rate of 5.6 deaths per 1,000 live births. Unfortunately, US infant mortality rate exceeds the U.S. Healthy People 2030 goal of 5.0 deaths per 1,000 live births.¹
- The infant mortality rate in NYS declined 12%, from 4.36 deaths per 1,000 live births in 2016 to 3.85 deaths per 1,000 live births in 2019.
- Combining 2016-2019, upstate infant mortality rates were consistently higher when compared to those in the Downstate regions of Mid-Hudson, New York City and Long Island. When looking at the eight Health Service Areas (HSAs) in NYS by region (**Appendix A1 and A2**), the highest infant mortality rates occurred in the Upstate region (Finger Lakes, Central NY/NY-Pennsylvania, Northeast NY, and Western NY HSAs) with a combined upstate rate of 5.60 per 1,000 live births, and the lowest rates occurred in the Downstate region (Mid-Hudson, NYC, and Nassau-Suffolk HSAs) with a combined Downstate rate of 3.44 per 1,000 live births.
- From 2016 to 2019, NYC consistently had lower rates of infant mortality compared to the rest of the state (in 2019 3.43 vs Rest of State 4.23 deaths per 1,000 live births).
- Factors associated with the lowest infant mortality rates were increased educational attainment and having private insurance. Factors associated with the highest rates were very young age (<20 years) and older age (40+ years) when pregnant, which were consistent across regions.
- In 2019, the infant mortality rate for Non-Hispanic Black infants (8.46 deaths per 1,000 live births) was 2.8 times as high as that of Non-Hispanic White infants (3.07 deaths per 1,000 live births), and Hispanic infants (3.41 deaths per 1,000 live births).
 - Non-Hispanic Black infants were 2.8 times more likely to die compared to Non-Hispanic White infants in both Upstate and Downstate HSAs.
 - During both neonatal and postneonatal periods, Non-Hispanic Black infants were more likely to die compared to other racial/ethnic groups.
 - The infant mortality rate among Non-Hispanic Black infants has increased slightly over time from 8.37 deaths per 1,000 live births in 2016 to 8.46 deaths per 1,000 live births in 2019.
- In 2019, the infant mortality rate for male infants was 4.48 deaths per 1,000 live births, 1.4 times higher than the rate for female infants at 3.20 deaths per 1,000 live births.
 - Since 2016, the infant mortality rate decreased 23% among female infants and 1% among male infants.
- Infants born at less than 28 weeks gestation were more likely to die than infants born at 28 weeks or after. Infant mortality rate continually decreased as gestational age increased with the lowest rates being observed among infants born late preterm at 34-36 weeks gestation or longer.
- Infants born with a birth weight less than 1,500 grams had an infant mortality rate approximately 109 times that of normal birth weight infants (2,500+ grams) in 2019.
- The infant mortality rate was highest in the neonatal period and declined over time through the postneonatal period.
- Between 2016 and 2019, the infant mortality rate for those with prenatal care initiation in the first trimester decreased 19%, whereas the infant mortality rates increased for those with prenatal care initiation in the second trimester and third trimester/none at all respectively at

20% and 18%. The highest rates of both neonatal and postneonatal mortality occurred in those who initiated care in the third trimester or had no prenatal care at all.

- Infant mortality rates were higher among newborns when there was a report of smoking, drinking alcohol, using illegal drugs, and/or experiencing depression during pregnancy, as well as among those suffering from chronic pre-pregnancy hypertension and/or diabetes.
 - Smoking was more commonly reported among birthing persons (12% reported smoking vs. 6%) of infants who died within the first year of life and similarly for maternal drug use (8% reported using substances illegally vs. 3% in the overall population of individuals who delivered a live infant).
 - There was a slight increase of reported depression during pregnancy among individuals whose infants died when compared to individuals who delivered a live infant (20% vs. 15%).
 - The presence of any of these modifiable risks, alone or in combination, resulted in a nearly two-fold (1.8 times) higher mortality rate compared to live births having no prenatal exposure to any of these risks.
- The leading causes of mortality among neonates were complications due to short gestation and low birth weight (24%); congenital malformations (20%); perinatal cardiovascular disorders (12%); effects of maternal conditions on newborns (8%); respiratory distress and other respiratory system disorders (7%); perinatal infections (4%); and complications of placenta, cord, or membranes (4%). These leading causes totaled more than three-quarters (79%) of all neonatal deaths.
- Among the 33% of deaths that occurred in the postneonatal period, the leading causes of mortality were sudden unexpected infant death (SUID), including sleep-related deaths (31%); congenital malformations (16%); accidents/unintentional injuries (5%); and short gestation/low birth weight (3%).
- Despite declines in New York State's infant mortality rate, the SUID rate has not declined. When combining 2016 through 2019 data, non-Hispanic Black infants have a SUID rate more than twice that of Hispanic infants (2.7 times) or non-Hispanic White (2.2 times) infants.
- SUID rates were higher among offspring of birthing persons who lived in the Upstate region, had lower educational attainment, were unmarried, started prenatal care late, smoked or had maternal drug use.

Key Recommendations from the Expert Workgroup

- NYSDOH should convene and hold key informant interviews and/or focus groups with community members and providers, in health service areas with higher infant mortality rates, to help discern factors associated with higher risk of infant mortality, as well as the effects of racial and ethnic disparities. This area-specific work will aid in developing targeted recommendations which may differ across the state.
- NYSDOH should more broadly engage Regional Perinatal Centers, their affiliate hospitals, and communities to address the individual needs of each region including education, training, and quality improvement initiatives.
- NYSDOH should identify provider shortage areas and work with partners, such as SUNY, to provide support for recruitment and retention strategies in provider shortage areas.
- NYSDOH should expand Medicaid to support more comprehensive postpartum care and enhanced screening for risk factors during pregnancy.

- NYS clinicians and home visiting programs should engage in efforts to ensure prenatal screening for co-morbidities that are known drivers of preterm birth are performed and provide enhanced support during pregnancy, birth and in the postpartum/neonatal period.
- Universal home visiting should be implemented throughout the state.
 - At a minimum, one home visit early during the postpartum period should be offered universally.
 - Home visiting programs should provide education, support, and linkages to care to address modifiable risk factors when working with individuals of reproductive age.
- NYSDOH should develop and implement social media strategies to help persons of reproductive age understand the importance of healthy choices and improved pregnancy outcomes and have access to supports needed for healthy choices.
- NYSDOH should work with the American College of Obstetricians and Gynecologists District II (ACOG) to educate providers about the importance of prenatal screening and the negative affect on infant mortality when it is not done.
- NYSDOH, in conjunction with ACOG and specialists, should ensure providers are educated on the management of diabetes in pregnant persons.
- NYSDOH should continue to provide tools and resources to pregnant and postpartum persons to assist with smoking cessation.
- NYSDOH and partners should continue to promote a consistent message to pregnant and parenting persons on safe sleep practices, using the ABCs of safe sleep, meaning infants should sleep **A**lone, on their **B**ack, in a safe **C**rib, and in a **s**moke-free home, through a multimedia approach.
- NYSDOH should continue to provide home visiting agencies with materials that support infant safe sleep practices (portable cribs, sleep sacks, onesies with safe sleep messaging).
- Given the persistent infant mortality disparities, especially affecting Black infants, the NYSDOH NYS Perinatal Quality Collaborative (NYSPQC) program should implement a neonatal equity project in NYS birthing facilities that employs a collaborative learning model to identify how racism negatively affects birth outcomes at the facility level and identify actions to improve neonatal outcomes and the experience of care for their families.
- NYSDOH should conduct more in-depth analysis to further explore predictors of and risk factors for infant mortality.
- NYS Office of Children and Family Services (OCFS) should expand Child Fatality Review Teams to all areas of the state.
- NYS should encourage the utilization of standardized infant death investigation procedures to improve cause-of-death certification and provide training to medical examiners and coroners on infant death investigation.
- NYSDOH should develop and disseminate resources and training materials for medical facilities to improve cause of death documentation on death certificates.

What NYS Is Doing to Address Infant Mortality

To address this problem, the New York State Department of Health (NYSDOH), in collaboration with partners, is involved in a statewide effort to reduce the rates of infant mortality and decrease disparities in infant mortality rates across the state through a variety of focused and collective evidence-based interventions. Interventions at the societal, community, and institutional levels are key to overcoming structural inequities in infant outcomes.

NYSDOH has implemented the following actions to reduce infant deaths and improve birth outcomes.

Implement updated perinatal regionalization standards, designations, and structured clinical quality improvement initiatives in birthing hospitals

Since 2017, the NYSDOH has worked to update NYS regulations for the state’s birthing hospitals, which are organized under Regional Perinatal Centers that provide the highest level of support to individuals and support to hospitals in their region. The updated regulations will reflect current national standards of obstetrical and neonatal care and perinatal levels of care, changes in health care systems and reimbursements, as well as hospital restructuring and other corporate structural changes. As part of the regulation development process, NYSDOH conducted an extensive review of current standards, in consultation with a 49-member multidisciplinary Expert Panel and other topical expert consultants. Additionally, the proposed regulations further integrate recently established midwifery birth centers (MBCs), along with physician-led birth centers, into the perinatal regional system, and place a greater emphasis on quality care and patient safety, particularly for obstetrical patients. It is anticipated that the Notice of Proposed Rule Making will be published in the State Register in Summer 2022. Adoption of these regulations is anticipated by December 2022.

Improve and expand access to prenatal and postnatal care

In alignment with evidence-based guidelines and best practices, access to comprehensive maternal and infant health services will be expanded through new or expanded Medicaid reimbursement. Postpartum coverage for individuals eligible for either Medicaid or Child Health Plus will be expanded from 60 days to 12 months leading to more equitable health outcomes across the state. Furthermore, Medicaid expansion will include reimbursement for the following services provided to pregnant and postpartum populations: registered dietitians who provide nutrition services; Community Health Workers and Patient Family Navigators for care coordination and peer support services; Bluetooth-enabled devices for telehealth/remote patient monitoring services; Midwifery services; and expanded coverage of non-invasive prenatal trisomy screening (NIPS) to include pregnant people of any age.

Identify infants who may have a rare, but treatable disease through bloodspot screening shortly after birth and connect them to care

The Newborn Bloodspot Screening (NBS) Program currently performs laboratory testing for 50 diseases, following national recommendations for NBS programs. The NBS program ensures that every newborn in the state receives newborn bloodspot screening as a public health service, with no fee for testing. The program also performs follow-up case management to ensure newborns with a positive screening result receive appropriate diagnostic testing and treatment. Specialty Care Centers are certified and monitored to ensure newborns have access to specialty care for disease-specific testing and management. In addition, the NBS Program contracts with each of the state’s 10 Inherited Metabolic Disease (IMD) Specialty Care Centers to enroll patients with an IMD diagnosis identified by newborn screening in the NYS Newborn Screening Patient Registry.

Increase capacity and competencies of local maternal and infant home visiting programs

Under the NYSDOH’s Maternal and Infant Early Childhood Home Visiting (MIECHV) Initiative, grant funds have supported the expansion of two specific evidenced-based home visiting models: Nurse Family Partnership (NFP) and Healthy Families New York (HFNY) Programs. These home visiting programs complement other evidence-based programs operating in New York communities including Early Head Start, Parents as Teachers, and home Instruction for Parents of Preschool Youngsters (HIPPY), as well as other traditional and emerging service models that include community outreach, home visits, and family support elements such as public health nursing, community health workers and doulas.

Under the NYSDOH'S MIECHV Initiative, local home visiting programs have been engaged in a variety of efforts to build capacity and improve effectiveness in key areas including increasing referrals, client enrollment, and retention; extending the duration of breastfeeding/chestfeeding; and increasing home visitors' knowledge and skills related to key topics such as intimate partner violence, substance use, mental health, smoking cessation, self-care, and postpartum/interconception care.

Perinatal and Infant Community Health Collaborative (PICHC) programs work to implement evidence-based/informed strategies across the reproductive life course. Each PICHC employs community health workers (CHWs) from the communities they serve, to engage individuals in prenatal care and ongoing primary and preventive health care. The PICHC is a needs-driven, community-based collaborative approach to improving key perinatal and infant health outcomes, including preterm birth, low birth weight, infant mortality, and maternal mortality and eliminating racial, ethnic, and economic disparities in those outcomes. Using three separate approaches – life course, social-ecology, and performance management – the PICHC develops strategies to address different areas of reproductive health including preconception, prenatal, postpartum, and interconception. Strategies for addressing these areas include individual, family, organization, and community level interventions to increase access to health insurance, engage birthing persons in their health care, coordinate multiple services, and promote opportunities for healthy behaviors.

Engage in collaborative clinical and community-based strategies to reduce sleep-related infant deaths

The NYSDOH is working with the Office of Children and Family Services and other partners to promote safe sleep practices and prevent infant deaths caused by an unsafe sleep environment using several strategies including legislative and policy efforts, robust public awareness campaigns using media outlets, hospital-based education programs regarding the American Academy of Pediatrics' recommended ABCs of Safe Sleep⁷, as well as home-based visiting programs to support and educate parents and caregivers during the prenatal and postpartum periods.

Engage in collaborative strategies to respond to increasing use of opioids in the population, including pregnant individuals

Addressing the opioid epidemic is a public health priority in NYS. In 2014, the state established the Heroin and Opioid Task Force and enacted Combat Heroin legislation, establishing a multi-faceted response with a focus on prevention, harm reduction, treatment, recovery, and law enforcement. A collaborative approach is essential to addressing this complex issue. Several initiatives are underway at the state level, including efforts focused specifically on individuals who are pregnant and their families.

The NYS Opioid Use Disorder (OUD) in Pregnancy and Neonatal Abstinence Syndrome (NAS) Project, which began in November 2018, seeks to support birthing hospitals to provide appropriate and respectful care to individuals with OUD during pregnancy. This project seeks to improve early identification of OUD, standardization of therapy, and coordination of aftercare (i.e., plan of safe care) of infants with NAS. The project is achieving this goal by delivering provider and patient education; implementing universal verbal screening; improving the management of patients during labor, delivery, and immediately postpartum; coordinating discharge care; and collaborating across hospital teams to share and learn. The project's goal of improving the care of infants with NAS is being achieved by delivering provider and patient education; improving early identification of infants at risk; improving the management of patients using standardized NAS treatment protocols, including pharmacological and non-pharmacological management; coordinating discharge care; and collaborating across hospital teams to share and learn. Thirty-nine NYS birthing hospitals from diverse geographic areas and representing all levels of NYSDOH perinatal designations are participating in the project.

In their 2018 recommendations to reduce maternal mortality and morbidity, the Maternal Mortality Review Board (MMRB) suggested making Naloxone more available to pregnant and recently pregnant women and their families. The NYSDOH NYSPQC developed the Naloxone Patient and Family Education Brochure to support the implementation of the Board's recommendation by describing Naloxone and its use in reversing opioid overdose, symptoms to watch for, and how to obtain Naloxone with no or low copayments through the NYS Naloxone co-payment assistance program. The brochure was created in collaboration with teams from the NYSDOH AIDS Institute (AI), the New York State Office of Addiction Services and Supports (OASAS), and patient advocates from the New York State Opioid Use Disorder (OUD) in Pregnancy and Neonatal Abstinence Syndrome (NAS) Project. It is anticipated the brochure will be available by the Fall of 2022.

The NYSDOH, in collaboration with partners and stakeholders, will continue to employ a multi-pronged approach toward reducing racial disparities and addressing infant mortality, in accordance with the NYS Prevention Agenda 2019-2024 objectives. The efforts of the NYSDOH and its partners will additionally include addressing the key recommendations for action to improve perinatal health and reduce infant mortality.

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Section 2: Introduction

Infant mortality is an important marker of the overall health of a society and gives us key information about the health of people who are pregnant and infants. Infant mortality is defined as the death of an infant before the age of one. Neonatal mortality is defined as death within 27 days of birth, and postneonatal mortality is defined as death between 28 and 364 days of birth. The infant mortality rate is the number of infant deaths for every 1,000 live births. In 2019, the infant mortality rate in the United States (US) was 5.6 deaths per 1,000 live births.¹ In 2019, infant mortality rates in the US by race/ethnicity per 1,000 live births were as follows: Non-Hispanic Black 10.62; Non-Hispanic Native Hawaiian/Pacific Islander 8.19; Non-Hispanic American Indian/Alaskan Native 7.87; Hispanic 5.58; Non-Hispanic White 4.49; and Non-Hispanic Asian 3.38.²

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Despite national and NYS efforts to combat and eliminate racial and ethnic disparities in infant mortality, these disparities continue to endure. In 2019, Non-Hispanic Black infants (10.62) were 2.4 times as likely to die in infancy as Non-Hispanic White infants (4.49). Furthermore, Non-Hispanic Native Hawaiian/Other Pacific Islander (8.19) and Non-Hispanic American Indian/Alaska Native (7.87) infants were both 1.8 times as likely to die in infancy as Non-Hispanic White infants (4.49).^{2,4} These disparities have increased marginally since 2016. In 2016, infant mortality rates for Non-Hispanic Black, Non-Hispanic American Indian/Alaskan Native, and Non-Hispanic White infants were 11.21, 8.61, and 4.87 deaths per 1,000 live births respectively.⁴ In NYS, from 2016 to 2019, infant mortality rates declined for all racial/ethnic groups except for Non-Hispanic Black infants. The infant mortality rate for Non-Hispanic Black infants increased slightly from 8.37 to 8.46 deaths per 1,000 live births. In contrast, infant mortality rates declined for Hispanic (3.93 vs. 3.41), Non-Hispanic White (3.52 vs. 3.07), Non-Hispanic Asian (3.03 vs. 1.66), and Non-Hispanic Other (6.99 vs. 6.44) infants.

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This statewide report is prepared in response to Chapter 46 of the Laws of 2021 which requires the New York State Department of Health (NYSDOH) to conduct a study of the effects of racial and ethnic disparities on infant mortality, discuss with an expert group, and prepare a report to share the findings from the comprehensive review of infant mortality in NYS from 2016-2019 and the recommendations from the expert group. This report provides information regarding infant mortality risk factors and includes recommendations to reduce infant mortality and describes current actions the NYSDOH has taken to address this public health issue.

The infant mortality report provides information regarding various risk factors for infant mortality that inform planning for prevention activities. NYSDOH is committed to addressing these risk factors, especially in populations where disparities exist. The next section presents NYS infant mortality trends by various characteristics from 2016-2019 among infants who were born and died as NYS residents during their first year of life. The subsequent section provides descriptions of the clinical and community-based prevention strategies that have been utilized to achieve a reduction in the NYS infant mortality rate. Recommendations made by the expert workgroup that was convened by the NYSDOH to review the data are included in the final section.

Section 3: Infant Mortality Surveillance, 2016-2019

Methodology

This report was developed using linked infant birth and death certificate records for NYS resident infants who were born between 2016 and 2019 and died before reaching one year of age. Each year's cohort includes all live births that occurred during the calendar year and infant deaths (within 364 days of birth) that occurred during the year of birth or the following calendar year. Data for the 2019 cohort are considered provisional, with 99% of deaths during 2020 reported to date.

The birth-to-death record linkage rate from 2016 to 2019 was 96.1%. Unmatched records included those for infants who were born out of state and for whom birth certificate records were otherwise not available, or those for which critical identifiers needed for linking were missing. The overall and stratified numbers of infant deaths and live births were used respectively as the numerator and denominator for calculating overall and stratified rates for the birth year. Data for residents from all 62 counties in NYS are represented in all data sources and include their births and/or deaths that occurred outside of as well as within NYS.

Demographic, risk, and other characteristic variables included in the analyses were derived from the birth data, with the exception of date and cause of death. Maternal variables examined include county of residence, years of education, marital status, expected payor, age, and modifiable risk factors. Infant variables include sex assigned at birth, gestational age, birth weight, plurality, race and ethnicity, and cause of death; date of death was used to distinguish postnatal period of infant death, with neonatal being death within 27 days of birth and postneonatal being death between 28 and 364 days of birth.

Births and deaths were examined by geographic regions categorized several ways based on county of maternal residence. County-specific occurrences were grouped by eight NYS health service areas (HSAs), including Western, Finger Lakes, Central NY, NY-Pennsylvania, Northeastern, Mid-Hudson, New York City (NYC), and Long Island (Appendix A1 and A2). The low volumes of birth and death data for the NY-Pennsylvania were combined with those of the Central HSA based on their contiguity and similarity of rates. The Western NY, Finger Lakes, Central NY + NY-Pennsylvania, and Northeast NY HSAs were grouped together as the Upstate region, and the Mid-Hudson, New York City, and Nassau-Suffolk HSAs were grouped into the Downstate region. Categorizations by urban, suburban, and rural locales were derived based on the 2013 Urban Rural Classification Scheme for Counties, which were defined by the federal Health Resources and Services Administration (HRSA) based on the Office of Management and Budget's metropolitan and non-metropolitan statistical areas. Based on similarity of mortality rates, urban areas were defined as counties with large central areas having populations of one million or more and those in their large fringe metropolitan areas. Similarly, suburban regions were defined as counties with medium metropolitan areas with populations between 250,000 and 999,999 and small

metropolitan areas with populations between 50,000 and 249,999. Rural regions were defined as counties with micropolitan urban cluster populations between 10,000 and 49,999 and counties with populations below 10,000.

New York State Public Health Law (4135) prohibits the specific statement on the birth certificate as to the birthing person's marital status. Marital status for birthing persons reporting that an acknowledgement of paternity/parentage has been filed or supplying no paternal/other parent information are defined as being not married; those reporting that acknowledgement of paternity/parentage is not required and supplying paternal/other parent information are defined as married.

Maternal risk factors that are associated with increased risk for infant mortality and are reported in the state's administrative data included self-reported smoking, drinking alcohol, maternal drug use, and experiencing any depression during pregnancy, and clinical diagnoses of pre-existing chronic diabetes and hypertension prior to pregnancy.

Infant race and ethnicity were attributed from maternal data only, which is the established practice. Race/ethnicity categories were created using standard practices that combine race and ethnicity responses together. The categories used in the analysis are Hispanic, which is regardless of race selected; the remaining categories are Non-Hispanic Black, Non-Hispanic White, and Non-Hispanic Asian and Non-Hispanic Other which included American Indian/Alaskan Native, Native Hawaiian/Other Pacific Islander, any specified other race or with multiple race selections. There were small numbers of infant deaths which result in small cell sizes and unstable analyses, so these groupings were required to perform the analyses.

Gestational age at birth was derived from the obstetrical estimate recorded in the birth certificate or in its absence, calculated based on the date of the mother's last menstrual period, and was cross validated with infant birth weight. Records with invalid combinations of gestational age and weight and those with gestational ages below 17 weeks were excluded from the rate calculations.

Dates of death were used to determine the postnatal period during which the infant death occurred. Those occurring within 27 days of birth were defined as neonatal deaths, while those occurring between 28 and 364 days of birth were defined as postneonatal deaths.

Primary causes of death are reported in death certificates using a wide variety of specifically detailed codes within ranges of diagnostic categories from the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10).⁷ To summarize leading causes of death for this report, primary causes found in the data are categorized by their diagnostic ranges. Those comprising 3% or more of neonatal or postneonatal deaths are shown in detail.

In conducting the study of infant mortality, the Department sought the advice of persons specializing in maternal and child health advocacy, neonatology, obstetrics and gynecology, maternal fetal medicine, nursing, pediatrics, pediatric emergency medicine, and pathology. The Department convened two work group meetings of these specialists to review mortality trends and sub-analyses for infants who died between 2016 and 2019. The work group advised the Department by providing input and recommendations on these data findings.

Findings

In this section tables and graphical figures showing statistics related to infant mortality trends and sub-analyses are presented.

Between 2016 and 2019, the number of infants who died declined in NYS. In 2016, 1,014 infants died in infancy, with 671 expiring in the neonatal period before 28 days of age, and 343 expiring during the postneonatal period between 28 and 364 days of age. In 2019, 850 infants died, with 561 occurring during the neonatal period and 289 occurring during the postneonatal period, a decline of 16% from 2016 in each group (Table 1).

Table 1. Infant Mortality by Year

	2016	2017	2018	2019
Neonatal Mortality*	671	668	621	561
Postneonatal Mortality**	343	270	296	289
Total Infant Mortality	1,014	938	917	850

* Neonatal Mortality defined as infants who died between 0 and 27 days of age

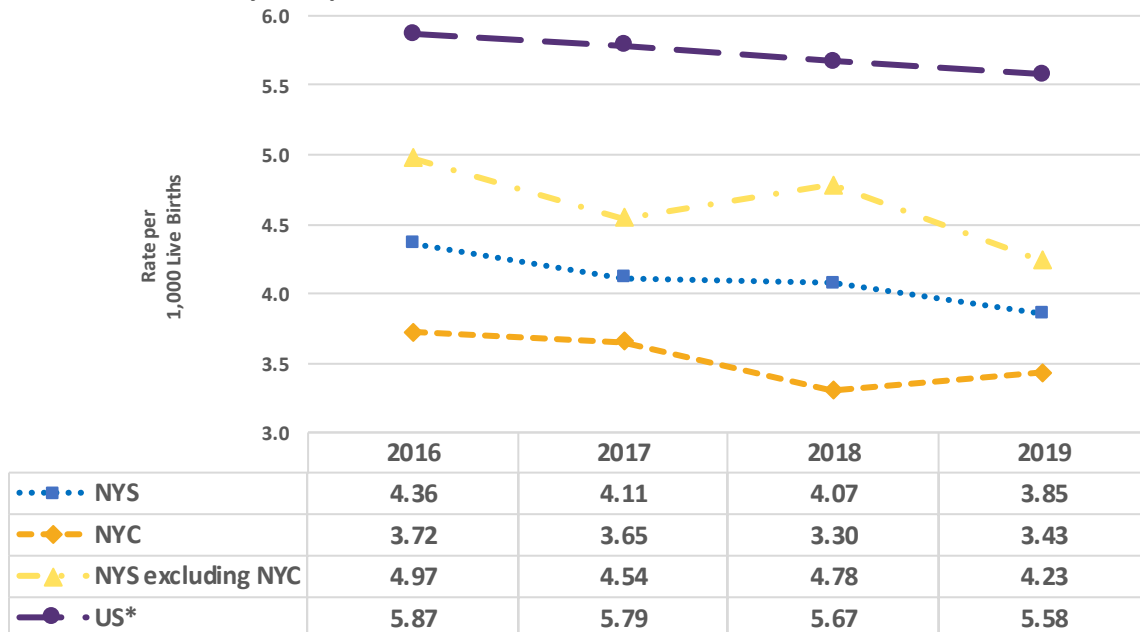
** Postneonatal Mortality defined as infants who died between 28 and 364 days of age

Trends in Geographic Patterns of Infant Mortality

In the US infant mortality has declined by 5% in the last decade. By contrast, NYS infant mortality rates have declined by 12% from 4.36 deaths per 1,000 live births in 2016 to 3.85 deaths per 1,000 live births in 2019.

While the overall rate of infant mortality in NYS has declined, racial, ethnic, and geographic disparities persist. New York City (NYC) has consistently experienced a lower rate of infant mortality than the rest of the state at 3.43 deaths per 1,000 live births in 2019, compared to 4.23 deaths per 1,000 live births in NYS excluding NYC during the same period (Figure 1). Both areas had infant mortality rates below the national rate of 5.6 deaths per 1,000 live births as well as U.S. Healthy People 2030 goal of 5.0 deaths per 1,000 live births.¹

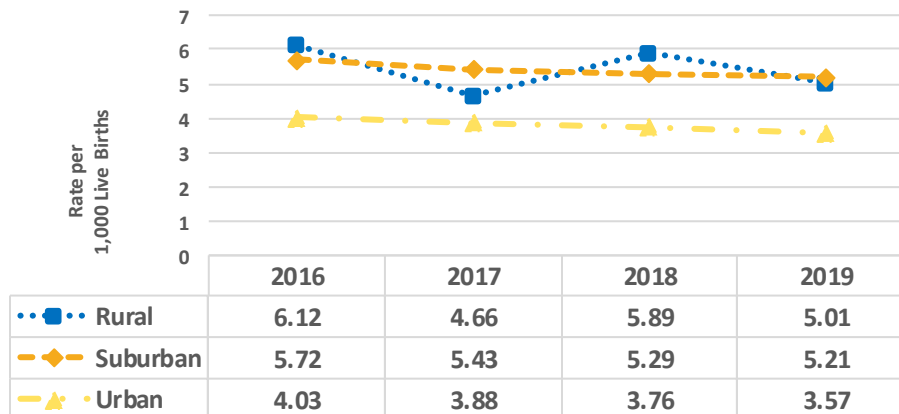
Figure 1. Infant Mortality Rate per 1,000 Live Births in NYS, within and outside of NYC, 2016-2019



*US Infant Mortality Rate is sourced from National Vital Statistics Report, National Center for Health Statistics, Centers for Disease Control and Prevention; https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_10-508.pdf. US Infant Mortality Rate uses period method while the report employs birth cohort method.

Figure 2 shows the small declines in the infant mortality rate over the four-year report period (2016-2019) for three different types of locales in NYS – urban, suburban, and rural. Higher rates of infant mortality were observed in rural and suburban areas of the state than in urban areas. Rates in the least populous rural areas fluctuated a bit over the 4-year period, likely due to small numbers, but ranged from a high of 6.12 per 1,000 live births in 2016 to 5.01 per 1,000 live births in 2019; rates in suburban areas declined more steadily from a high of 5.72 per 1,000 live births in 2016 to 5.21 per 1,000 live births in 2019. Urban areas have consistently had slightly lower infant mortality rates than the rest of the state declining from a high of 4.03 per 1,000 live births in 2016 to a low of 3.57 per 1,000 live births in 2019. The urban designation includes NYC and the contiguous highly populated areas of the Mid-Hudson Valley, Long Island, Buffalo, Rochester, and their surrounding areas.

Figure 2. Infant Mortality by Urban, Suburban, and Rural Locale *, 2016-2019

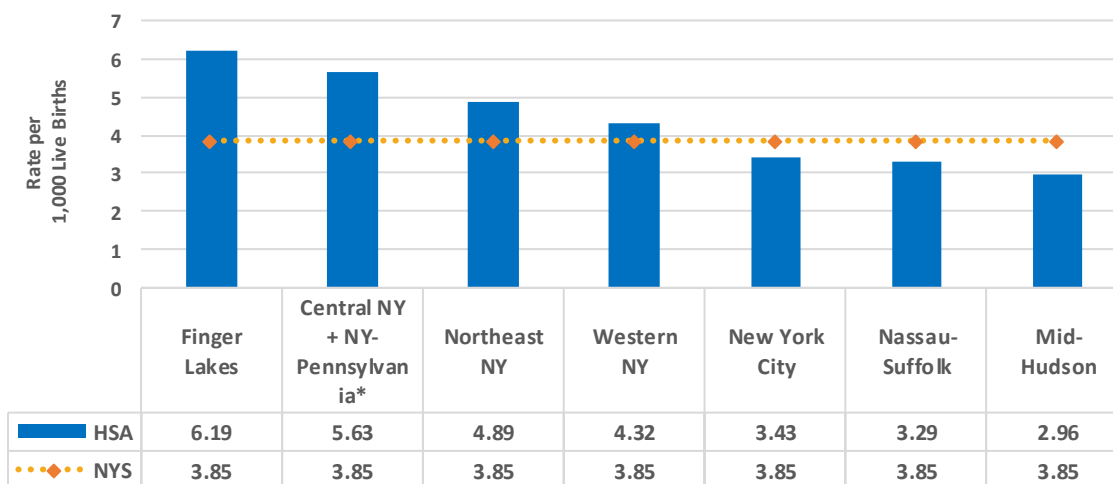


*Urban/suburban/rural locale designations derived from the 2013 Urban Rural Classification Scheme for Counties (based on OMB Metropolitan/Nonmetropolitan statistical areas)

- –Urban - counties in large central areas with 1 million+ populations or in their large fringe metropolitan areas
- Suburban -counties within medium metropolitan areas with 250,000-999,999 populations and small metropolitan areas with 50,000 – 249,999 populations
- –Rural - counties with micropolitan urban cluster populations of 10,000-49,999 and counties with fewer than 10000 populations

Figure 3 illustrates that in 2019 the rate of infant mortality varied throughout NYS’s eight health service areas (HSAs), with Central NY and NY-Pennsylvania combined. The highest rates of infant mortality occurred in the Finger Lakes, Central NY/NY-Pennsylvania, Northeast NY, and Western NY HSAs. Each of which exceeded the statewide average of 3.85 per 1,000 live births individually, as well as a combined Upstate rate of 5.24 per 1,000 live births. Infant mortality rates for Mid-Hudson, NYC, and Nassau-Suffolk HSAs all had similar rates of 3.33 per 1,000 live births, which were below the statewide average.

Figure 3. Infant Mortality Rate by Health Service Area, 2019



* Central NY was combined with the contiguous NY-Pennsylvania due to the latter’s small cell size

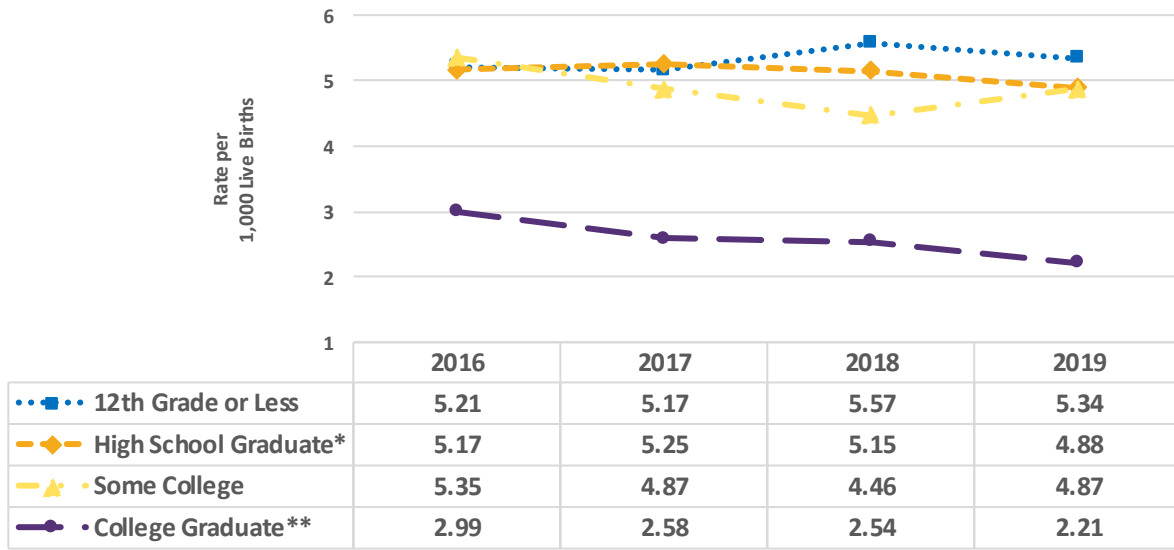
Infant Mortality by Maternal Demographic Characteristics

Disparities in infant mortality have been observed across various maternal demographic characteristics, including maternal age, educational level, race/ethnicity, and marital status.

Maternal Education:

Disparities in infant mortality were observed across varying levels of maternal education. An increase of 2% in infant mortality was seen in infants born to mothers with less than a high school education between 2016 - 2019. For those infants born to mothers with a high school diploma or equivalent, infant mortality decreased 6%. The infant mortality rate also decreased by 9% among infants born to mothers with some college. There was a significant decrease in infant mortality when mothers report having a college degree or higher, and this group experienced the greatest decline in infant mortality, decreasing by 26% from 2016 to 2019 (Figure 4).

Figure 4. Infant Mortality Rate by Maternal Education, 2016-2019



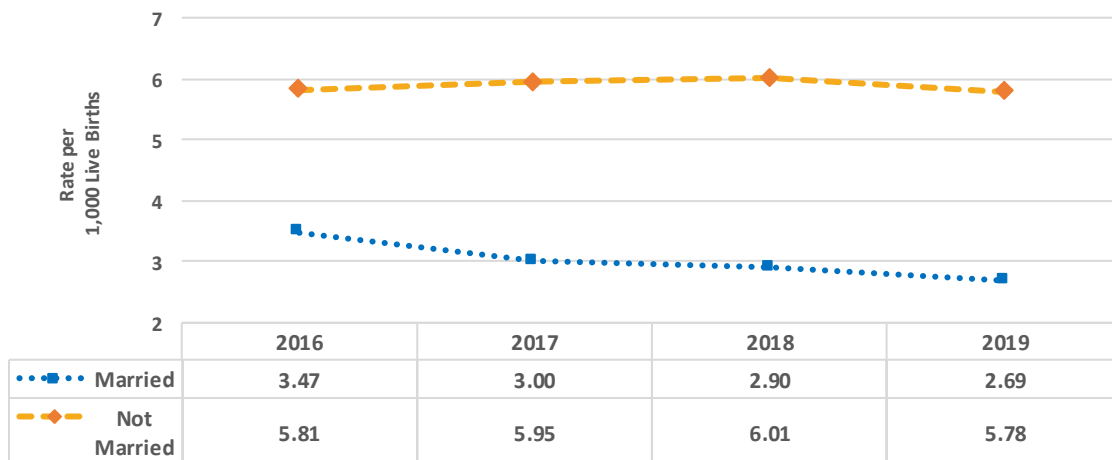
* High school graduates include persons who graduated from high school or obtain high school equivalency

** College graduates include persons with Associate’s, Bachelor’s, Master’s, or Doctorate degrees.

Maternal Marital Status:

The infant mortality rate between 2016 and 2019 among birthing persons who were not married was about twice that of those who were married. (Figure 5). The infant mortality rates among married individuals declined steadily, dropping by 23% during the four-year period. Rates fluctuated among unmarried individuals, with only a 1% decline between 2016 and 2019.

Figure 5. Infant Mortality Rate by Maternal Marital Status, 2016-2019

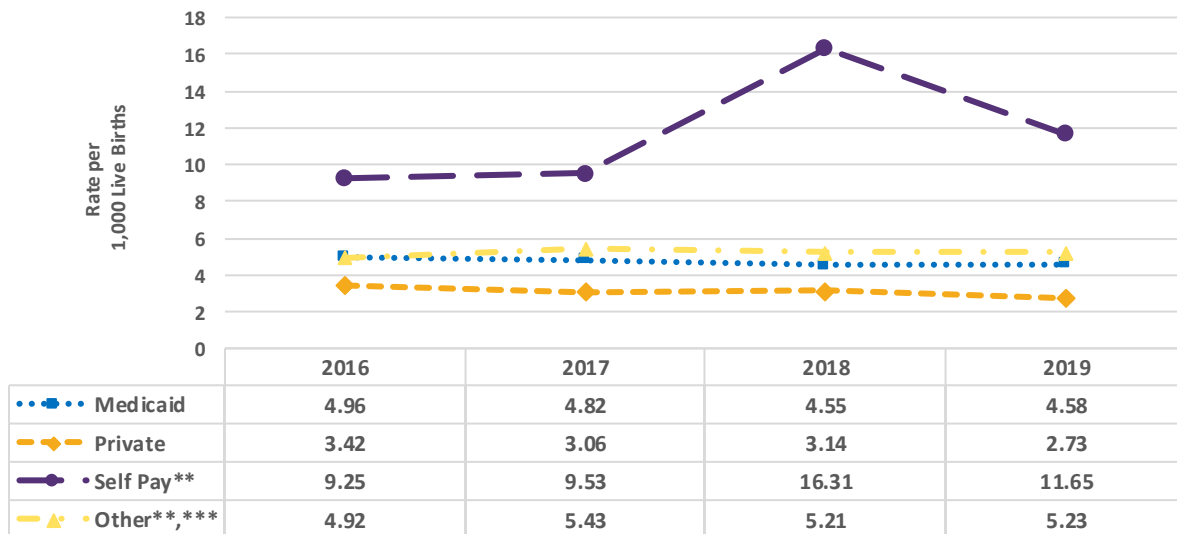


Expected Payor:

Disparities in infant mortality was observed among varying hospitalization payor groups. In 2019, the infant mortality rate was highest among those who were self-paying (11.65 deaths per 1,000 live births), followed by those with governmental insurance other than Medicaid or Medicare (i.e., Indian Health Service, CHAMPUS/TRICARE, Other Government/Child Health Plus, and Other at 5.23 deaths per 1,000 live births), followed by those with Medicaid (4.58 deaths per 1,000 live births), and those with private

insurance (2.73 deaths per 1,000 live births). Since 2016, the largest decrease in the infant mortality rate was observed in the private insurance group with a 20% decline, followed by an 8% decline in infant mortality in the Medicaid group. However, the rates of infant mortality increased among the self-pay insurance and Other groups (26% and 6%, respectively). Note that rates of mortality among infants born to mothers in these two payor groups may be unstable over time due to small sample size and should be interpreted with caution (Figure 6).

Figure 6. Infant Mortality Rate by Expected Payor*, 2016-2019



* Expected payor information as coded on birth certificates may be different from the final payor; Medicaid includes both primary and secondary payor

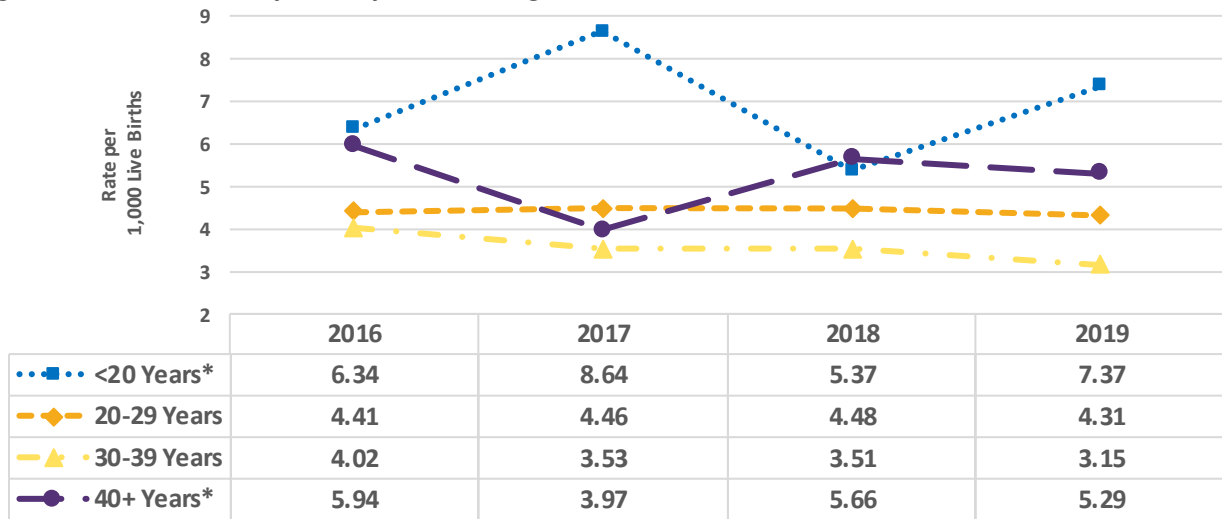
** Self Pay and Other rates may be unstable due to small cell size

*** Other=Child Health Plus, Other Government, and Other

Maternal Age:

Between 2016 and 2019, infant mortality decreased steadily from 4.02 deaths per 1,000 live births to 3.15 deaths per 1,000 live births, a 22% decline, among infants born to mothers in the 30–39-year age range, but there was little change in the rate for infants born to mothers in the 20-29 age range. Infant mortality rates were generally higher but fluctuated considerably during this period among infants born to mothers less than 20 years old and 40 years or older, which may be due to the relatively small numbers of deaths in both age groups (Figure 7).

Figure 7. Infant Mortality Rate by Maternal Age, 2016-2019

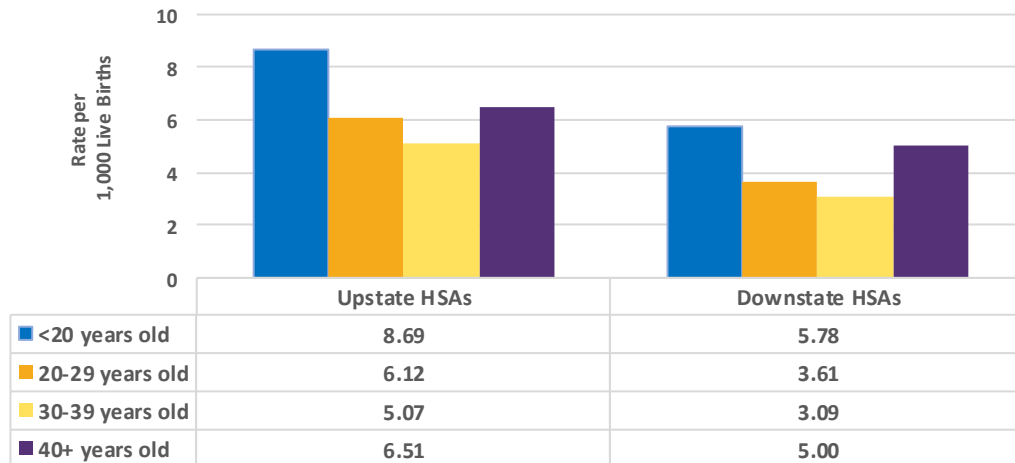


* <20 Years and 40+ Years rates may be unstable over time due to small cell sizes

Geographic Region:

When stratified by region for combined years 2016-2019, the infant mortality rates were higher for all maternal age groups in Upstate HSAs (Figure 8). The highest rates of infant mortality occurred among newborns born to mothers under the age of 20 (8.69 deaths per 1,000 live births Upstate vs. 5.78 deaths per 1,000 live births Downstate) followed by women 40 years of age and older (6.51 vs. 5.00) and were lowest in the 20-29 age range (6.12 vs. 3.61) and the 30-39 age range (5.07 vs. 3.09).

Figure 8. Infant Mortality by Maternal Age and Region*, 2016-2019



Maternal Age	2016-2019								
	Upstate HSAs			Downstate HSAs			Statewide		
	Infant Mortality Rate	Infant Deaths	Births	Infant Mortality Rate	Infant Deaths	Births	Infant Mortality Rate	Infant Deaths	Births
<20 years old	8.69	98	11,280	5.78	103	17,827	6.91	201	29,107
20-29 years old	6.12	737	120,500	3.61	918	254,367	4.41	1,655	374,867
30-39 years old	5.07	543	107,164	3.09	1,080	349,685	3.55	1,623	456,849
40+ years old	6.51	43	6,603	5.00	195	39,034	5.22	238	45,637

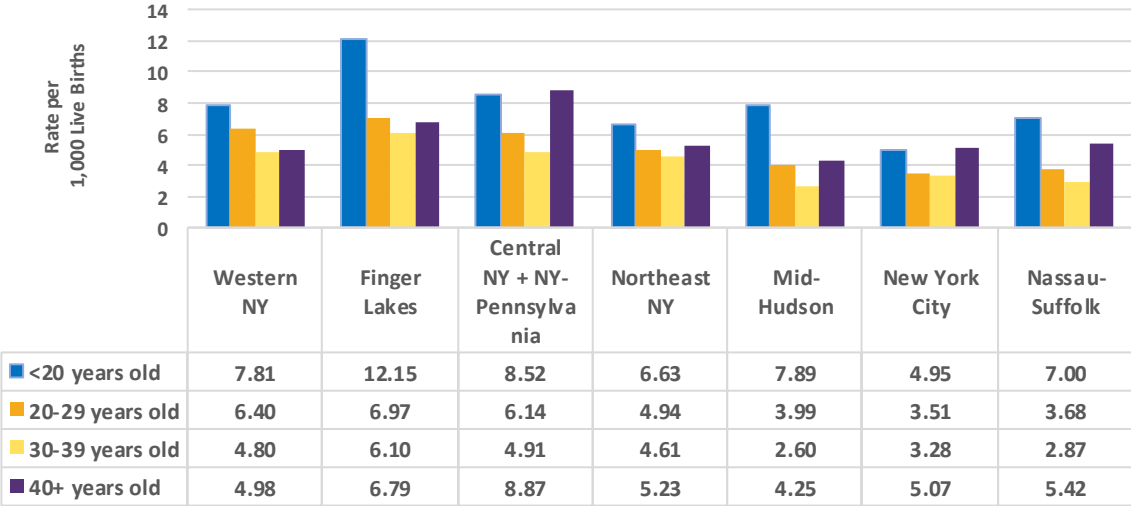
*Upstate HSAs include Western NY, Finger Lakes, Central NY, NY Pennsylvania, and Northeast NY. Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk.

Infants born to birthing individuals in their teens had the highest mortality rate, as is found for the 2016-2019 NYS birth cohort and each of the HSAs (Figure 9). Birthing persons aged 20-29 years old and more than 40 years of age alternated in having the next highest infant mortality rate. Outside of NYC, rates for infants born to individuals who are less than 20 years old and who are 40 years or older should be interpreted with caution due to the small numbers of infant deaths represented, but the increased rates are seen consistently by region and at the state level.

When further broken down by region, the pattern of infant mortality rates persists. Among infants born to mothers aged 20-29, the rate is highest in the Finger Lakes HSA at nearly 7 per 1,000 live births, followed closely by those in the Western and Central/NY Pennsylvania HSAs where the rate is over 6 per 1,000 live births, and then Northeast NY HSA at just under 5 per 1,000 live births. Infant mortality rates in the Mid-Hudson, New York City, and Nassau-Suffolk HSAs all had the lowest rates in this age category ranging between 3.51 (NYC) and 3.99 per 1,000 live births (Mid-Hudson).

Mortality among infants born to mothers aged 30-39 years was slightly lower than 5 per 1,000 live births in all the Upstate HSAs, with the exception of the Finger Lakes, again having the highest rate at 6.10 per 1,000. Rates in the Downstate HSAs were generally lower in this age group, at under 3 per 1,000 live births in the Mid-Hudson and Nassau-Suffolk HSAs and only slightly higher in NYC, at 3.28 per 1,000.

Figure 9. Infant Mortality by Maternal Age and HSA, 2016-2019



Maternal Age	2016-2019							
	Western NY		Finger Lakes		Central NY +		Northeast NY	
	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths
<20 years old	7.81	24	12.15	28	8.52	31	6.63	15
20-29 years old	6.40	197	6.97	175	6.14	235	4.94	130
30-39 years old	4.80	135	6.10	143	4.91	144	4.61	121
40+ years old	4.98	8	6.79	10	8.87	16	5.23	9

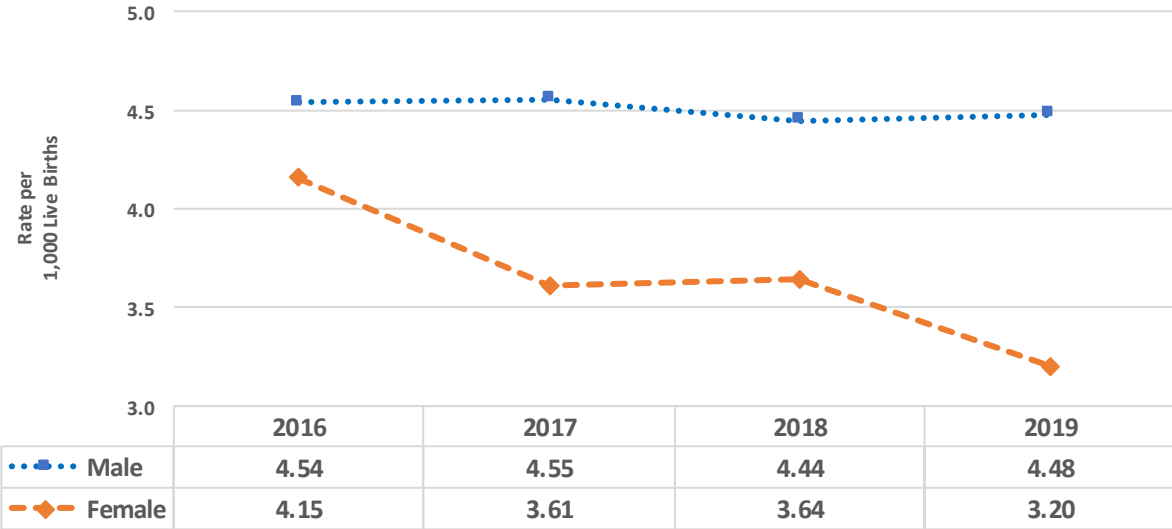
Maternal Age	2016-2019					
	Mid-Hudson		New York City		Nassau-Suffolk	
	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths
<20 years old	7.89	23	4.95	59	7.00	21
20-29 years old	3.99	161	3.51	615	3.68	142
30-39 years old	2.60	147	3.28	734	2.87	199
40+ years old	4.25	27	5.07	132	5.42	36

[Infant Mortality by Infant Characteristics](#)

Sex Assigned at Birth:

Infant mortality varies in relation to multiple infant characteristics, such as gender, gestational age at birth, and birthweight. In NYS in 2019, the infant mortality rate for male infants was 4.48 deaths per 1,000 live births, 1.4 times higher than the rate for female infants at 3.20 deaths per 1,000 live births. Since 2016, the infant mortality rate decreased 23% among female infants and 1% among male infants (Figure 10).

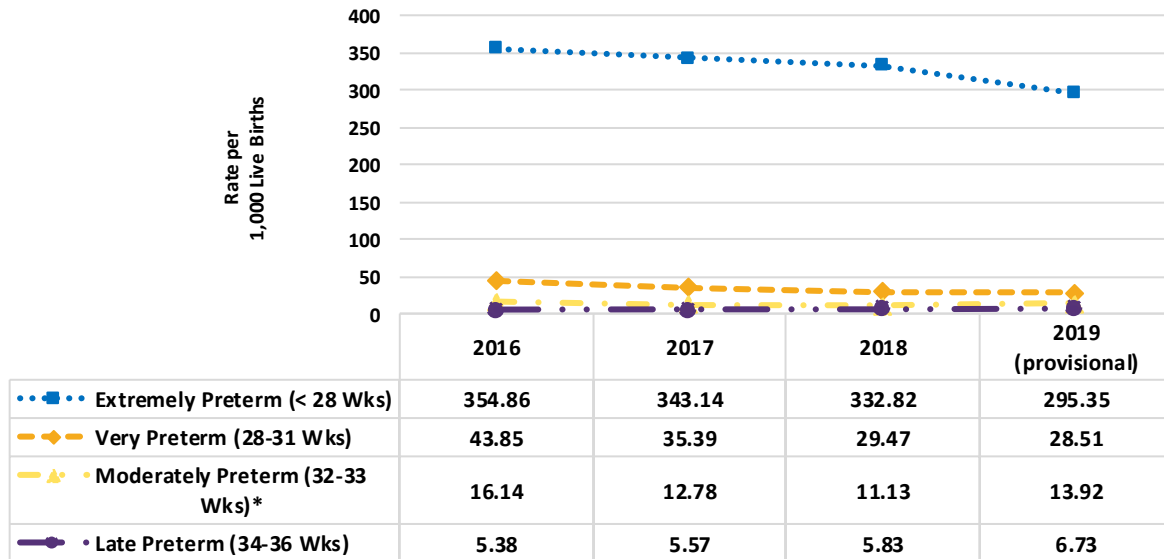
Figure 10. Infant Mortality Rate by Sex Assigned at Birth, 2016-2019



Preterm Gestational Age:

Figure 11 shows that infants born at less than 28 weeks gestation were most likely to die, with the rate continually decreasing as gestational age increases, with the lowest rate of infant mortality being observed among infants born late preterm at 34-36 weeks gestation or longer (354.86 vs 5.38 deaths per 1,000 live births in 2016 compared to 295.35 vs 6.73 deaths per 1,000 live births in 2019, respectively).

Figure 11. Infant Mortality Rate by Preterm Gestational Age, 2016-2019



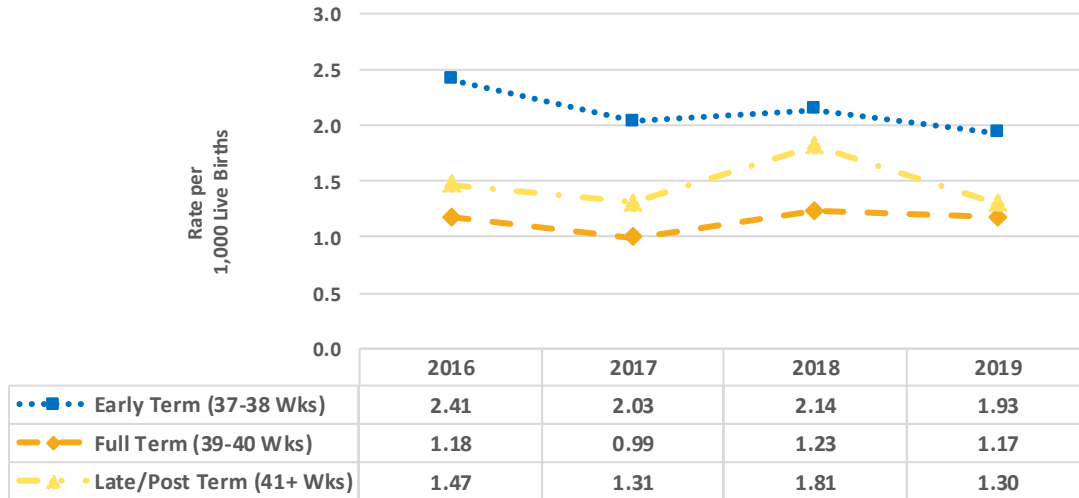
* Early Preterm rates may be unstable over time due to small cell sizes.

Term Gestational Age:

Infants born at early term (between 37-38 weeks gestation) account for a higher percentage of infant deaths compared to infants born at 39 weeks or later (Figure 12). These data support the American College of Obstetricians and Gynecologist’s recommendation that in the absence of medical need, a planned elective C-section should not be performed before 39 weeks. The infant mortality rate decreased when infants were born at full term (39-40 weeks). Ensuring that as many pregnancies as possible reach full-term (39 to 40 weeks gestation) will help NYS reduce infant mortality.

The infant mortality rate increased in the post-term period (41+ weeks). The rate of infant mortality among early term infants was 51% higher than the infant mortality rate of full-term infants born between 39-40 weeks gestation in 2016 (2.41 vs. 1.18 deaths per 1,000 live births) and 39% higher in 2019 (1.93 vs 1.17 deaths per 1,000 live births). The rate of infant mortality among post-term infants was 20% higher than that of full-term infants in 2016 (1.47 vs. 1.18 deaths per 1,000 live births) and 10% higher in 2019 (1.30 vs 1.17 deaths per 1,000 live births).

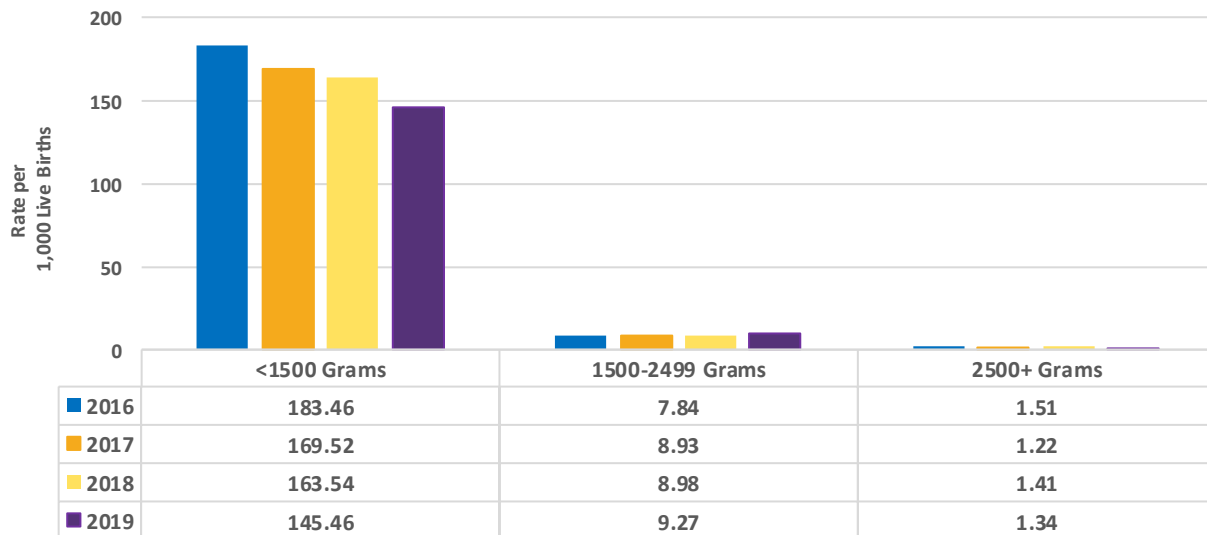
Figure 12. Infant Mortality Rate by Term Gestational Age, 2016-2019



Birth Weight:

Low infant birth weight is one of the leading causes of infant mortality. Infants born with a birth weight less than 1,500 grams had an infant mortality rate approximately 121 times that of normal birth weight infants in 2016 (183.46 vs. 1.51 deaths per 1,000 live births, respectively), and 109 times in 2019 (145.46 vs. 1.34 per 1,000 live births, respectively) (Figure 13). Birth weight is highly correlated with gestational age presented in Figures 12 and 13.

Figure 13. Infant Mortality Rate by Birth Weight, 2016-2019



Plurality:

Giving birth to multiples (2 or more infants) is a risk factor for infant mortality. In 2019, the infant mortality rate for singleton births was 3.45 infants per 1,000 live births, whereas the infant mortality rate for multiple births was 15.56 infants per 1,000 live births (Figure 14a). The rate of infant death was 78% higher for multiple births as compared to singleton births in 2019.

Twins had an infant mortality rate 21 times higher than singletons and 5 times higher mortality rate than multiples. In 2019, the infant mortality rate for singleton births was 3.45 infants per 1,000 live births, for twin births 72.22, and for multiple births 14.13 infants per 1,000 live births. The rate of infant mortality was 95% higher for twin births as compared to singleton births and 78% higher for twin births as compared to multiple births in 2019 (Figure 14b).

Figure 14a. Infant Mortality Rate by Plurality (Single vs. Multiple), 2016-2019

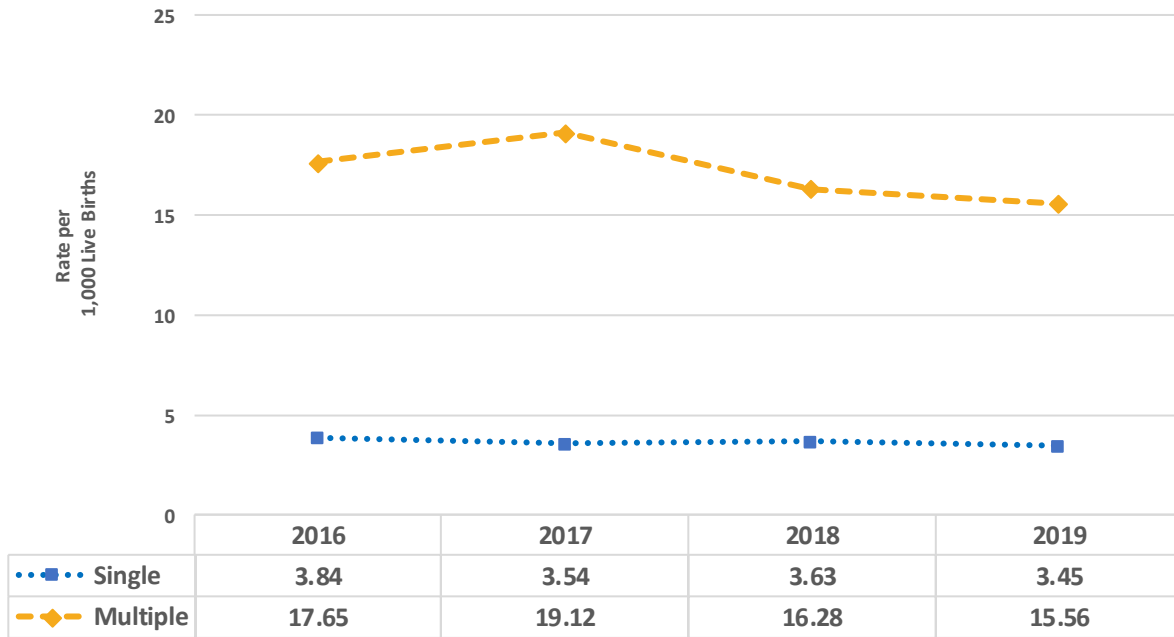
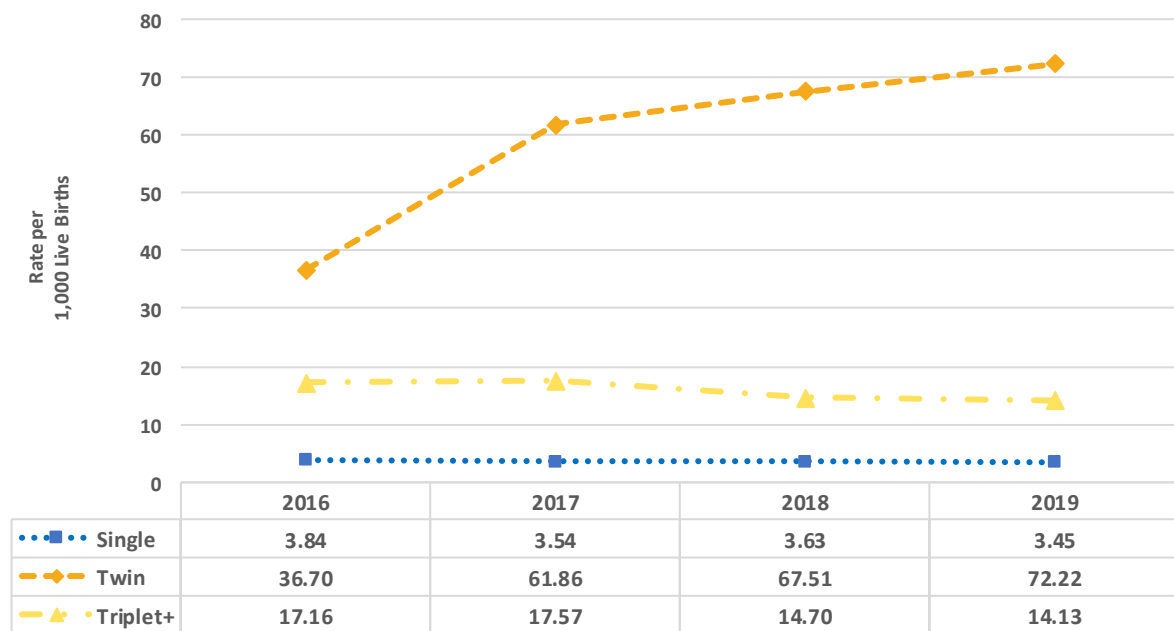


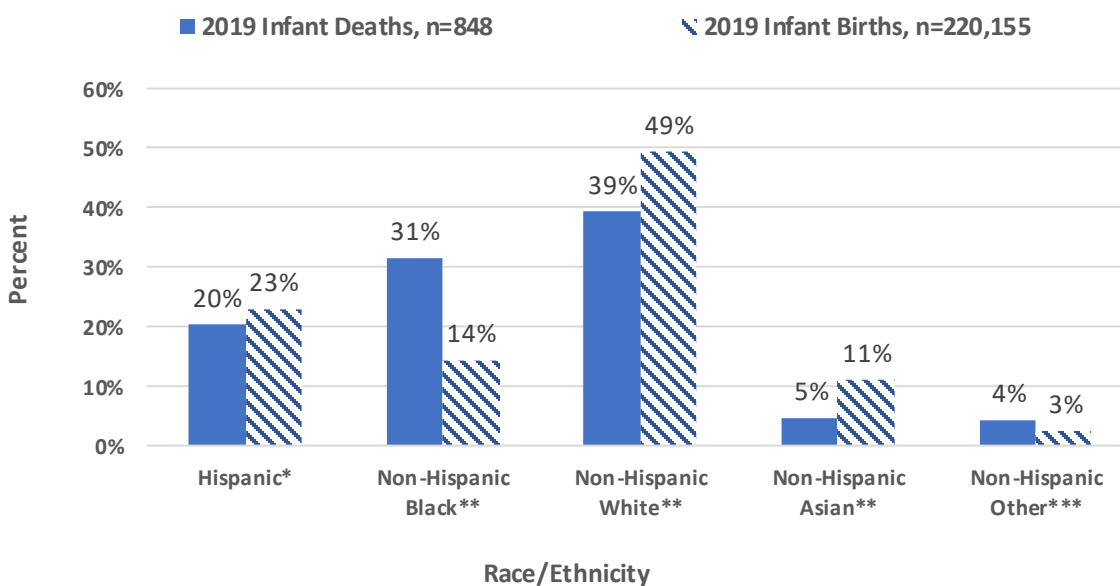
Figure 14b. Infant Mortality Rate by Plurality (Single vs. Twin vs. Triplet+), 2016-2019



Infant Mortality by Race/Ethnicity

Figure 15 shows the distribution of infant deaths and births by race/ethnicity and highlights racial and ethnic disparities in infant mortality. While infants born to Non-Hispanic Black persons made up 14% of all infant births in 2019, they accounted for 31% of infant deaths. Non-Hispanic Other infants also had a higher percentage of infant deaths than births (4% vs. 3%), while the remaining racial/ethnic groups had a lower percentage of infant deaths than infant births: Hispanic (20% vs. 23%), Non-Hispanic White (39% vs. 49%), and Non-Hispanic Asian (5% vs. 11%).

Figure 15. Distribution of Infant Deaths/Births by Race/Ethnicity, 2019



* Hispanic includes all infants of Hispanic origin of any race.

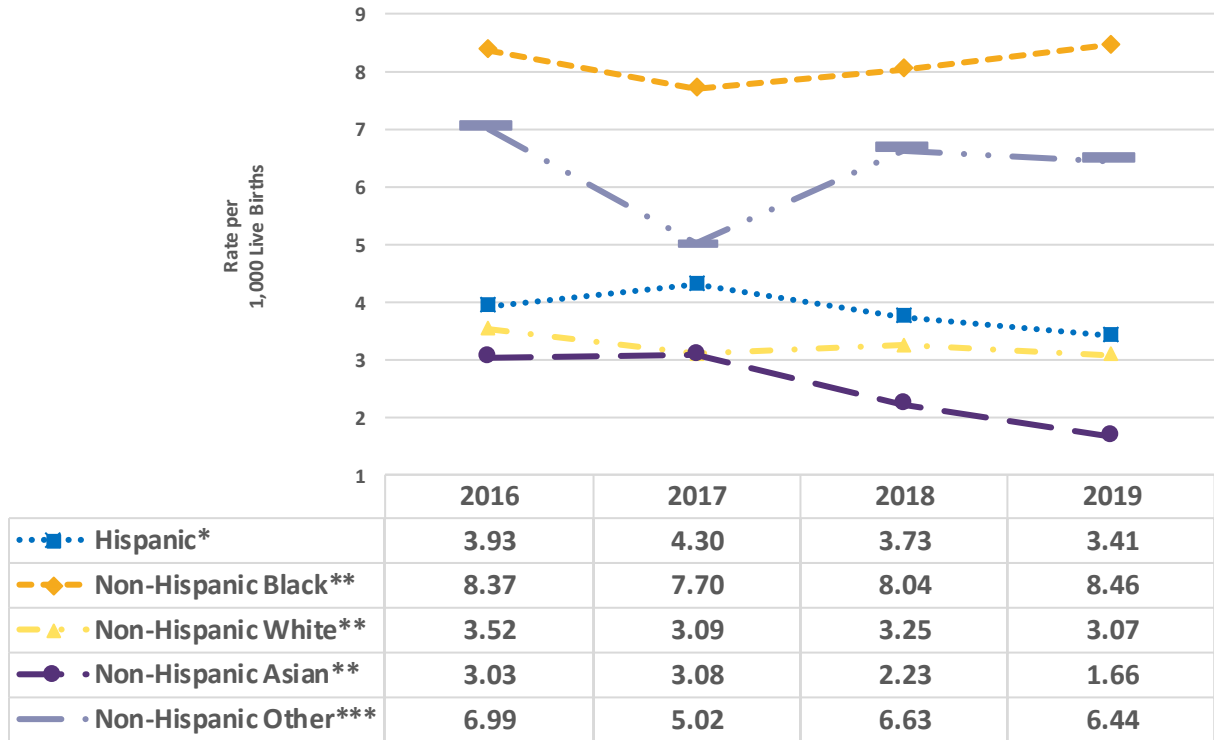
** Non-Hispanic Black, White, and Asian include all infants of these single races

*** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, and specified other and multiple race infants

Racial and Ethnic Disparities:

From 2016 to 2019, Non-Hispanic Black infants had the highest rate of infant mortality in NYS. In 2019, the infant mortality rate among Non-Hispanic Black infants (8.46 deaths per 1,000 live births) was 2.8 times as high as that of Non-Hispanic White infants (3.07 deaths per 1,000 live births), and Hispanic infants (3.41 deaths per 1,000 live births). Unfortunately, the infant mortality rate among Non-Hispanic Black infants experienced a slight increase from 8.37 deaths per 1,000 live births in 2016 to 8.46 deaths per 1,000 live births in 2019. This is in contrast to a decline in non-Hispanic White infant mortality for the same time period - 3.52 deaths per 1,000 live births in 2016 to 3.07 deaths per 1,000 live births in 2019. This contributed to the racial disparities between non-Hispanic Black and non-Hispanic White infants from 2016-2019. (Figure 16)

Figure 16. Infant Mortality Rate by Race/Ethnicity, 2016-2019



* Hispanic includes all infants of Hispanic origin of any race.

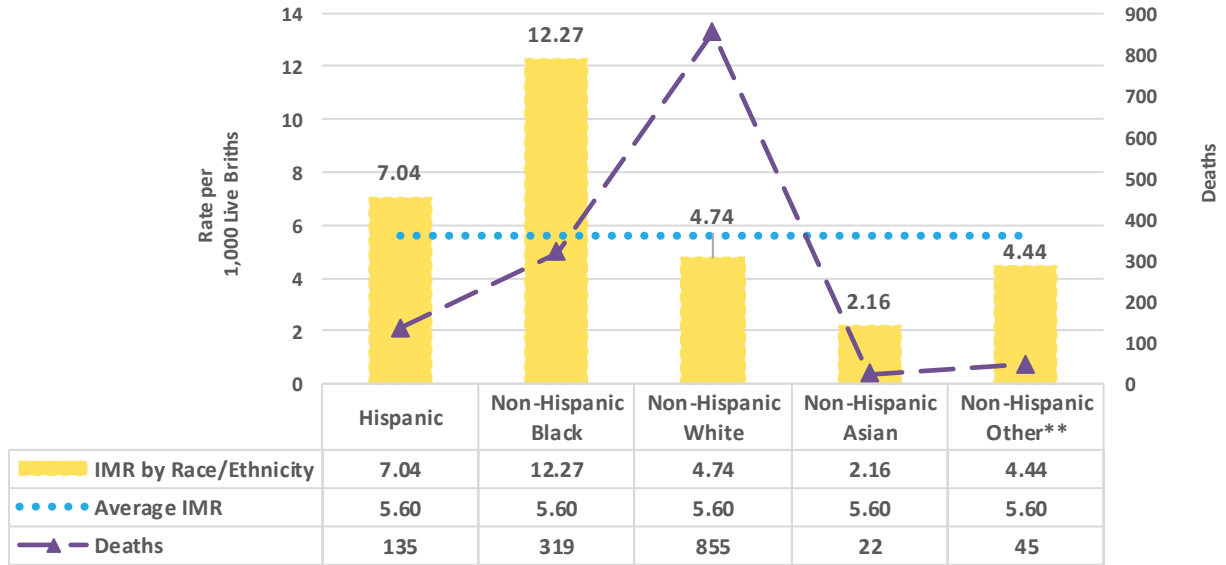
** Non-Hispanic Black, White, and Asian include all infants of these single races; Non-Hispanic Asian rates may be unstable due to small cell size.

*** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, and specified other and multiple race infants.

Upstate Health Service Area:

The 2016-2019 infant mortality rate for the Upstate HSAs was 5.60 per 1,000 live births (Figure 17). Among the Upstate HSAs, the rate of infant mortality was highest among infants born to Non-Hispanic Black mothers (12.27), followed by Hispanic (7.04), Non-Hispanic White (4.74), Non-Hispanic Other (4.44), and Non-Hispanic Asian (2.16). When compared to average Upstate HAS of 5.60 per 1,000 live births, the infant mortality rates of Hispanic and Non-Hispanic Black were both higher. The number of infant deaths in Upstate HSAs is by far the highest among Non-Hispanic White (n=855), followed by Non-Hispanic Black (n=319), Hispanic (n=135), Non-Hispanic Other (n=45), and Non-Hispanic Asian (n=22).

Figure 17. Infant Mortality by Race/Ethnicity for Upstate* HSAs, 2016-2019



*Upstate HSAs include Western NY, Finger Lakes, Central NY, NY Pennsylvania, and Northeast NY

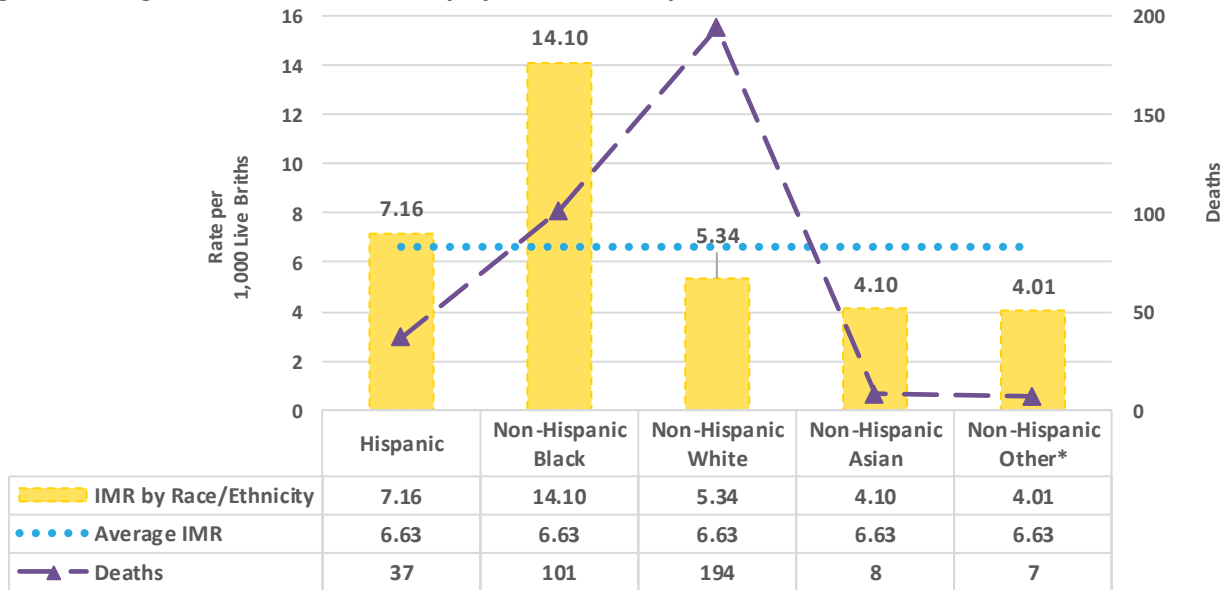
**Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, and specified other and multiple race infants; rates may be unstable due to small sample sizes.

The four figures below present a further breakdown of the Upstate HSA into Finger Lakes, Western NY, Central NY + NY-Pennsylvania, and Northeast NY.

Finger Lakes Health Service Area:

The overall infant mortality rate for the Finger Lakes HSA was 6.63 per 1,000 live births (Figure 18). Out of all Upstate HSAs, the rate of infant mortality for Non-Hispanic Black (14.10) was the highest in the Finger Lakes. Non-Hispanic Black (14.10) and Hispanic infants (7.16) died at a higher rate than the overall rate in the Finger Lakes (6.63). The highest number of deaths occurred among Non-Hispanic Whites (n=194); however, this group had an infant mortality rate of 5.34, which was lower than the HSA average infant mortality rate. Non-Hispanic Asians (4.10) and Non-Hispanic Others (4.01) also had rates lower than the HSA average infant mortality rate.

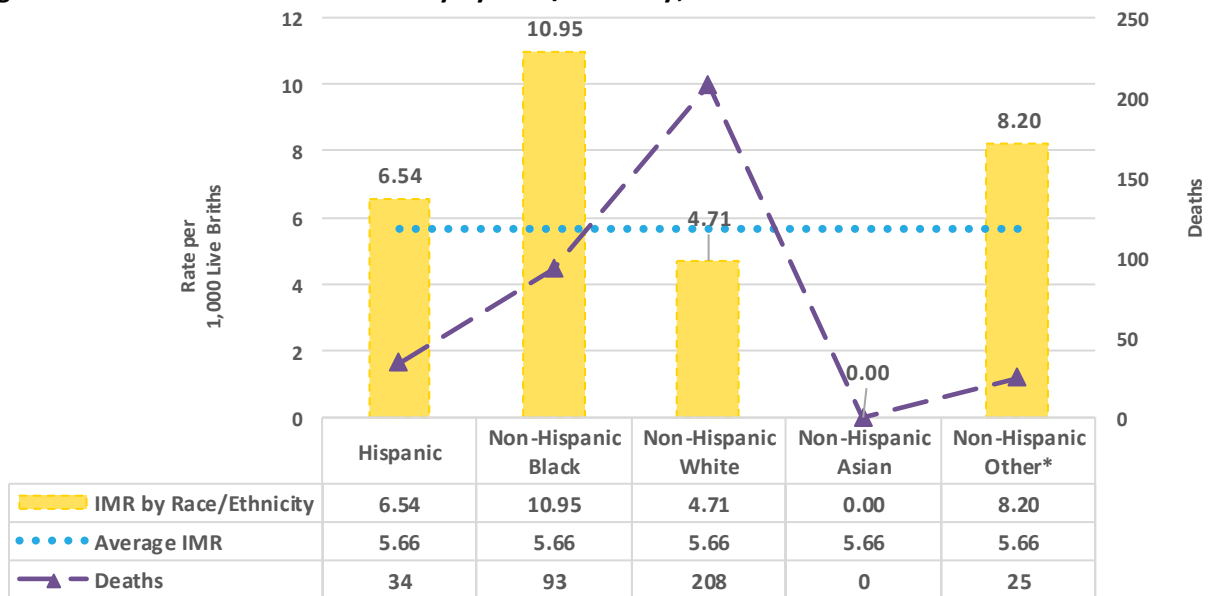
Figure 18. Finger Lakes Infant Mortality by Race/Ethnicity, 2016-2019



Western NY Health Services Area:

The overall infant mortality rate for the Western NY HSA was 5.66 per 1,000 live births. Non-Hispanic Black (10.95), Non-Hispanic Other (8.20), and Hispanic (6.54) infants died at a higher rate than the overall rate for the HSA (5.66), while Non-Hispanic Whites had a lower rate (4.71) (Figure 19). There were no infant deaths among Non-Hispanic Asian.

Figure 19. Western NY Infant Mortality by Race/Ethnicity, 2016-2019

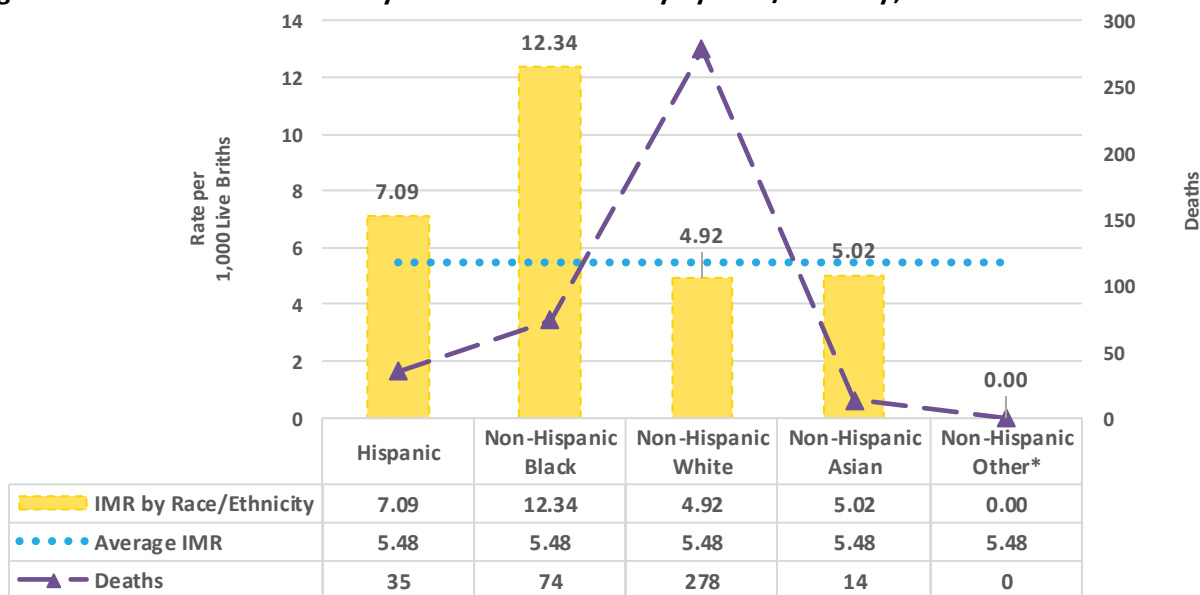


Central NY + NY-Pennsylvania Health Services Area:

The overall infant mortality rate for the Central NY + NY-Pennsylvania HSA was 5.48 per 1,000 live births. Non-Hispanic Black infants (12.34) and Hispanic infants (7.09) died at a higher rate than the overall infant mortality rate for the HSA (5.48), while Non-Hispanic White (4.92) and Non-Hispanic Asian infants

(5.02) had lower infant mortality rates than the HSA average (Figure 20). There were no infant deaths among Non-Hispanic Other birthing persons.

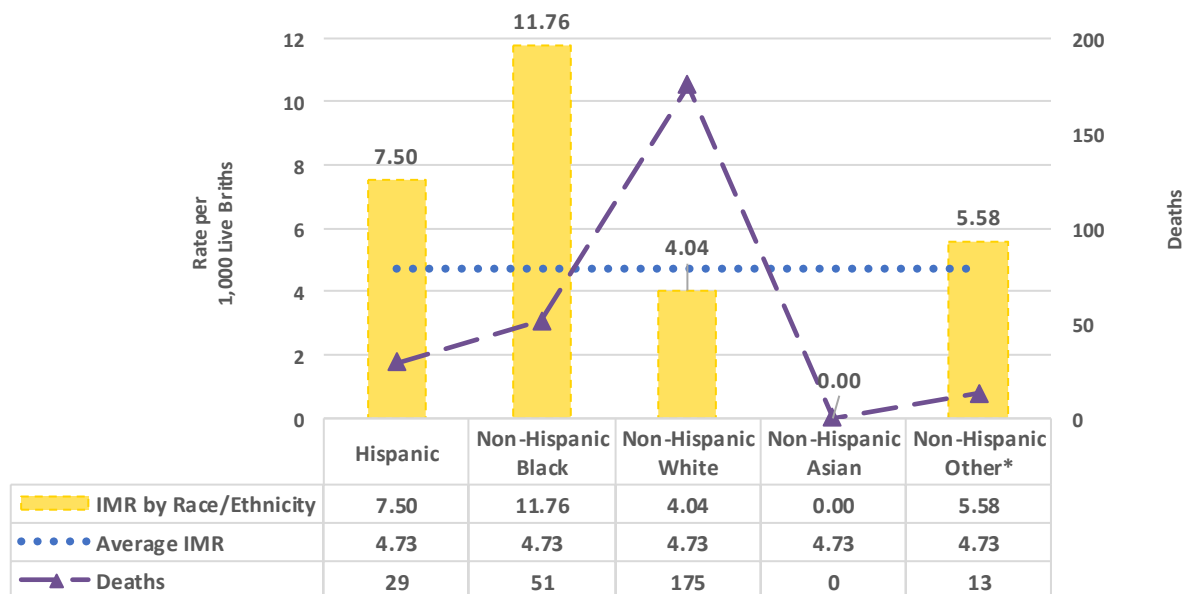
Figure 20. Central NY + NY-Pennsylvania Infant Mortality by Race/Ethnicity, 2016-2019



Northeast NY Health Services Area:

The overall infant mortality rate for the Northeast NY HSA was 4.73 per 1,000 live births. Non-Hispanic Black (11.76), Hispanic (7.50), and Non-Hispanic Other (5.58) infants died at a higher rate than the overall HSA infant mortality rate (4.73) (Figure 21). The highest number of deaths occurred among Non-Hispanic Whites (n=175); however, this group had an infant mortality rate of 4.04, which is lower than the HSA average. There were no infant deaths among Non-Hispanic Asian.

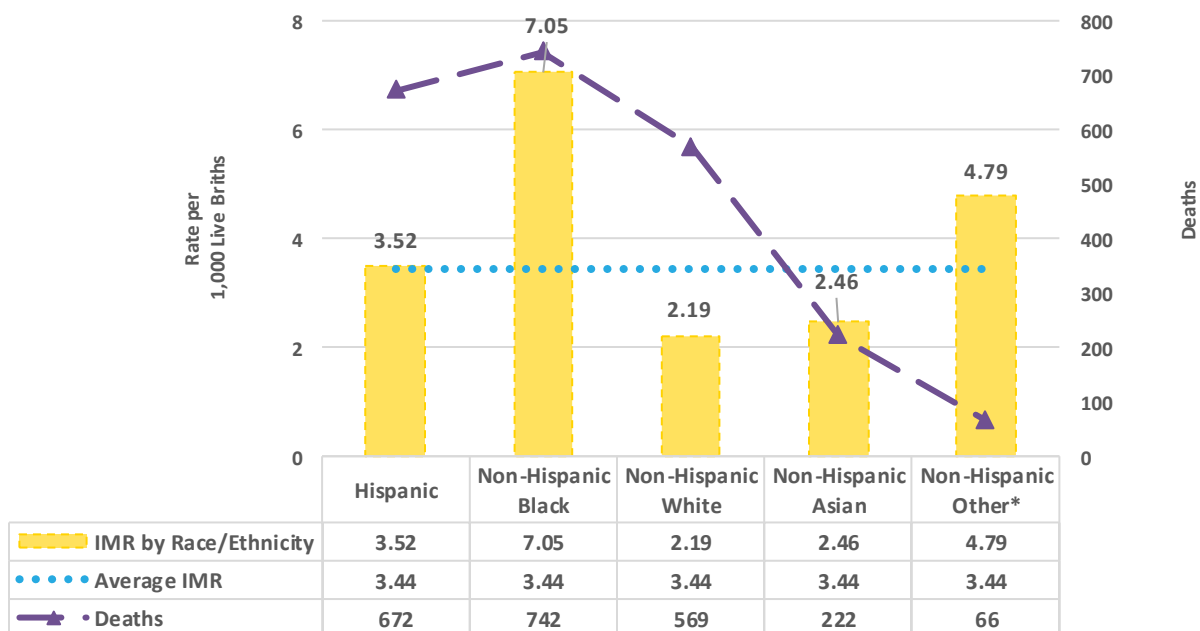
Figure 21. Northeast NY Infant Mortality by Race/Ethnicity, 2016-2019



Downstate Health Services Area:

The 2016-2019 infant mortality rate for the Downstate HSAs was 3.44 per 1,000 live births. Among the Downstate HSAs, the rate of infant mortality was highest among infants born to Non-Hispanic Black birthing individuals (7.05), followed by Non-Hispanic Other (4.79), Hispanic (3.52), Non-Hispanic Asian (2.46), and Non-Hispanic White (2.19) (Figure 22). The infant mortality rates of among Non-Hispanic Black, Non-Hispanic Other, and Hispanic were all higher than the overall Downstate HSAs infant mortality rate of 3.44 per 1,000 live births. The number of infant deaths is highest among Non-Hispanic Black (n=742), followed by Hispanic (n=672), Non-Hispanic White (n=569), Non-Hispanic Asian (n=222), and Non-Hispanic Other (n=66).

Figure 22. Infant Mortality by Race/Ethnicity for Downstate* HSAs, 2016-2019



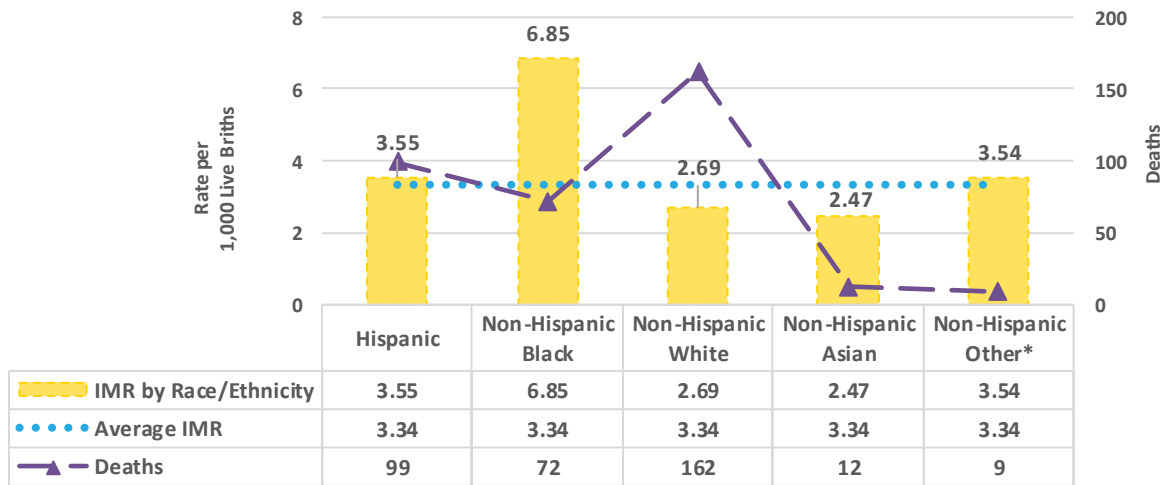
*Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk

The three figures below present a further breakdown of the Downstate HSA into Mid-Hudson, New York City, and Nassau-Suffolk.

Mid-Hudson Health Services Area:

The overall infant mortality rate in the Mid-Hudson, which is part of the Downstate HSA, was 3.34 per 1,000 live births. Non-Hispanic Black (6.85), Hispanic (3.55), and Non-Hispanic Other (3.54) infants died at a higher rate than the overall HSA infant mortality rate (3.34), while both Non-Hispanic White (2.69) and Non-Hispanic Asian (2.47) infant mortality rates were lower (Figure 23).

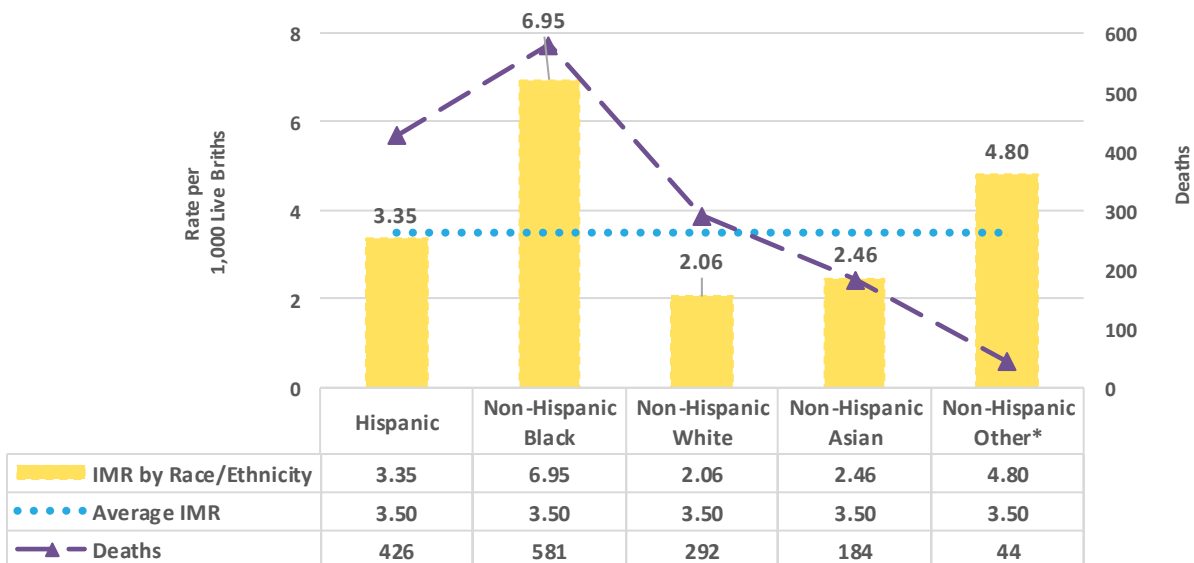
Figure 23. Mid-Hudson Infant Mortality by Race/Ethnicity, 2016-2019



New York City Health Service Area:

The overall infant mortality rate for New York City, which includes Bronx, King (Brooklyn), New York, Queens, and Richmond (Staten Island) counties, was 3.50 per 1,000 live births. Both non-Hispanic Black (6.95) and Non-Hispanic Other (4.80) infant mortality rates were higher than the overall NYC HSA rate of 3.50, while Hispanic (3.35), Non-Hispanic Asian (2.46) and Non-Hispanic White (2.06) all had lower infant mortality rates than the overall (Figure 24). The number of infant deaths was highest for Non-Hispanic Black infants (n=581) compared with other race/ethnicity groups.

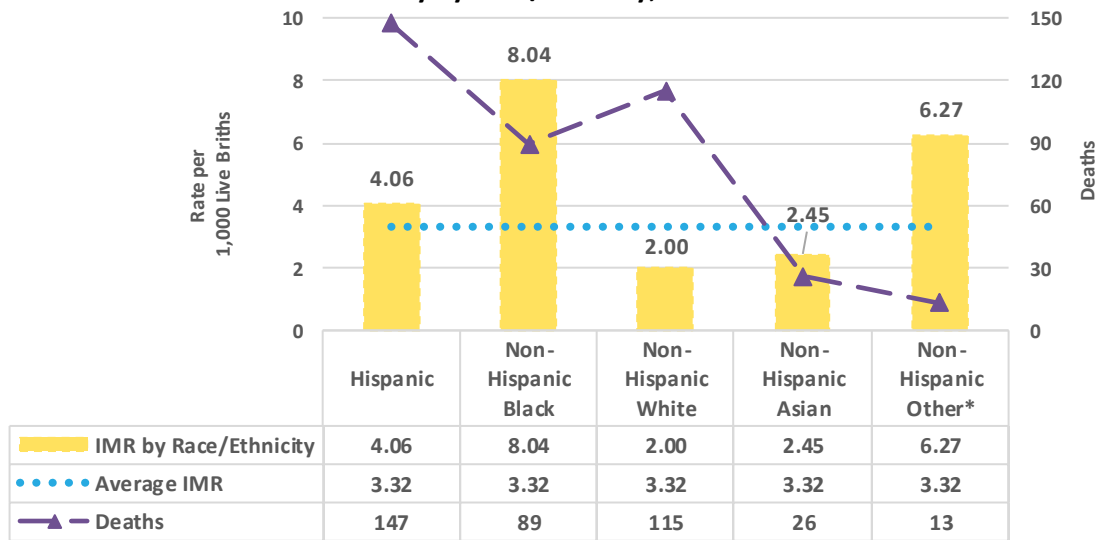
Figure 24. New York City Infant Mortality by Race/Ethnicity, 2016-2019



Nassau-Suffolk:

The overall infant mortality rate for the Nassau-Suffolk HSA was 3.32 per 1,000 live births. Non-Hispanic Black (8.04), Non-Hispanic Other (6.27), and Hispanic (4.06) infants died at a higher rate than the average Nassau-Suffolk HSA (3.32), while Non-Hispanic Asian (2.45) and Non-Hispanic White (2.00) were lower (Figure 25). The number of deaths was highest for Hispanic infants (n=147).

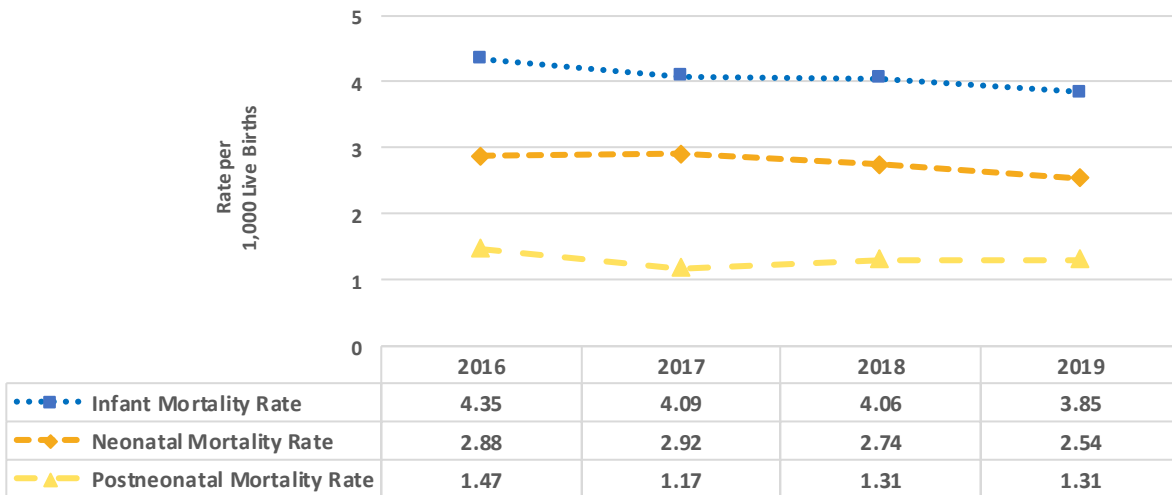
Figure 25. Nassau-Suffolk Infant Mortality by Race/Ethnicity, 2016-2019



Neonatal and Postneonatal Mortality

From 2016-2019, the rates of infant mortality, neonatal mortality (i.e., under 28 days of age), and postneonatal mortality (i.e., 28 days and older but less than 1 year) all decreased (Figure 26). The infant mortality rate decreased 11% from 4.35 per 1,000 live births in 2016 to 3.85 deaths per 1,000 live births in 2019. The neonatal mortality rate decreased 12% from 2.88 deaths per 1,000 live births in 2016 to 2.54 deaths per 1,000 live births in 2019. Similarly, the postneonatal mortality rate decreased 11% from 1.47 deaths per 1,000 live births in 2016 to 1.31 deaths per 1,000 live births in 2019. On average, neonatal deaths accounted for more than two-thirds (68%) of infant deaths in the four-year period.

Figure 26. Infant, Neonatal, and Postneonatal Mortality Rates, 2016-2019



Regional Breakdown:

There are regional differences in infant, neonatal, and postneonatal mortality rates, with higher rates for all groups in the Upstate region when compared to Downstate (Table 2). Conversely in terms of volume, the Downstate region has 2.7 times the number of live births and 1.6 times the number of infant deaths, neonatal, postneonatal, and in total, as the Upstate region.

Table 2. Neonatal and Postneonatal Mortality by Region, 2016-2019

Region	2016-2019						
	Infant Mortality Rate	Neonatal Mortality Rate	Postneonatal Mortality Rate	Infant Deaths	Neonatal Deaths	Postneonatal Deaths	Births
Upstate*	5.79	3.88	1.90	1,423	955	468	245,907
Downstate**	3.47	2.37	1.10	2,296	1,566	730	660,947
Statewide	4.10	2.78	1.32	3,719	2,521	1,198	906,854

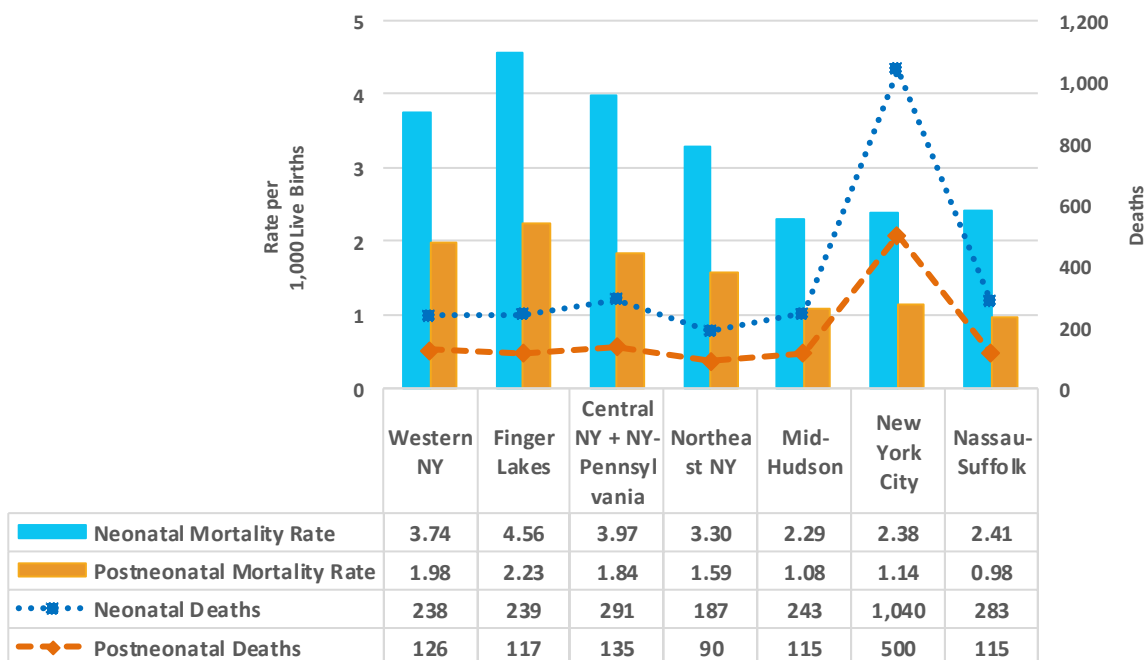
*Upstate HSAs include Western NY, Finger Lakes, Central NY, NY-Pennsylvania, and Northeast NY

** Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk

Health Service Areas:

Figure 27 illustrates that in 2016-2019 the neonatal and postneonatal mortality rates varied throughout the health service areas. The highest rates of both neonatal and postneonatal mortality occurred in the Finger Lakes, Central NY/NY-Pennsylvania, Western NY, and Northeast NY HSAs. The highest number of deaths, both neonatal and postneonatal, occurred in New York City. This is attributed to its high population density. Even with the highest deaths, New York City had the lowest infant mortality rate within the State. For the other HSAs, the number of deaths were similar.

Figure 27. Neonatal and Postneonatal Mortality by HSA, 2016-2019

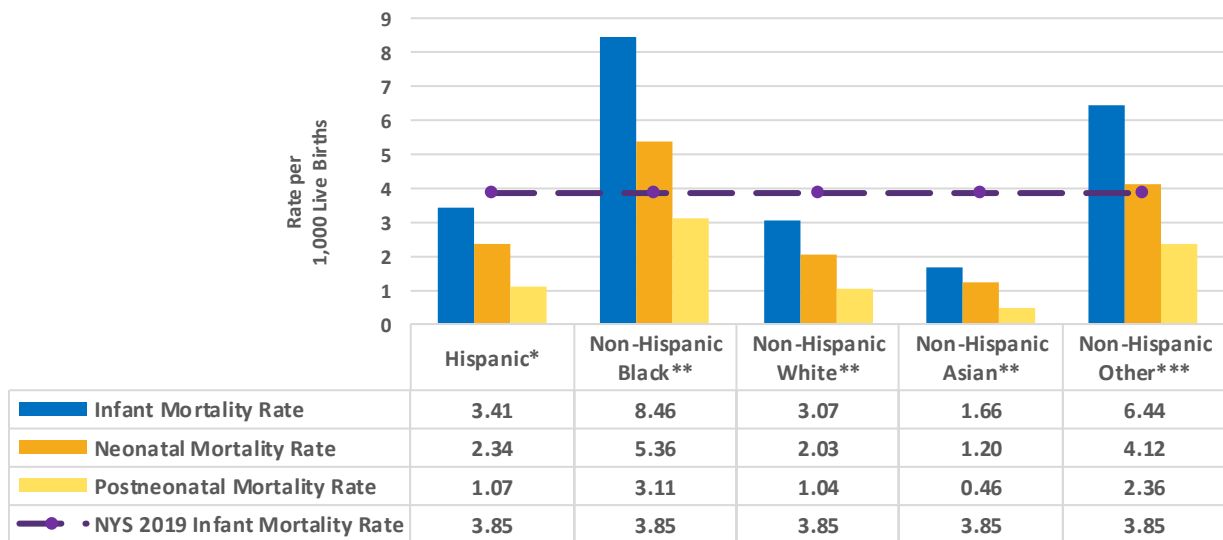


Race and Ethnicity:

Racial and ethnic disparities in mortality also exist among infants in the neonatal and postneonatal age groups, as seen in Figure 28. In 2019, the mortality rate for Non-Hispanic Black infants was 2.6 times

that of Non-Hispanic White infants in the neonatal period (5.36 and 2.03 deaths per 1,000 live births, respectively), and 3 times as high in the postneonatal period (3.11 and 1.04 deaths per 1,000 live births, respectively). Similarly, the infant mortality rate among Non-Hispanic Black infants was 2.3 times that of Hispanic infants in the neonatal period (5.36 and 2.34 deaths per 1,000 live births, respectively) and 2.9 times in the postneonatal period (3.11 and 1.07 deaths per 1,000 live births, respectively). The infant mortality rate among Non-Hispanic Asian infants was the lowest among all race/ethnic groups. Specifically Non-Hispanic Asian infant mortality rate was 0.6 times lower than that of Non-Hispanic White infants in both the neonatal period (1.20 and 2.03 deaths per 1,000 live births, respectively), and 0.4 times in the postneonatal period (0.46 and 1.04 deaths per 1,000 live births, respectively).

Figure 28. Infant, Neonatal, and Postneonatal Mortality Rate by Race/Ethnicity, 2019



* Hispanic includes all infants of Hispanic origin of any race.

** Non-Hispanic Black, White, and Asian include all infants of these single races; Non-Hispanic Asian rates may be unstable due to small cell size.

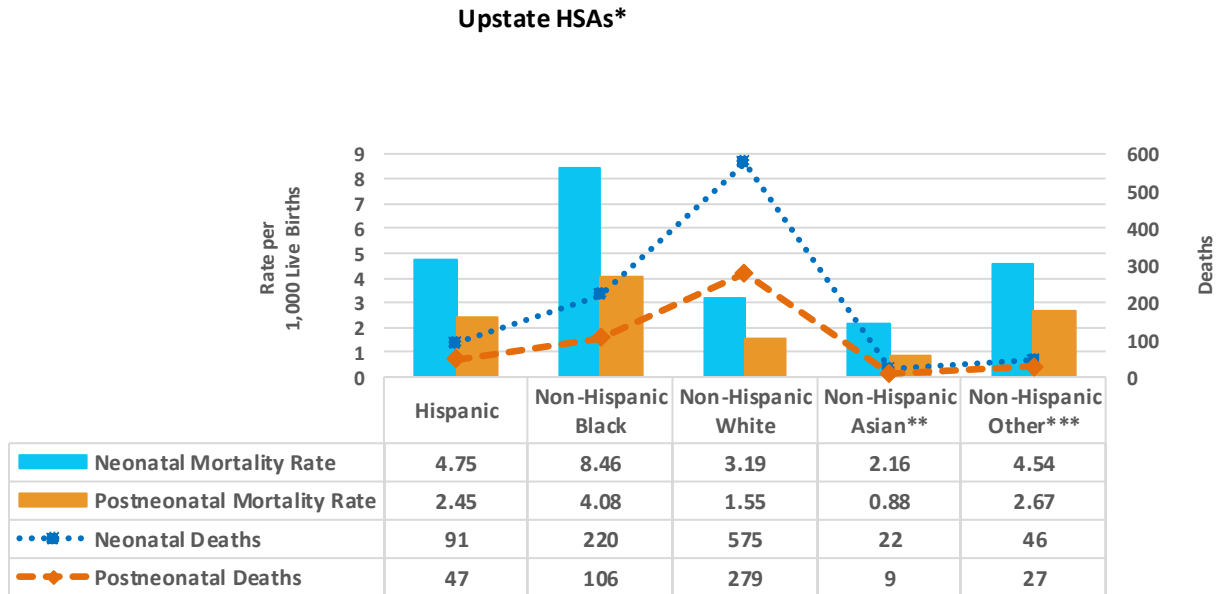
*** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, and specified other and multiple race infants

Region:

When stratified by region, the highest rates of neonatal and postneonatal mortality are seen in the Upstate HSAs (Figure 29a). In the Upstate HSA, the neonatal mortality rate is highest among Non-Hispanic Black (8.46 per 1,000 live births), Hispanic (4.75), Non-Hispanic Other (4.54), Non-Hispanic White (3.19), and Non-Hispanic Asian (2.16). The postneonatal mortality rate is highest among Non-Hispanic Black (4.08), Non-Hispanic Other (2.67), Hispanic (2.45), Non-Hispanic White (1.55), and Non-Hispanic Asian (0.88). The number of infant deaths, both neonatal and postneonatal, is highest Upstate for Non-Hispanic White, followed by Non-Hispanic Black, Hispanic, Non-Hispanic Other, and Non-Hispanic Asian.

In the Downstate HSAs (Figure 29b), the neonatal mortality rate is highest among Non-Hispanic Black (4.71), Non-Hispanic Other (4.13), Hispanic (2.42), Non-Hispanic Asian (1.80), and Non-Hispanic White (1.46). The postneonatal mortality rate is highest among Non-Hispanic Black (2.34), Non-Hispanic Other (1.52), Hispanic (1.10), Non-Hispanic White (0.73), and Non-Hispanic Asian (0.67). The number of infant deaths, both neonatal and postneonatal, is highest Downstate for Non-Hispanic Black, followed by Hispanic, Non-Hispanic White, Non-Hispanic Asian, and Non-Hispanic Other.

Figure 29a. Upstate Neonatal and Postneonatal Mortality by Race/Ethnicity and Region, 2016-2019

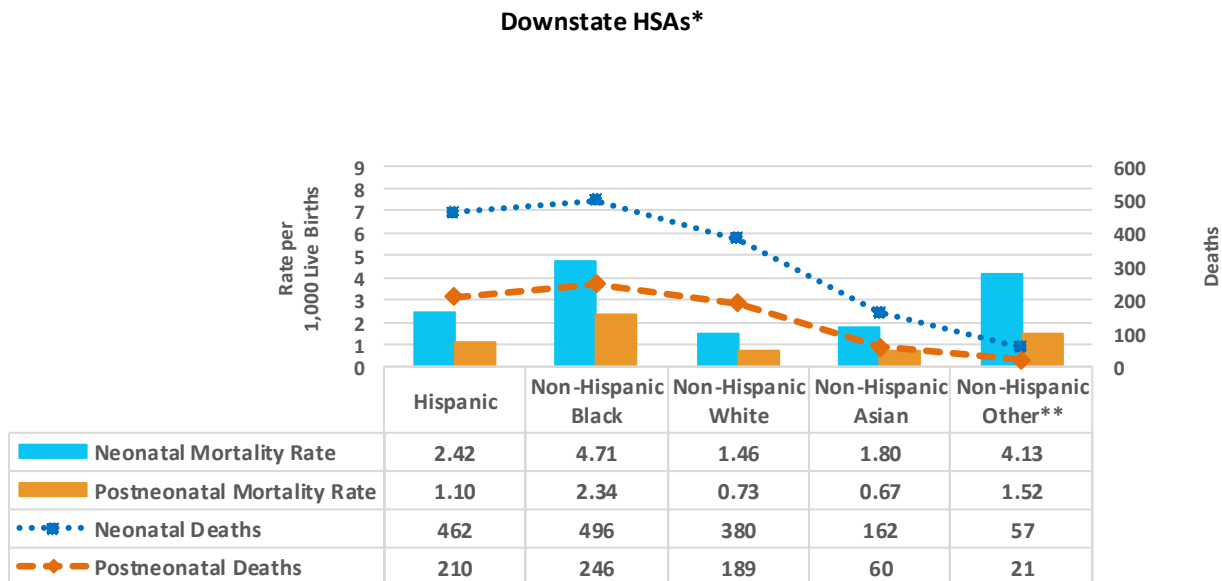


*Upstate HSAs include Western NY, Finger Lakes, Central NY, NY Pennsylvania, and Northeast NY

** Non-Hispanic Asian rates may be unstable due to small cell size

*** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, and specified other and multiple race infants; Non-Hispanic Other rates may be unstable due to small cell size

Figure 29b. Downstate Neonatal and Postneonatal Mortality by Race/Ethnicity and Region, 2016-2019



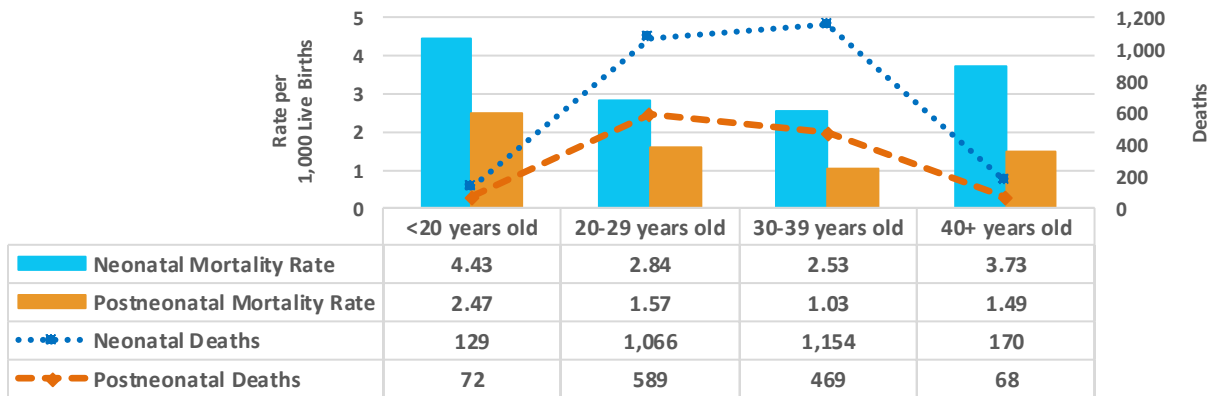
* Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk

** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, and specified other and multiple race infants; Non-Hispanic Other rates may be unstable due to small cell size

Maternal Age:

The rates of neonatal and postneonatal mortality were highest among individuals who were less than 20 years old when giving birth. Neonatal mortality was also high among those giving birth at 40 years of age or older. The number of infant deaths, both neonatal and postneonatal, was highest among infants born to individuals aged 20-29 and 30-39 years old, among whom the highest numbers of births also occurred (Figure 30).

Figure 30. Neonatal and Postneonatal Mortality by Maternal Age, 2016-2019



Maternal Age	2016-2019						
	Infant Mortality Rate	Neonatal Mortality Rate	Postneonatal Mortality Rate	Infant Deaths	Neonatal Deaths	Postneonatal Deaths	Births
<20 years old	6.91	4.43	2.47	201	129	72	29,107
20-29 years old	4.41	2.84	1.57	1,655	1,066	589	374,867
30-39 years old	3.55	2.53	1.03	1,623	1,154	469	456,849
40+ years old	5.22	3.73	1.49	238	170	68	45,637

Maternal Age by Region:

When stratified by region, we see similarities to the overall State-level analysis when stratified by maternal age. For both Upstate and Downstate, infant mortality and neonatal mortality rates and the Downstate postneonatal mortality rate were highest among those less than 20 years old, followed by 40 years of age or older, 20-29 years old, and 30-39 years old (Table 3). The Upstate postneonatal mortality rate was lowest among those 40 years or older while the group in Downstate with the lowest Postneonatal mortality rate was 30-39 years old.

Table 3. Postneonatal Mortality by Maternal Age and Region*, 2016-2019

Maternal Age	2016-2019						
	Upstate						
	Infant Mortality Rate	Neonatal Mortality Rate	Postneonatal Mortality Rate	Infant Deaths	Neonatal Deaths	Postneonatal Deaths	Births
<20 years old	8.69	5.59	3.10	98	63	35	11,280
20-29 years old	6.12	3.88	2.23	737	468	269	120,500
30-39 years old	5.07	3.61	1.46	543	387	156	107,164
40+ years old	6.51	5.30	1.21	43	35	8	6,603

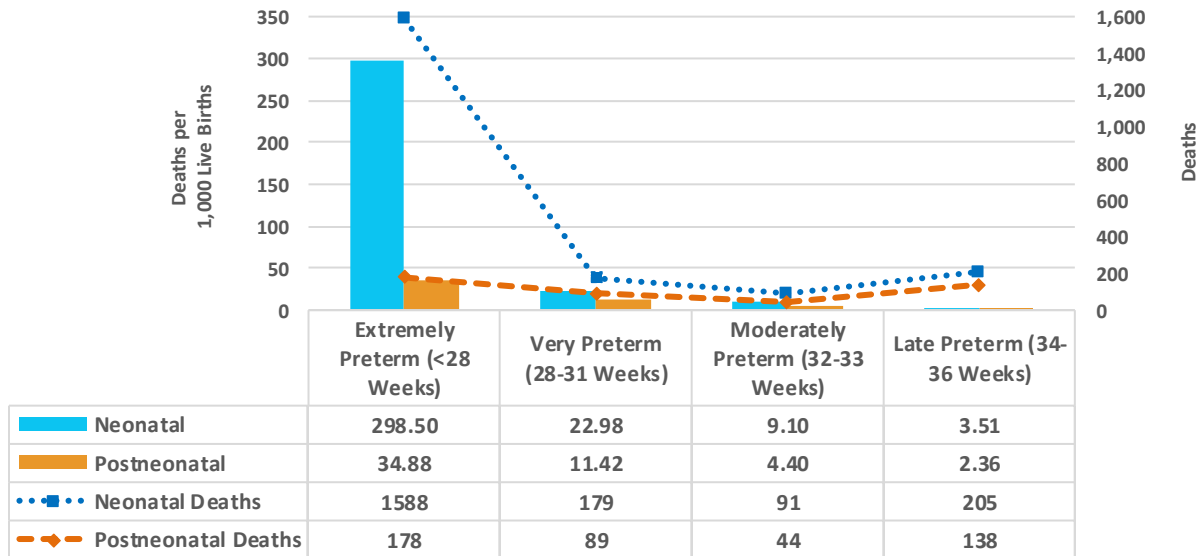
Maternal Age	2016-2019						
	Downstate						
	Infant Mortality Rate	Neonatal Mortality Rate	Postneonatal Mortality Rate	Infant Deaths	Neonatal Deaths	Postneonatal Deaths	Births
<20 years old	5.78	3.70	2.08	103	66	37	17,827
20-29 years old	3.61	2.35	1.26	918	598	320	254,367
30-39 years old	3.09	2.19	0.90	1,080	767	313	349,685
40+ years old	5.00	3.46	1.54	195	135	60	39,034

*Upstate HSAs include Western NY, Finger Lakes, Central NY, NY Pennsylvania, and Northeast NY. Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk

Preterm Gestational Age:

Early gestational age is a large contributor to infant mortality. Figure 31 shows that among preterm infants of any gestational age, deaths were more likely to occur in the neonatal period. Extremely preterm infants (<28 weeks) had the highest mortality rates in both the neonatal and postneonatal periods by far. As gestational age increases, the rates of neonatal and postneonatal mortality decreased.

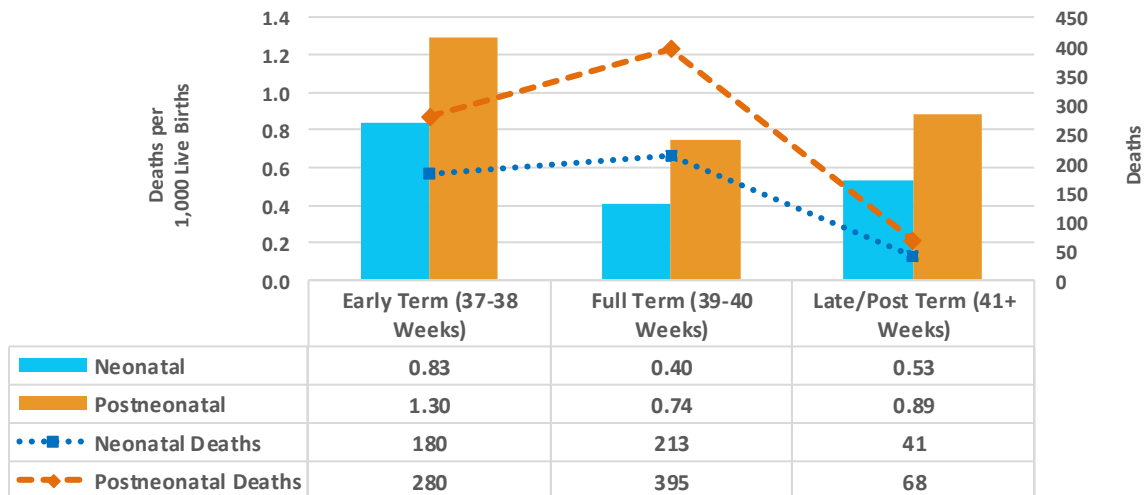
Figure 31. Neonatal and Postneonatal Mortality by Preterm Gestational Age, 2016-2019



Term Gestational Age:

Early term infants (37-38 weeks) and late/post term infants (41+ weeks) had higher neonatal and postneonatal rates when compared to full term infants (39-40 weeks) for 2016-2019 (Figure 32). The number of infant deaths was highest for both neonatal and postneonatal among full term infants, followed by early term and late/post term infants.

Figure 32. Neonatal and Postneonatal Mortality by Term Gestational Age, 2016-2019

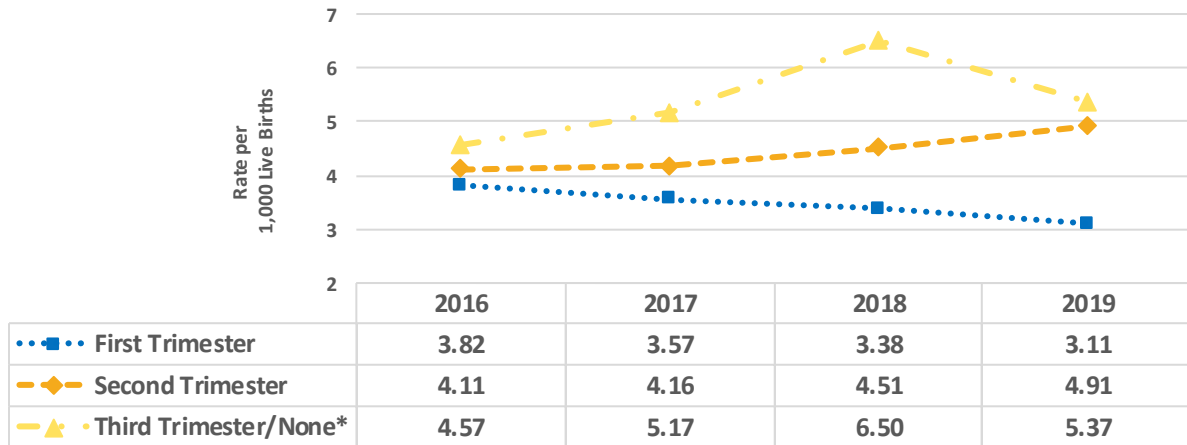


[Infant Mortality by Trimester of Care Initiation](#)

Prenatal care is important to reduce the risk of pregnancy complications. Among individuals who had a live birth in NYS between 2016 and 2019, approximately 6% either received no prenatal care at all or did not initiate prenatal care until after the end of the first trimester of pregnancy. Receiving early and regular prenatal care increases the chance of having a healthy pregnancy. Figure 33 shows trends in infant mortality rates from 2016 to 2019 by the trimester in which prenatal care was initiated. Since 2016, the infant mortality rate decreased 19% when prenatal care was initiated in the first trimester,

whereas the infant mortality rate increased 20% when prenatal care was initiated in the second trimester and 18% when initiated in the third trimester. Rates of infant mortality when prenatal care was initiated in the third trimester are unstable over time due to small sample size and should be viewed with caution.

Figure 33. Infant Mortality Rate by Trimester of Prenatal Care Initiation, 2016-2019

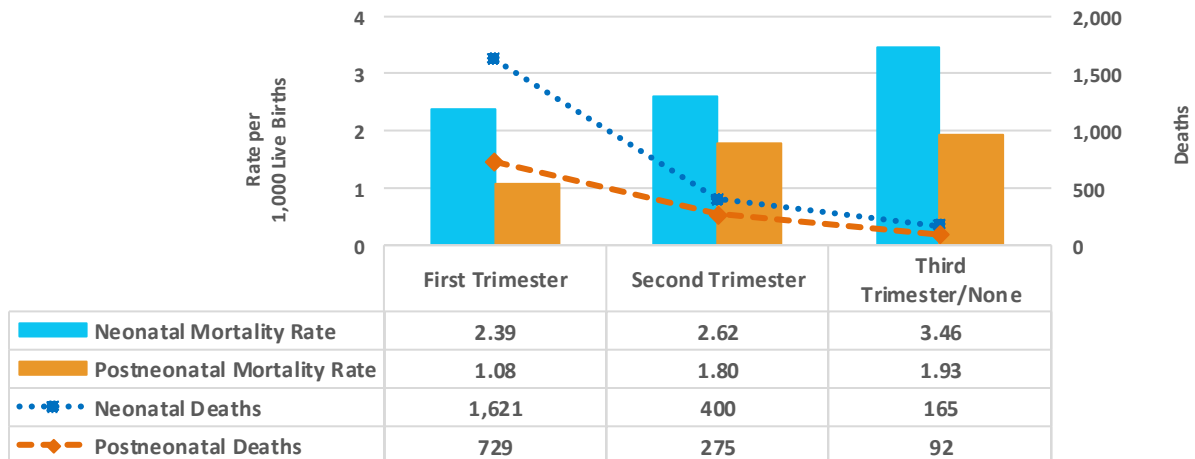


* Third Trimester/None rate over time may be unstable due to small cell size and/or inconsistent reporting.

Neonatal and Postneonatal Mortality:

The 2016-2019 neonatal and postneonatal mortality rates varied by trimester of prenatal care initiation (Figure 34). The highest rates of both neonatal and postneonatal mortality occurred in those who initiated care in the third trimester or had no prenatal care. The highest number of births and deaths, both neonatal and postneonatal, occurred among those with first trimester prenatal care initiation.

Figure 34. Neonatal and Postneonatal Mortality by Trimester of Prenatal Care Initiation, 2016-2019

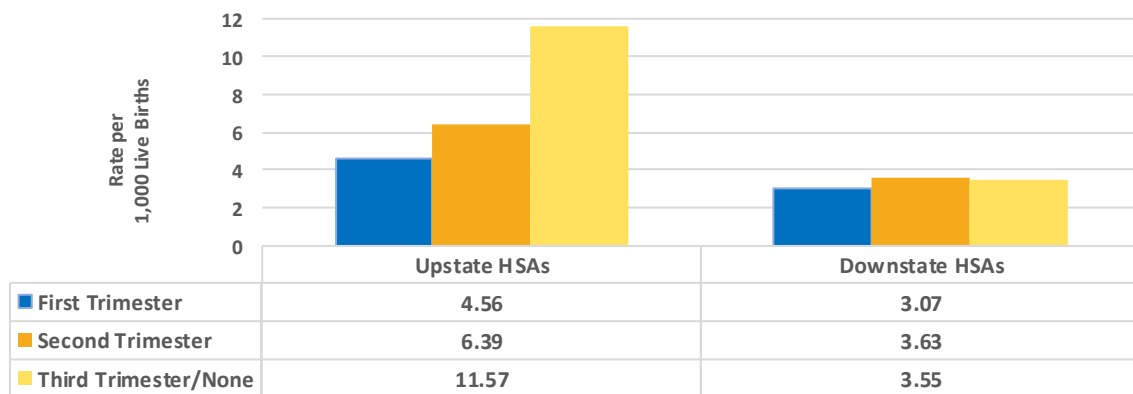


Trimester of Prenatal Care Initiation	2016-2019						
	Infant Mortality Rate	Neonatal Mortality Rate	Postneonatal Mortality Rate	Infant Deaths	Neonatal Deaths	Postneonatal Deaths	Births
First Trimester	3.47	2.39	1.08	2,350	1,621	729	677,383
Second Trimester	4.42	2.62	1.80	675	400	275	152,884
Third Trimester/None	5.40	3.46	1.93	257	165	92	47,624

Regional Breakdown:

Regional differences exist in infant mortality by trimester of care initiation. The infant mortality rate is higher Upstate than Downstate for all trimesters of initiation (Figure 35). There are not large differences in the rate of infant mortality Downstate by care initiation in the first trimester (3.07 deaths per 1,000 live births), second trimester (3.63 deaths per 1,000 live births), or third trimester/none (3.55 deaths per 1,000 live births). For the Upstate region, the infant mortality rate increased steadily the later care was initiated with first trimester at 4.56, second trimester at 6.39, and third trimester/none at 11.57.

Figure 35. Infant Mortality by Trimester of Care Initiation and Region*, 2016-2019



*Upstate HSAs include Western NY, Finger Lakes, Central NY, NY Pennsylvania, and Northeast NY. Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk

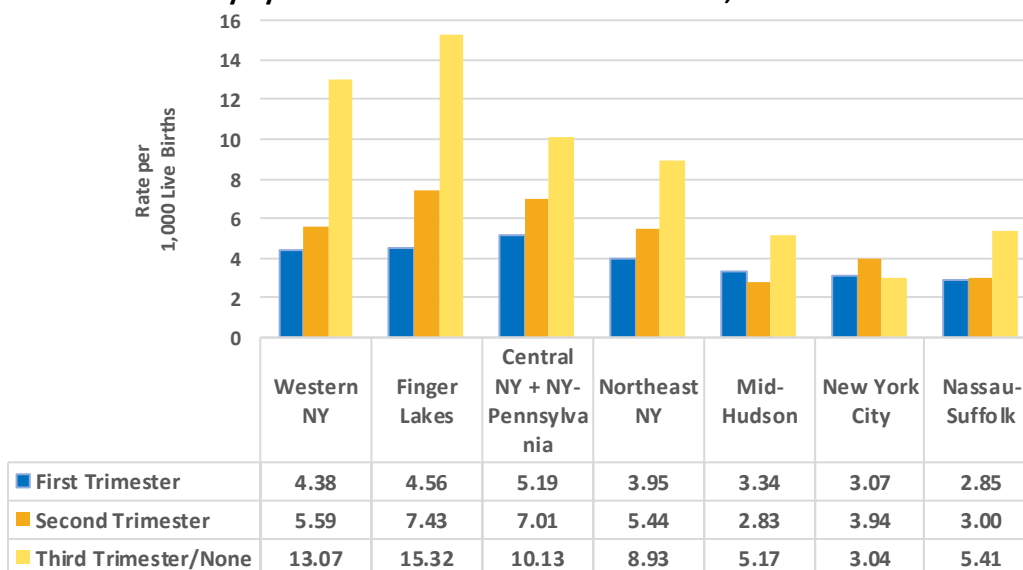
Trimester of Care Initiation	2016-2019					
	Upstate HSAs			Downstate HSAs		
	Infant Mortality Rate	Infant Deaths	Births	Infant Mortality Rate	Infant Deaths	Births
First Trimester	4.56	827	181,244	3.07	1,523	496,139
Second Trimester	6.39	277	43,327	3.63	398	109,557
Third Trimester/None	11.57	127	10,979	3.55	130	36,645

Health Service Area:

Figure 36 illustrates that the 2016-2019 infant mortality rate by trimester of care initiation varied throughout the health service areas. The highest rates of infant mortality occurred among those initiating care in the third trimester or receiving no care in Upstate HSAs (Finger Lakes, Western NY, Central NY/INY-Pennsylvania, and Northeast NY) HSAs. New York City is the only HSA where the infant mortality rate is highest in the second trimester, while the rest have highest infant mortality rates for the third trimester/none. Infant mortality rates for those having received prenatal care beginning in the

third trimester or not at all for individual HSAs other than NYC should be interpreted with caution due to the small number of deaths.

Figure 36. Infant Mortality by Trimester of Care Initiation and HSA, 2016-2019



Trimester of Care Initiation	2016-2019							
	Western NY		Finger Lakes		Central NY +		Northeast NY	
	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths
First Trimester	4.38	199	4.56	175	5.19	286	3.95	167
Second Trimester	5.59	60	7.43	67	7.01	97	5.44	53
Third Trimester/None	13.07	39	15.32	31	10.13	31	8.93	26

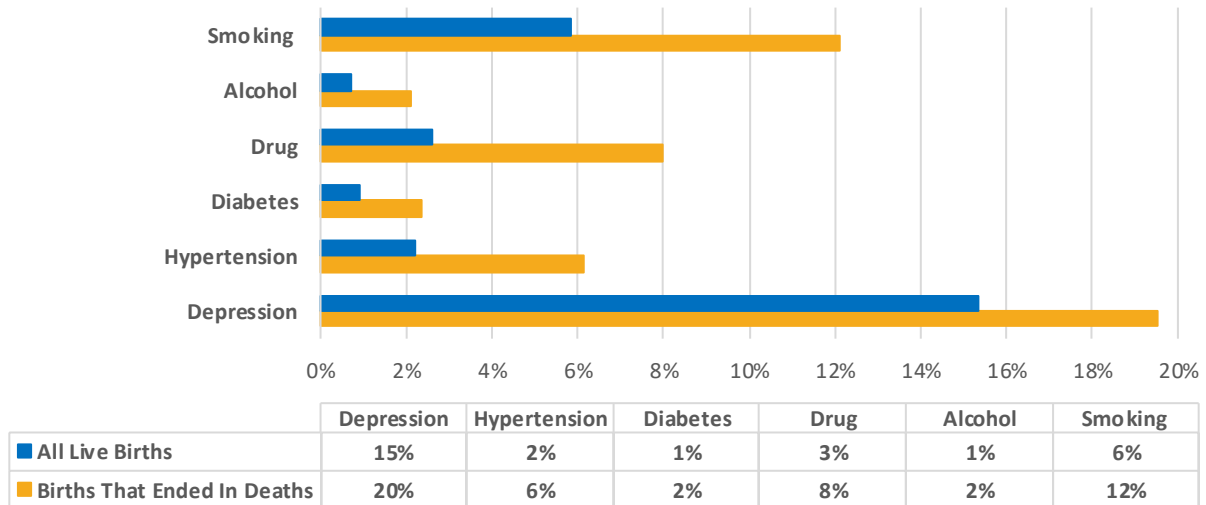
Trimester of Care Initiation	2016-2019					
	Mid-Hudson		New York City		Nassau-Suffolk	
	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths	Infant Mortality Rate	Infant Deaths
First Trimester	3.34	268	3.07	985	2.85	270
Second Trimester	2.83	51	3.94	303	3.00	44
Third Trimester/None	5.17	22	3.04	86	5.41	22

Infant Mortality by Maternal Modifiable Risk Factors

The State’s birth certificate collects information about maternal health, including depression, pre-pregnancy hypertension and diabetes, leading into or during pregnancy and behaviors, such as use of tobacco and drugs, which are known to increase risk for poor maternal and infant outcomes. Among infants that died within the first year of life, the prevalence of smoking during pregnancy was 12% compared to 6% prevalence of smoking during pregnancy among all live births. Similarly, among infants who died, the prevalence of maternal drug use was 8% compared to 3% prevalence among all live births.

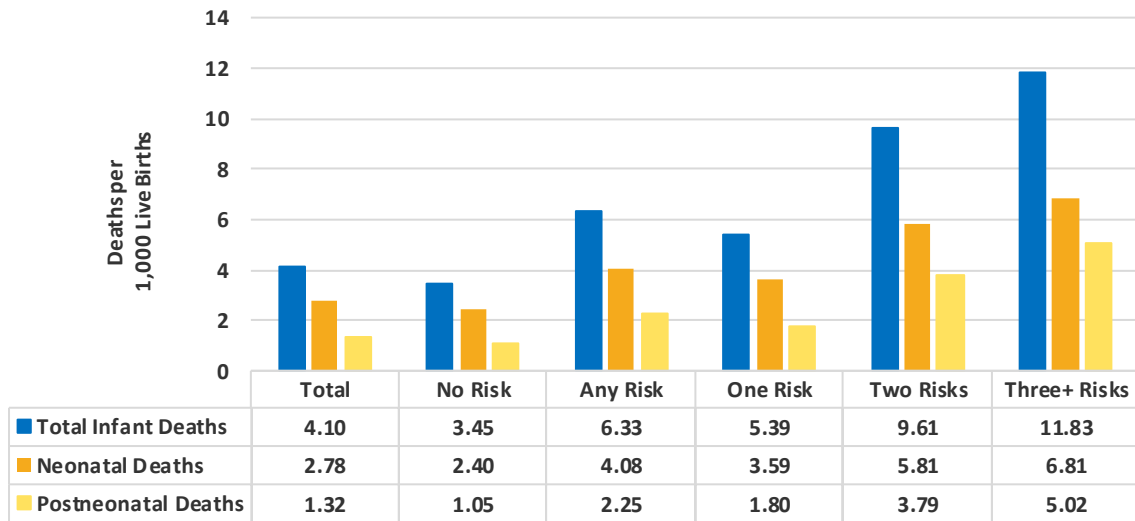
When looking at health and well-being during pregnancy, the prevalence of depression reported during pregnancy was 20% among infants who died compared to a prevalence of 15% among all live births. The prevalence of reported pre-pregnancy hypertension on the birth certificate was 6% among infants who died compared to a prevalence of 2% among all live births, and a prevalence of 2% for diabetes compared to 1% among all live births (Figure 37).

Figure 37. Prevalence of Selected Maternal Risk Factors among Infants who Died in the First Year Compared to the Overall Population of Live Births, 2019



Infant Mortality Rates by Risk Factors: Total infant, neonatal, and postneonatal mortality rates are notably higher among newborns delivered when smoking, drinking alcohol, using drugs, and/or experiencing depression during pregnancy, as well as among those suffering from chronic pre-pregnancy hypertension and/or diabetes (Figure 38) were reported on the birth certificate. In general, the presence of any of these modifiable risks, alone or in combination, resulted in a nearly two-fold (1.8) higher mortality rate compared to live births having no prenatal exposure to any of these particular risks (6.33 vs. 3.45 infant deaths per thousand live births). In the presence of two such risk factors, the mortality rate increased nearly three-fold (2.8) at 9.61 deaths per 1,000 live births, and in the presence of three to six such risk factors, the associated mortality rate was almost three and a half times (3.4) as high at 11.83 deaths per 1,000 live births. Similar risk factor status comparisons can be made for neonatal and postneonatal mortality rates.

Figure 38. Total Infant, Neonatal, and Postneonatal Mortality by Maternal Modifiable Risk Factor Status, 2016-2019

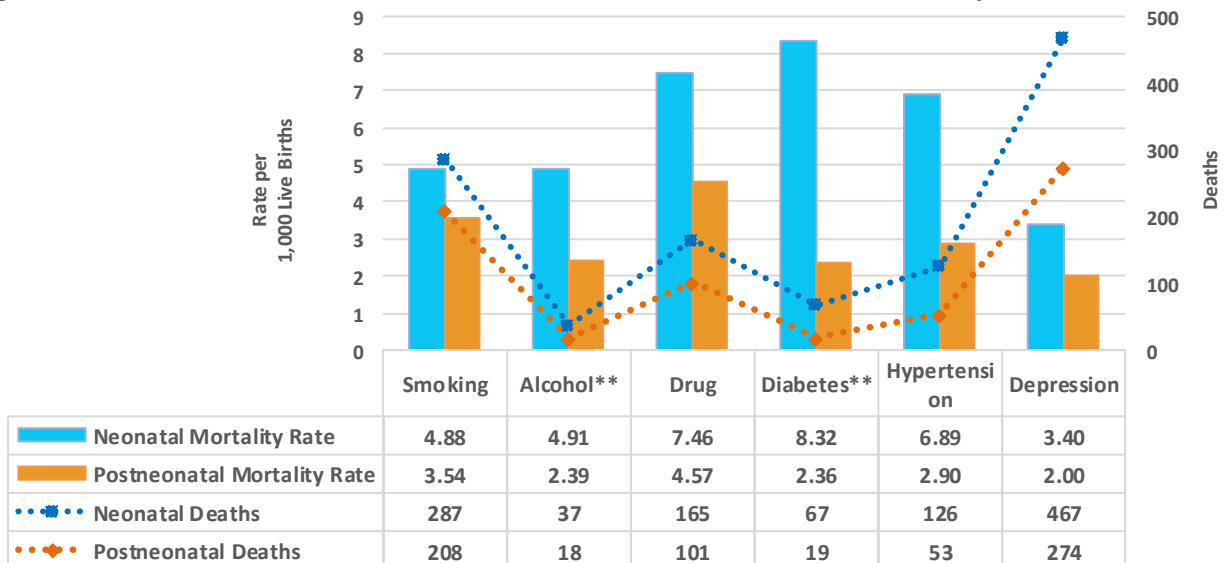


*Maternal Modifiable Risk Factors include Smoking during Pregnancy, Alcohol Consumed during Pregnancy, Maternal Drug Use, Chronic Diabetes, Chronic Hypertension, and Depression; Any Risk includes one or more of these factors.

Neonatal and Postneonatal Mortality Rates by Risk Factors:

As shown in Figure 39 below, at 8.32, 7.46, and 6.89 deaths per 1,000 live births respectively, neonatal mortality rates were highest in the presence of chronic diabetes, drug use, or chronic hypertension, alone or in combination with other modifiable risks. Postneonatal mortality rates were highest for infants exposed to drug use and smoking prenatally, at 4.57 and 3.54 deaths per 1,000 live births respectively.

Figure 39. Maternal Modifiable Risk Factors* Neonatal and Postneonatal Mortality, 2016-2019



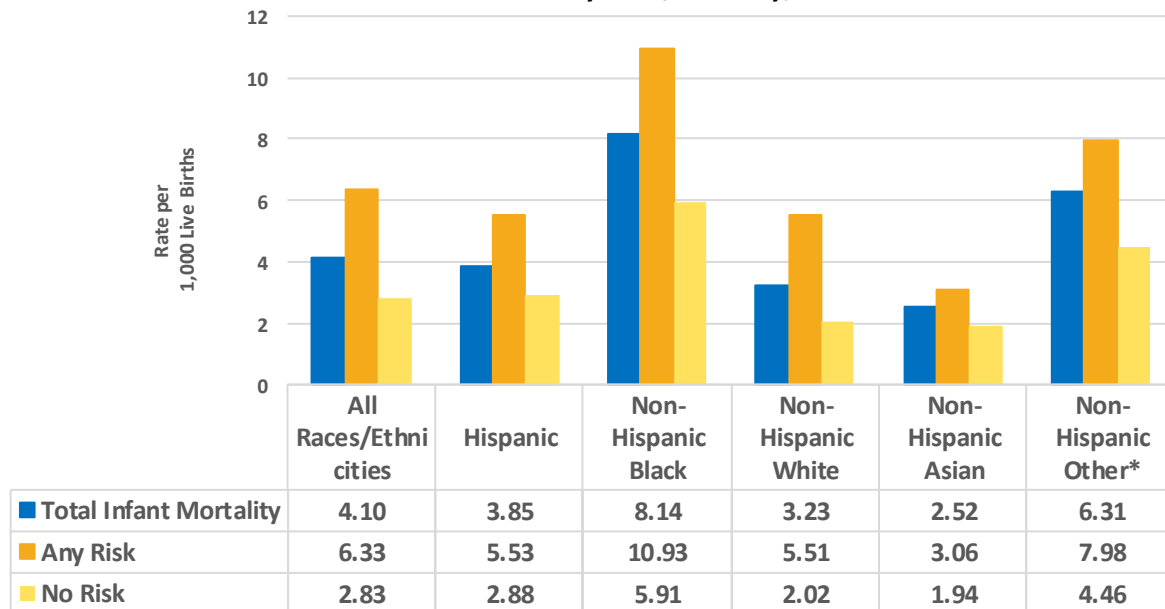
* Maternal Modifiable Risk Factors include Smoking during Pregnancy, Alcohol Consumed during Pregnancy, Maternal Drug Use, Chronic Diabetes, Chronic Hypertension, and Depression.

** Alcohol and Diabetes Postneonatal deaths have low cell size and may be unstable.

Infant Mortality Rates by Risk Factor and Race and Ethnicity:

Any of the modifiable risks alone or in combination, occurred most frequently among pregnant individuals who were Non-Hispanic Other (32%), followed by Non-Hispanic Black (27%), and Non-Hispanic White (24%). Reported maternal risk factors were lowest among pregnant individuals who were Non-Hispanic Asian and Hispanic, at approximately 18% each (data not shown). Infant Mortality was highest among Non-Hispanic Black infants, regardless of whether any of the potentially modifiable risk factors in the prenatal period were reported (Figure 40). Non-Hispanic Black newborns had the highest infant mortality rates when multiple risk factors were reported (data not shown). At 10.93 deaths per 1,000 live births, in the presence of any such risk factors, the Non-Hispanic Black infant mortality rate is 1.7 times the overall infant mortality rate of 6.33 when any modifiable maternal risk factor was reported. When comparing within racial/ethnic groups, the Non-Hispanic White infant mortality rate was 2.7 times greater when at least one maternal modifiable risk factors was reported compared to when there were no modifiable maternal risk factors. Hispanic infant mortality was 1.9 times greater when at least one modifiable risk factor was reported compared to when there were no modifiable maternal risk factors. Non-Hispanic Black infant mortality rate was 1.8 times greater, and Non-Hispanic Other infant mortality rate was 1.8 times greater, and Non-Hispanic Asian infant mortality was 1.6 times greater when at least one modifiable maternal risk factor was reported compared to when there were none reported.

Figure 40. Maternal Modifiable Risk Factor Status by Race/Ethnicity, 2016-2019



Note: Any Maternal Modifiable Risk includes one or more of the following: Smoking during Pregnancy, Alcohol Consumed during Pregnancy, Maternal Drug Use, Chronic Diabetes, and Chronic Hypertension, and Depression during Pregnancy.

* Includes unknown race/ethnicity

** Includes Hispanic ethnicity with any race

*** Includes American Indian/Native Alaskan, Native Hawaiian/Other Pacific Islander, specifiable other and multiple races of Non-Hispanic ethnicity

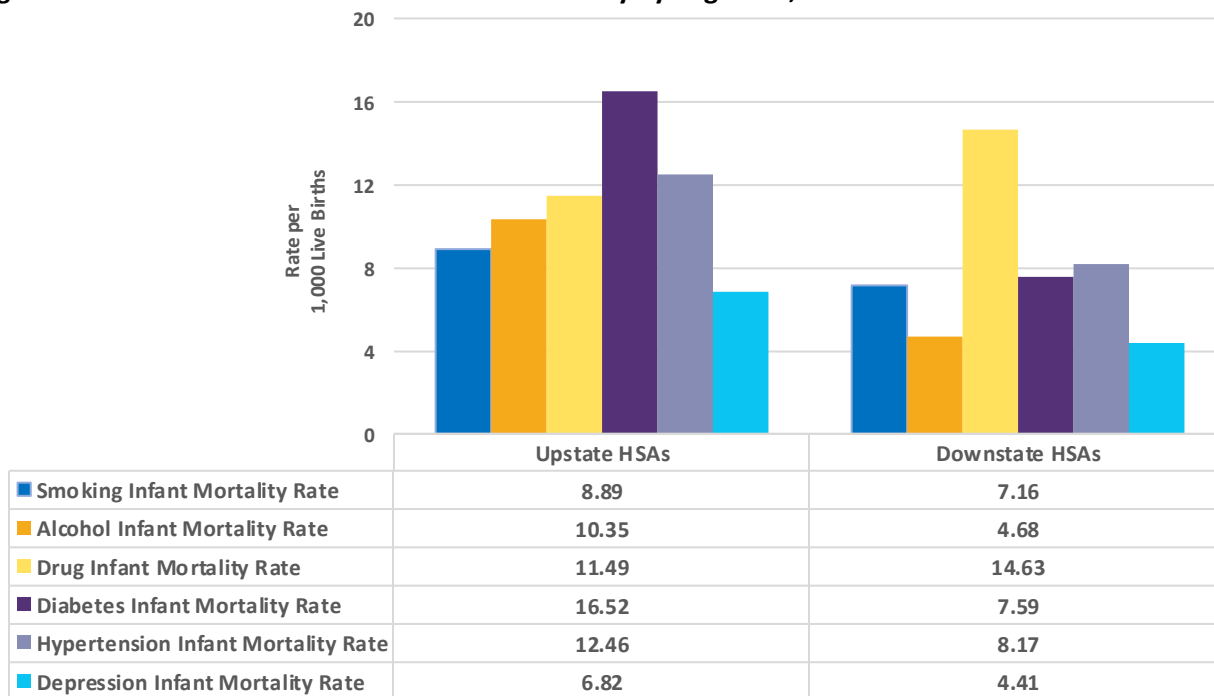
Infant Mortality by Risk Factor and Geographic Region:

As shown in Figure 41, infant mortality associated with any of the modifiable risks, alone or in combination, occurred at higher rates in the Upstate NY region compared to Downstate, with the exception of drug use. At 14.63 deaths per 1,000 live births, the Downstate rate of drug use was higher

than the Upstate rate of 11.49. Diabetes was associated with the highest modifiable risk-associated mortality rate among infants born in both regions. At 16.52 deaths per 1,000 live births, Upstate had more than double the Downstate rate of 7.91 per 1,000 live births. Other modifiable risks with high rates in the Upstate region include chronic hypertension, drug use, and alcohol use during pregnancy, at 12.46, 11.49, and 10.35 per 1,000 live births, respectively.

Overall, there were 2.7 times as many births and 1.6 times as many deaths Downstate compared to Upstate, but as shown in the table below, there were 2.7 times as many births coded with maternal smoking and 4.8 times as many births coded with maternal drug use in the Upstate region than Downstate. Furthermore, with the exception of hypertension where the difference was small, there were fewer Downstate deaths associated with these modifiable risk factors. With no knowledge of regional differences in the prevalence of these risk factors in the general or childbearing populations, we cannot preclude that these differences might be artifacts of coding practices related to these risk factors. We therefore suggest that the regional modifiable risk rates be interpreted with some caution.

Figure 41. Maternal Modifiable Risk* Infant Mortality by Region **, 2016-2019



* Maternal Modifiable Risk includes Smoking during Pregnancy, Alcohol Consumed during Pregnancy, Maternal Drug Use, Chronic Diabetes, and Chronic Hypertension.

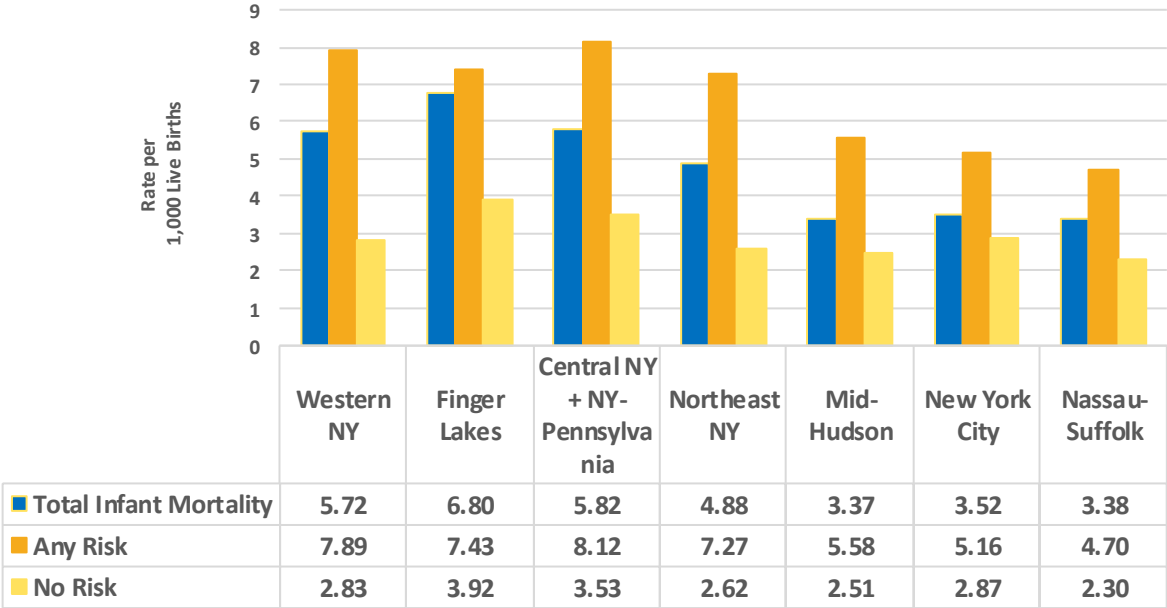
**Upstate HSAs include Western NY, Finger Lakes, Central NY, NY Pennsylvania, and Northeast NY. Downstate HSAs include Mid-Hudson, New York City, and Nassau-Suffolk.

Maternal Modifiable Risk	2016-2019								
	Upstate HSAs			Downstate HSAs			Statewide		
	Infant Mortality Rate	Infant Deaths	Births	Infant Mortality Rate	Infant Deaths	Births	Infant Mortality Rate	Infant Deaths	Births
Smoking	8.89	380	42,748	7.16	115	16,058	8.42	495	58,806
Alcohol	10.35	36	3,479	4.68	19	4,058	7.30	55	7,537
Drug	11.49	210	18,279	14.63	56	3,829	12.03	266	22,108
Diabetes	16.52	46	2,784	7.59	40	5,267	10.68	86	8,051
Hypertension	12.46	86	6,904	8.17	93	11,387	9.79	179	18,291
Depression	6.82	384	56,276	4.41	357	80,933	5.40	741	137,209

Infant Mortality Rate by Risk Factor Status and Health Service Area:

As shown in Figure 42, Infant mortality rates for infants exposed to any of the six prenatally modifiable risks were highest in the Central NY + NY Pennsylvania HSA at just over 8.12 deaths per 1,000 live births. The other three Upstate HSAs also had high rates exceeding 7 deaths per 1,000 live births (Western NY, Finger Lakes, and Northeast NY). Infant mortality rates for infants in each of the Downstate HSAs were comparable, ranging from a high of 5.58 deaths per 1,000 in Mid-Hudson to a low of 4.70 deaths per 1,000 live births in Nassau-Suffolk and New York City in between at 5.16 deaths per 1,000 live births. Infant mortality rates for those having no exposure to any of the six modifiable risks were comparable across all HSAs, with the notable exception of Finger Lakes at 3.92.

Figure 42. Maternal Modifiable Risk Factor Status* Infant Mortality by HSA, 2016-2019



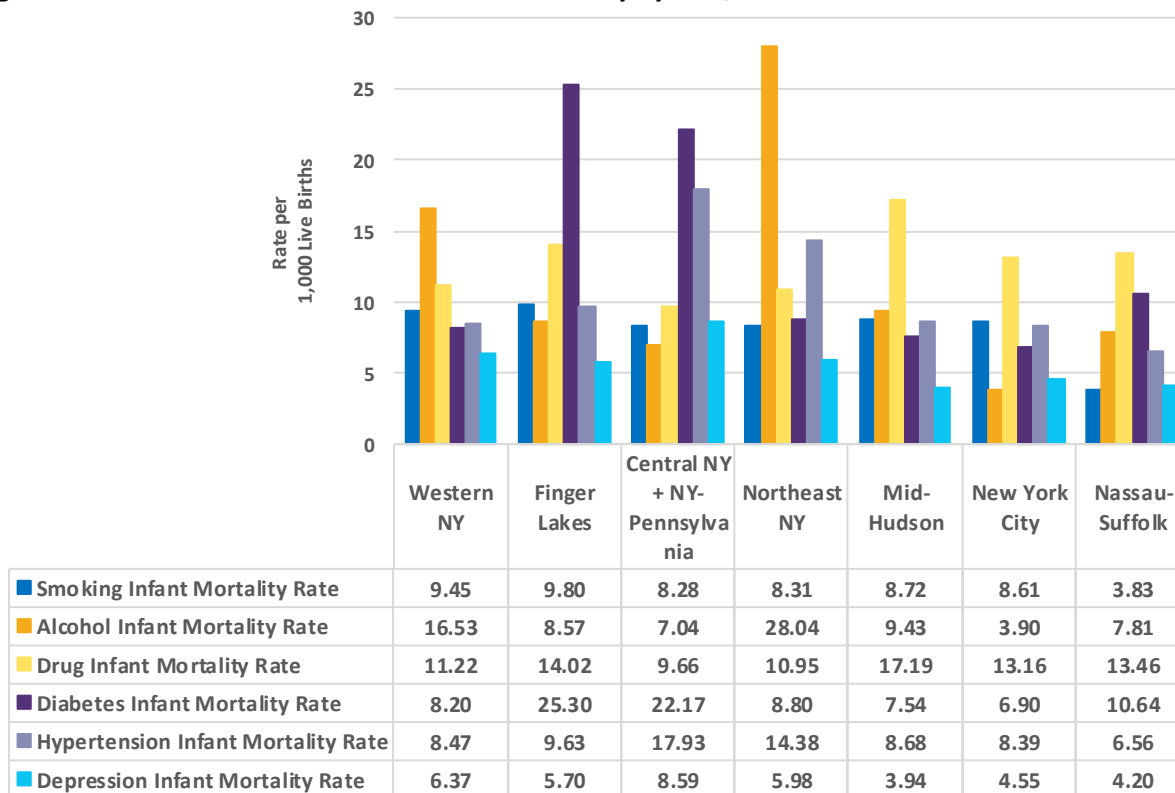
* Any Maternal Modifiable Risk includes one or more of the following: Smoking during Pregnancy, Alcohol Consumed during Pregnancy, Maternal Drug Use, Chronic Diabetes, and Chronic Hypertension, and Depression during Pregnancy.

Infant Mortality Rate by Risk Factor and HSA:

For 2016-2019, the most prevalent modifiable risk across the Downstate HSAs (Mid-Hudson, NYC, and Nassau-Suffolk) was drug use during pregnancy (Figure 43). In the Upstate HSAs, the leading modifiable risk varied. For the same time period, alcohol consumption during pregnancy was highest in the

Northeast and Western HSAs, while diabetes was the most prevalent in the Finger Lakes, Central NY, and NY-Pennsylvania HSAs. Understanding the leading modifiable risk in each HSA can help target regional-specific prevention strategies. For reasons noted above regarding the Upstate/Downstate modifiable risk (Figure 41), and also because they are derived from an even smaller number of deaths, these HSA-specific rates should also be interpreted with caution.

Figure 43. Maternal Modifiable Risk* Infant Mortality by HSA, 2016-2019



* Maternal Modifiable Risk includes Smoking during Pregnancy, Alcohol Consumed during Pregnancy, Maternal Drug Use, Diabetes, Hypertension, and Depression during Pregnancy

Leading Causes of Infant Death

Leading causes of infant death differ somewhat between the neonatal and postneonatal periods. This is in part due to the definition of certain ICD-10 diagnosis codes specific to the perinatal period, which coincide with the 28-day neonatal period – after birth and reflect the higher volume of deaths (67%) that occur in this period.

Between 2016 - 2019, the leading causes of mortality during the neonatal period were complications due to short gestation and low birth weight (24%); congenital malformations (20%); perinatal cardiovascular disorders originating in the perinatal period (12%); newborns affected by maternal conditions (8%); respiratory distress and other respiratory system disorders (7%); bacterial sepsis and other perinatal infections (4%); and complications of the placenta, cord, or membranes (4%), totaling more than three-quarters (79%) of neonatal deaths (Figure 44a).

Among the deaths that occurred postneonataally, which represent one third of all infant deaths, the leading causes of mortality were sudden unexpected infant death (SUID), including sleep-related deaths (31%), congenital malformations (16%), accidents (unintentional injuries) (5%), and short gestation/low

birth weight (3%). (Figure 44b) These causes alone accounted for 57% of all postneonatal infant deaths in NYS between 2016 and 2019.

In combination, the neonatal and postneonatal causes of death listed above accounted for two-thirds of all infant deaths during the four-year period.

Figure 44a. Percentage of Deaths by Leading Causes of Neonatal Mortality, 2016-2019

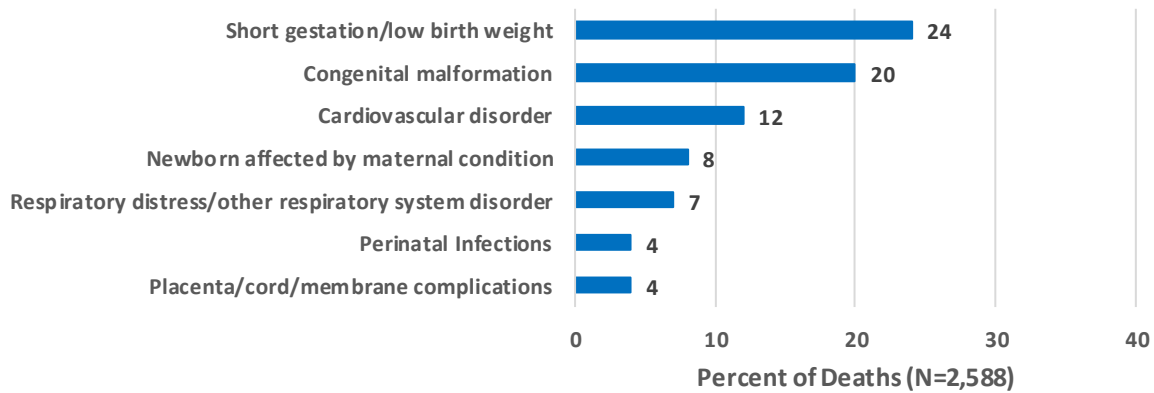
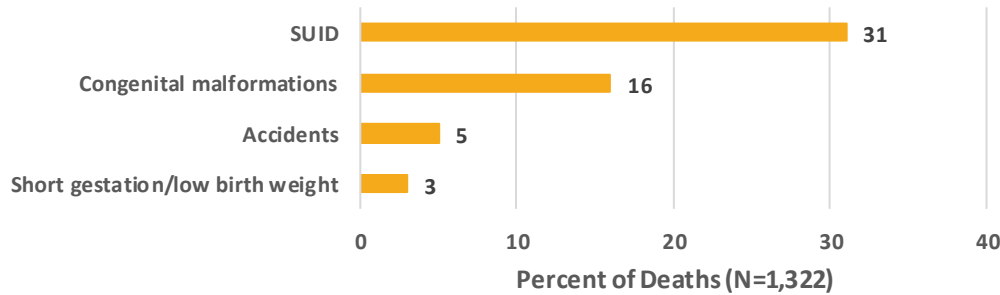


Figure 44b. Percentage of Deaths by Leading Causes of Postneonatal Mortality, 2016-2019



Infant Mortality Rates by Cause of Death:

Neonatal mortality rates among the leading causes of death ranged from a high of 67.49 per 100,000 live births due to short gestation or low birth weight to a low of 11.14 for placenta, cord, or membrane complications (Figure 45a). Postneonatal mortality rates for the leading causes ranged from 45.54 per 100,000 live births for Sudden Unexpected Infant Death (SUID) to 4.85 for short gestation or low birth weight (Figure 45b). Congenital malformations were the second leading cause of both neonatal and postneonatal deaths, at 57.23 and 23.93 per 100,000 live births respectively. The vast difference in rates for both short gestation/low birth weight and congenital malformations are reflective of the 2:1 ratio between neonatal and postneonatal mortality.

Figure 45a. Neonatal Mortality by Leading Causes of Death, 2016-2019

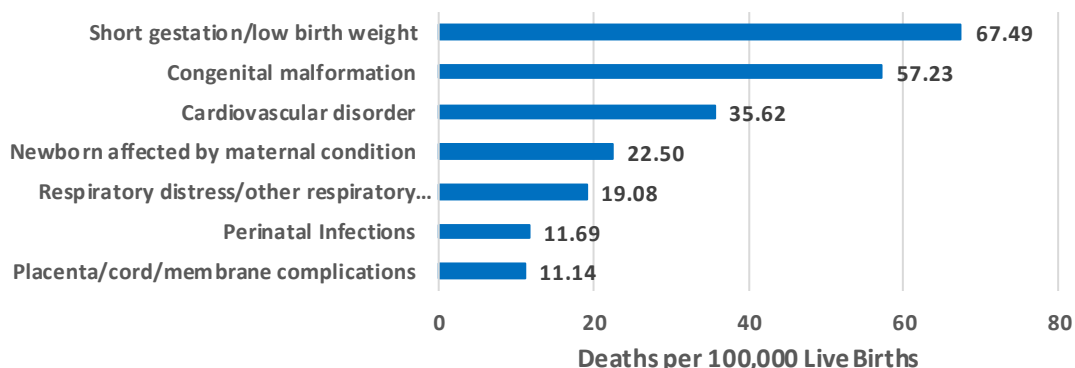
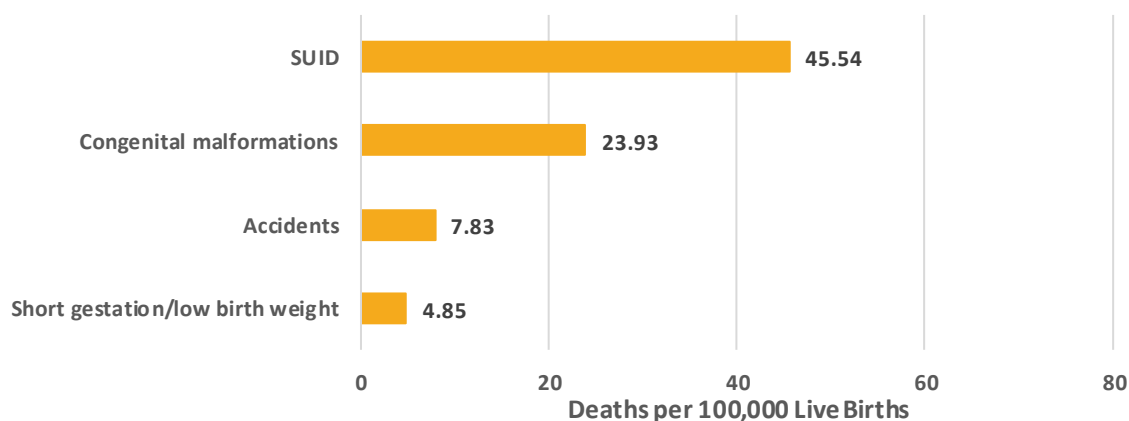


Figure 45b. Postneonatal Mortality by Leading Causes of Death, 2016-2019



Sudden Unexpected Infant Death

Sudden Unexpected Infant Death (SUID) is defined as a sudden and unexpected death, whether explained or unexplained, occurring in infancy.⁸ While the NYS infant mortality rate decreased over time, the SUID rate continued to rise. Between 2016 and 2019, among 906,862 infants born in NYS, 478 died suddenly and unexpectedly due to SUID, including deaths due to sleep-related causes. This resulted in an aggregate SUID rate of 52.71 per 100,000 live births across the 4 years (Table 4).

Table 4. Sudden Unexpected Infant Death (SUID)

SUID	2016-2019		
	Rate per 100,000 Live Births	Deaths	Births
	52.71	478	906,862

Figure 46 shows from 2016 to 2019, the Statewide SUID rate increased 35% from 44.70 deaths per 100,000 live births (104 deaths) to 60.31 deaths per 100,000 live births (133 deaths) (Figure 46). While the overall SUID rate increased in NYS, geographic disparities persist. Upstate HSAs, comprised of Western NY, Finger Lakes, Central NY/ NY-Pennsylvania, and Northeast NY, experienced a 47% increase in SUID rate from 2016 (78.56) to 2019 (115.41). In contrast, Downstate HSAs (Mid-Hudson, New York City, and Nassau-Suffolk) had a 22% increase from 2016(32.30) to 2019 (39.40). In terms of volume, when combining 2016-2019, the Upstate SUID rate was 94.75 deaths per 100,000 live births compared to the Downstate SUID rate of 37.07 deaths per 100,000. This represents a difference of 61% (Table 5).

Figure 46. Sudden Unexpected Infant Death Rate by Region, 2016-2019

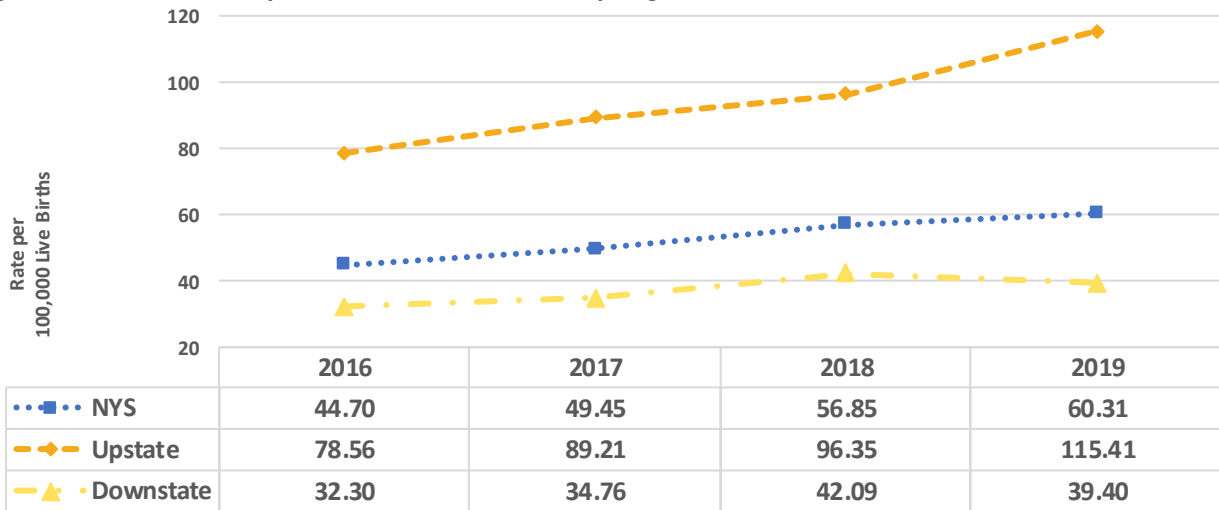
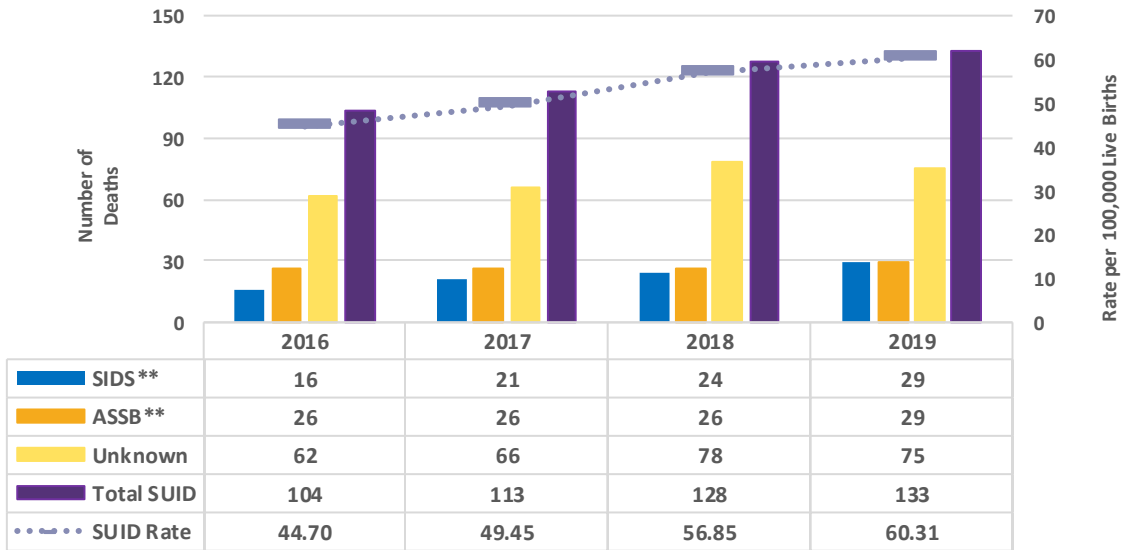


Table 5. Sudden Unexpected Infant Death Rate by Region, 2016-2019

Region	2016-2019		
	SUID Rate per 100,000 Live Births	Deaths	Births
NYS	52.71	478	906,862
Upstate	94.75	233	245,915
Downstate	37.07	245	660,947

SUIDs are reported under one of the following ICD-10 cause of death codes: 1) R95: SIDS; 2) T71 or W75: Accidental Suffocation and Strangulation in Bed (ASSB); or 3) R99: Unknown cause.⁹ In 2019, the rate of SUID increased to a rate of 60.31 deaths per 100,000 live births, with more than half of cases being of an Unknown Cause (56% n=75), followed equally by ASSB (22% n=29) and SIDS (22% n=29) (Figure 47). Between 2016 and 2019, the number of infant deaths of an unknown cause that were reported using the R99 code increased. Prior to this shift, most infant deaths of an unknown cause were reported using codes not included in the SUID definition. As such, these cases were not being counted toward the number of SUID deaths in NYS. This shift occurred primarily in NYC, which caused an increase in the number of SUID cases both regionally and statewide. This shift represents an improvement in SUID reporting practices rather than a true increase in the number of SUID deaths in the state.

Figure 47. Frequency of Sudden Unexpected Infant Death* (SUID) by Cause and Total SUID Rate per 100,000 Live Births, 2016-2019**



* Sudden Unexpected Infant Death (SUID) includes Sudden Infant Death Syndrome (SIDS), Accidental Suffocation or Strangulation in Bed (ASSB), or Unknown Cause.

** SIDS and ASSB over time may be unstable over time due to small cell size.

Substantial disparities in the SUID rate have been observed across various racial/ethnic groups. In combined years 2016-2019, Non-Hispanic Black infants had a SUID rate of 105.94 deaths per 100,000 live births. When compared to Hispanic (39.46 deaths per 100,000 live births) and Non-Hispanic White infants (48.85 deaths per 100,000 live births), Non-Hispanic Black infants had a SUID rate more than two times higher (Table 6). Since 2016, the SUID rate increased annually among most racial/ethnic groups, therefore, it would be prudent to focus on a 2019 comparison, which is the latest data available.

In 2019, the SUID rate among Non-Hispanic Black infants (142.60 deaths per 100,000 live births) was at least twice as high as that of Non-Hispanic White infants (57.14 deaths per 100,000 live births) and Hispanic infants (35.69 deaths per 100,000 live births). From 2016 to 2019, the SUID rate for Non-Hispanic Black infants increased 56% from 91.42 deaths per 100,000 live births in 2016 to 142.60 deaths per 100,000 live births in 2019 (Figure 48).

Table 6. Sudden Unexpected Infant Death Rate by Race/Ethnicity, 2016-2019

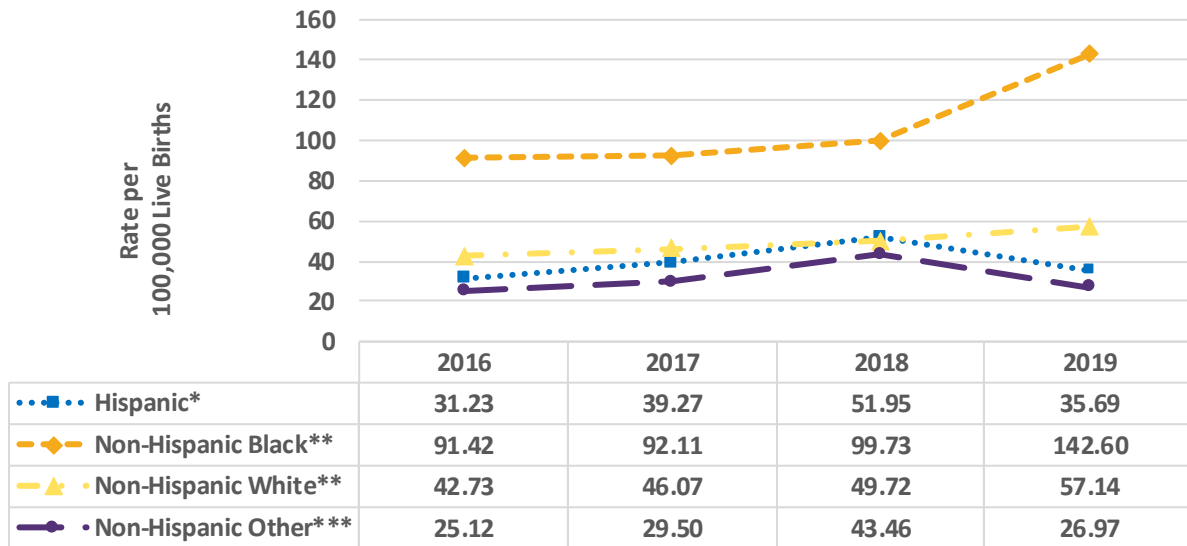
Race/Ethnicity	2016-2019		
	SUID Rate	Deaths	Births
Hispanic*	39.46	83	210,320
Non-Hispanic Black**	105.94	139	131,211
Non-Hispanic White**	48.85	215	440,147
Non-Hispanic Other***	31.39	39	124,246

* Hispanic includes all infants of Hispanic origin of any race; Hispanic rates may be unstable over time due to small cell sizes.

** Non-Hispanic Black and White include all infants of these single races.

*** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, Asian, and specified other and multiple race infants; Non-Hispanic Other rates may be unstable over time due to small cell sizes.

Figure 48. Sudden Unexpected Infant Death Rate by Race/Ethnicity, 2016-2019



* Hispanic includes all infants of Hispanic origin of any race; Hispanic rates may be unstable over time due to small cell sizes.

** Non-Hispanic Black and White include all infants of these single races.

*** Non-Hispanic Other includes American Indian/Native American, Native Hawaiian/Pacific islander, Asian, and specified other and multiple race infants; Non-Hispanic Other rates may be unstable over time due to small cell sizes.

When stratified by maternal education, infants born to individuals who graduated from college had a substantially lower SUID rate when compared to other educational achievements. In combined years 2016-2019, college graduates had a SUID rate of 23.78 deaths per 100,000 live births. This contrasts with non-high school graduates (86.96 deaths per 100,000 live births), high school graduates or equivalent (74.95 deaths per 100,000 live births), and those with some college education (70.98 deaths per 100,000 live births) (Table 7).

When compared to 2016, infants born to individuals who reported graduating from college were the only group that did not experience an increase in the SUID rate in 2019 (2019: 20.15 deaths per 100,000 live births). All other groups experienced a marked increase in the SUID rate from 2016 to 2019. Non-high school graduates (83.16 vs. 104.82 deaths per 100,000 live births), high school graduates or equivalent (56.14 vs. 102.81 deaths per 100,000 live births), or some college (50.59 vs. 74.27 deaths per 100,000 live births) (Figure 49).

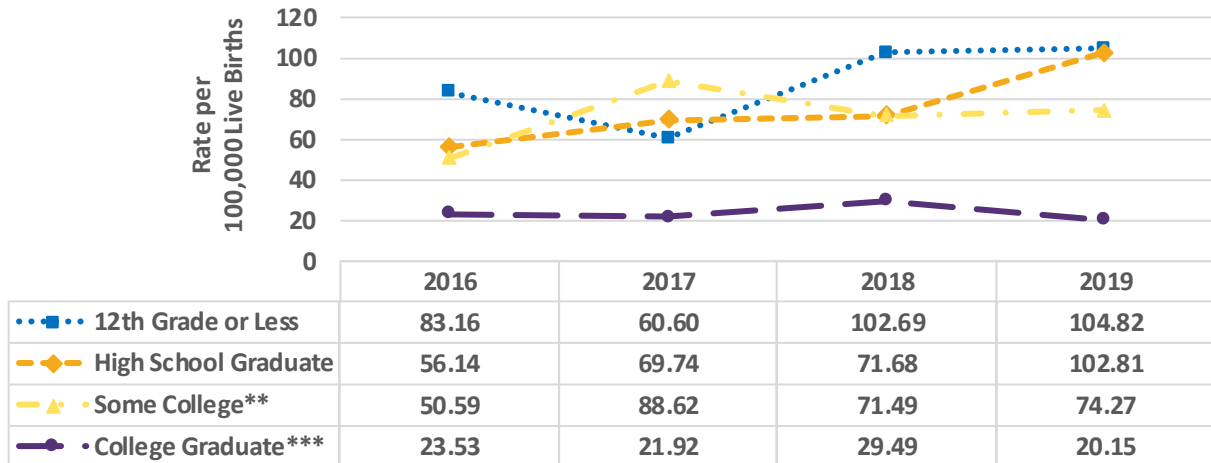
Table 7. Sudden Unexpected Infant Death Rate by Maternal Education, 2016-2019

Maternal Education	2016-2019		
	SUID Rate	Deaths	Births
12 th Grade or Less	86.96	116	133,389
High School Graduate	74.95	154	205,473
Some College*	70.98	101	142,290
College Graduate**	23.78	100	420,506

* High school graduate includes persons who graduated from high school or obtain high school equivalency.

** College graduates includes persons with Associate's, Bachelor's, Master's, or Doctorate degrees.

Figure 49. Sudden Unexpected Infant Death Rate by Maternal Education*, 2016-2019



* All groups (non-high school graduate, high school graduate or equivalent, some college, and college graduate) rates may be unstable over time.

** High school graduate includes persons who graduated from high school or obtain high school equivalency.

*** College graduate includes persons with Associate’s, Bachelor’s, Master’s, or Doctorate degrees.

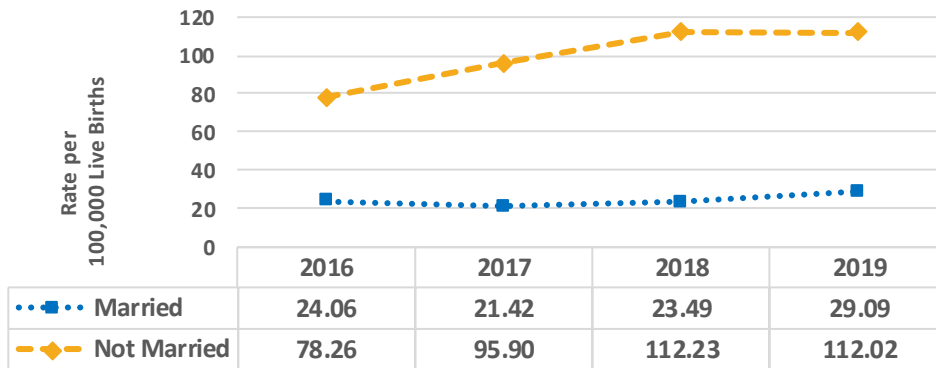
SUID Rates by Maternal Marital Status on the Birth Certificate:

Substantial disparities in the SUID rate have been observed among infants born to individuals who were married compared to those who were not married. In combined years 2016-2019, infants born to individuals who were not married had a SUID rate (99.92 deaths per 100,000 live births) 4 times higher than infants born to individuals who were married (24.49 deaths per 100,000 live births) (Table 8). From 2016 to 2019, infants born to those individuals not married experienced a 43% SUID rate increase, which was more than twice that of infants born to those individuals who were married (21%). As a result, in 2019, the SUID rate among infants born to those individuals who were married was 112.02 deaths per 100,000 live births, compared to 29.09 per 100,000 live births among those not married. (Figure 50).

Table 8. Sudden Unexpected Infant Death Rate by Marital Status on Birth Certificate, 2016-2019

Marital Status	2016-2019		
	SUID Rate	Deaths	Births
Married	24.49	137	559,322
Not Married	99.22	341	343,664

Figure 50. Sudden Unexpected Infant Death Rate by Marital Status, 2016-2019



SUID Rate by Initiation of Prenatal Care:

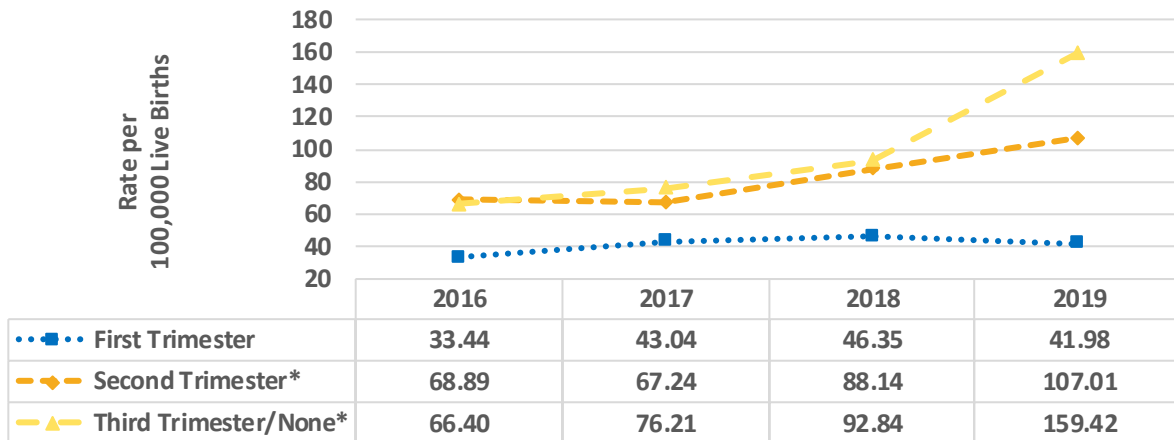
Substantial disparities exist in SUID rates by trimester of prenatal care initiation. In combined years 2016-2019, the SUID rate for birthing persons who started prenatal care in first trimester was 41.19 deaths per 100,000 live births, for birthing persons who started in the second trimester was 82.42 deaths per 100,000 live births, and for birthing persons who started in third trimester or did not receive prenatal care at all was 98.69 deaths per 100,000 live births (Table 9).

Since 2016, the SUID rate has increased across all years, regardless of when/if prenatal care was initiated. The SUID rate increased 26% for infants when prenatal care was initiated in the first trimester, 55% when starting in the second trimester, and 175% when starting in the third trimester or no prenatal care was received (Figure 51). SUID rates when prenatal care was initiated in the second or third trimesters or not at all were unstable over time due to small cell size and cannot be compared reliably.

Table 9. Sudden Unexpected Infant Death Rate by Trimester of Prenatal Care Initiation

Trimester of Prenatal Care Initiation	2016-2019		
	SUID Rate	Deaths	Births
First Trimester	41.19	279	677,383
Second Trimester*	82.42	126	152,884
Third Trimester/None*	98.69	47	47,624

Figure 51. Sudden Unexpected Infant Death Rate by Trimester of Prenatal Care Initiation



*Second Trimester and Third Trimester/None rates over time may be unstable over time due to small cell size.

SUID Rate by Smoking Status:

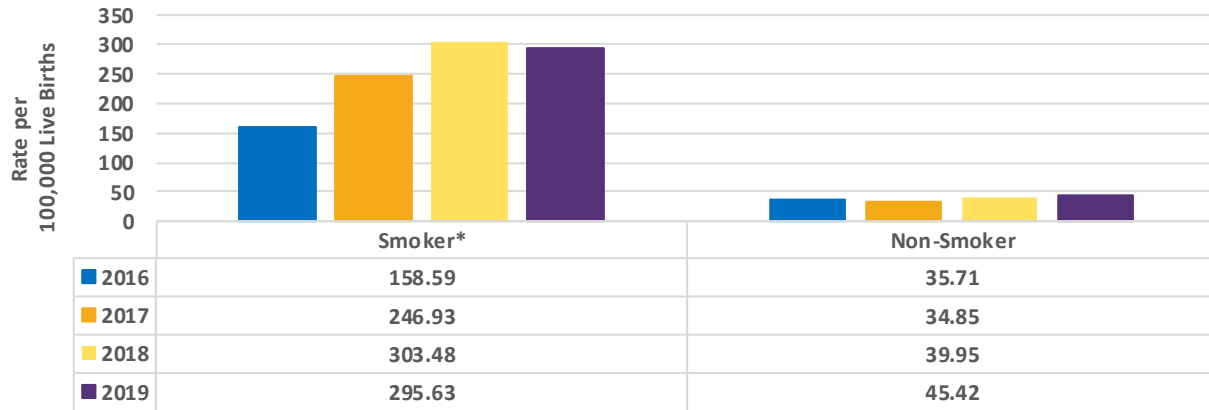
Substantial disparities in the SUID rate have been observed when maternal history of smoking is reported on the birth certificate compared to when there is no history of maternal smoking. Table 10 illustrates that in combined years 2016-2019, infants born to individuals with a history of smoking reported had a SUID rate (246.57 deaths per 100,000 live births) more than 6 times (6.3) greater than when there was not maternal history of smoking reported (38.93 deaths per 100,000 live births). Since 2016, the SUID rate increased more than three times (3.2 times; by 86%) compared with the rate for infants where no maternal history of smoking was reported (by 27%). As a result, in 2019, the SUID rate was 295.63 deaths per 100,000 live births for infants when there is a history of maternal smoking compared to 45.42 deaths per 100,000 live births without a maternal history of smoking reported (Figure 52).

The SUID rate among smokers in 2016 was unstable due to small cell size., However, 2017 through 2019 data as well as aggregated 2016-2019 data suggest the disparity in SUID rates by maternal smoking status is one of the greatest seen in the report.

Table 10. Sudden Unexpected Infant Death Rate by Maternal Smoking Status, 2016-2019

Maternal Smoking	2016-2019		
	SUID Rate	Deaths	Births
Smoker	246.57	145	58,806
Non-Smoker	38.93	329	845,142

Figure 52. Sudden Unexpected Infant Death Rate by Maternal Smoking Status, 2016-2019



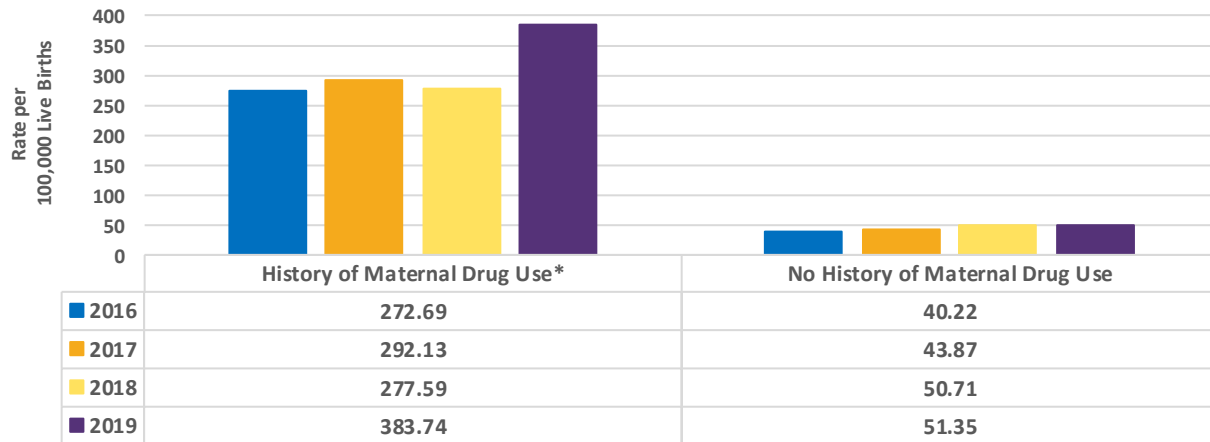
*Smoker SUID rate in 2016 may be unstable due to small cell size.

Substantial disparities in the SUID rate have been observed when a history of maternal drug use is reported compared to no history of maternal drug use. Table 11 illustrates that in combined years 2016-2019, the SUID rate (307.58 deaths per 100,000 live births) was more than six and a half times (6.6) higher than the SUID rate (46.44 deaths per 100,000 live births) when there was no history of maternal drug use.

Similar to those with history of maternal smoking, disparity exists between those with history of maternal drug use and those without. While SUID rates among those with history of maternal drug use by individual years were unstable due to small cell size and cannot be compared reliably, when combined across 4 years from 2016 to 2019, it highlights the SUID rates by maternal drug use as the other area showing the other great disparity in the report (maternal drug use 307.58 deaths per 100,000 live births vs. no history of maternal drug use 46.44 per 100,000 live births). (Figure 53).

Table 11. Sudden Unexpected Infant Death Rate by s, 2016-2019 Maternal Drug Use	2016-2019		
	SUID Rate	Deaths	Births
History of Maternal Drug Use	307.58	68	22,108
No History of Maternal Drug Use	46.44	403	867,864

Figure 53. Sudden Unexpected Infant Death Rate by Maternal Drug Use, 2016-2019



*SUID rates for those with history of maternal drug use for individual years are unstable due to small cell size.

Section 4: Key Recommendations

Key Recommendations from the Expert Workgroup

- NYSDOH should convene and hold key informant interviews and/or focus groups with community members and providers, in health service areas with higher infant mortality rates, to help discern factors associated with higher risk of infant mortality, as well as the effects of racial and ethnic disparities. This area-specific work will aid in developing targeted recommendations which may differ across the state.
- NYSDOH should more broadly engage Regional Perinatal Centers, their affiliate hospitals, and communities to address the individual needs of each region including education, training, and quality improvement initiatives.
- NYSDOH should identify provider shortage areas and work with partners, such as SUNY, to provide support for recruitment and retention strategies in provider shortage areas.
- NYSDOH should expand Medicaid to support more comprehensive postpartum care and enhanced screening for risk factors during pregnancy.
- NYS clinicians and home visiting programs should engage in efforts to ensure prenatal screening for co-morbidities that are known drivers of preterm birth are performed and provide enhanced support during pregnancy, birth and in the postpartum/neonatal period.
- Universal home visiting should be implemented throughout the state.
 - At a minimum, one home visit early during the postpartum period should be offered universally.
 - Home visiting programs should provide education, support, and linkages to care to address modifiable risk factors when working with individuals of reproductive age.
- NYSDOH should develop and implement social media strategies to help persons of reproductive age understand the importance of healthy choices and improved pregnancy outcomes and have access to supports needed for healthy choices.
- NYSDOH should work with the American College of Obstetricians and Gynecologists District II (ACOG) to educate providers about the importance of prenatal screening and the negative affect on infant mortality when it is not done.

- NYSDOH, in conjunction with ACOG and specialists, should ensure providers are educated on the management of diabetes in pregnant persons.
- NYSDOH should continue to provide tools and resources to pregnant and postpartum persons to assist with smoking cessation.
- NYSDOH and partners should continue to promote a consistent message to pregnant and parenting persons on safe sleep practices, using the ABCs of safe sleep, meaning infants should sleep **A**lone, on their **B**ack, in a safe **C**rib, and in a **s**moke-free home, through a multimedia approach.
- NYSDOH should continue to provide home visiting agencies with materials that support infant safe sleep practices (portable cribs, sleep sacks, onesies with safe sleep messaging).
- Given the persistent infant mortality disparities, especially affecting Black infants, the NYSDOH NYS Perinatal Quality Collaborative (NYSPQC) program should implement a neonatal equity project in NYS birthing facilities that employs a collaborative learning model to identify how racism negatively affects birth outcomes at the facility level and identify actions to improve neonatal outcomes and the experience of care for their families.
- NYSDOH should conduct more in-depth analysis to further explore predictors of and risk factors for infant mortality.
- NYS Office of Children and Family Services (OCFS) should expand Child Fatality Review Teams to all areas of the state.
- NYS should encourage the utilization of standardized infant death investigation procedures to improve cause-of-death certification and provide training to medical examiners and coroners on infant death investigation.
- NYSDOH should develop and disseminate resources and training materials for medical facilities to improve cause of death documentation on death certificates.

Section 5: Statewide Prevention Interventions to Address Infant Mortality

[NYS Prevention Agenda 2019-2024](#)

The Prevention Agenda 2019-2024 is NYS’s health improvement plan, the blueprint for State and local action to improve the health and well-being of all New Yorkers and to promote health equity in all populations who experience disparities. In partnership with more than 100 organizations across the state, the Prevention Agenda is updated by the NYS Public Health and Health Planning Council at the request of the NYSDOH. This is the third cycle for this statewide initiative that started in 2008. New to this 2019-2024 cycle is the incorporation of a Health Across All Policies approach, initiated in 2017, which calls on all State agencies to identify and strengthen the ways in which policies and programs can have a positive effect on health.

One of the goals of the NYS Prevention Agenda 2019-2024 is to reduce infant mortality and morbidity. The NYS Prevention Agenda outlines five interventions to reduce infant mortality so that every infant can reach their first birthday and beyond. These statewide prevention interventions are listed below and are further described in this section:

1. Implement updated perinatal regionalization standards, designations, and structured clinical quality improvement initiatives in birthing hospitals.

2. Identify infants who may have a rare, but treatable disease through bloodspot screening shortly after birth.
3. Increase capacity and competencies of local maternal and infant home visiting programs.
4. Engage in collaborative clinical and community-based strategies to reduce sleep-related infant deaths.
5. Engage in collaborative strategies to respond to increasing use of opioids among women, including pregnant women, and effect on infants.

Perinatal Regionalization

NYS has been a longstanding national leader in implementing statewide systems of regionalized perinatal care. NYS's regulations for perinatal regionalization and designation, as well as perinatal care services, were last updated in 2000 and 2005, respectively. It is imperative for NYS to ensure all perinatal hospitals are functioning in accordance with current standards of care for both obstetrical and neonatal outcomes. Since 2017, the NYSDOH has worked to update these regulations to reflect current national standards of obstetrical and neonatal care and perinatal levels of care, changes in health care systems and reimbursements, as well as hospital restructuring and other corporate structural changes. As part of the regulation development process, NYSDOH staff conducted an extensive review of current standards, in consultation with a 49-member multidisciplinary Expert Panel and other topical expert consultants. Additionally, the proposed regulations further integrate recently established midwifery birth centers (MBCs), along with physician-led birth centers, into the perinatal regional system, and place a greater emphasis on quality care and patient safety, particularly for obstetrical patients.

Current efforts to strengthen this public health system include increased efforts to address maternal morbidity and mortality, integration of physician- and midwifery-led birth centers into the regional systems, and increased access to ancillary services such as alcohol and substance use and mental health services, directly and/or through referral and commensurate with the birthing facility's level of care. In May 2021, a Midwifery Birth Center (MBC) Accreditation bill was passed by both houses of the legislature and signed by Governor Hochul on December 30, 2021. A subsequent Chapter Amendment to incorporate accreditation into the Certificate of Need process and require additional perinatal regionalization-related requirements beyond the scope of birth center accreditation was passed by both houses and signed by Governor Hochul in early March 2022. The proposed changes to the perinatal regionalization regulations required updates based on the MBC Accreditation Law. It is anticipated that the Notice of Proposed Rule Making will be published in the State Register in Summer 2022. Adoption of these regulations is anticipated by December 2022.

New York State Perinatal Quality Collaborative (NYSPQC)

Working within this statewide system of perinatal regionalization, the NYSDOH Division of Family Health implements the NYSPQC, which aims to provide the best, safest, and most equitable care for birthing people and infants in NYS by collaborating with birthing hospitals, perinatal care providers, and other key stakeholders to prevent and minimize harm through the translation of evidence-based guidelines to clinical practice. The NYSPQC has adapted the Institute for Healthcare Improvement (IHI) model for Idealized Perinatal Care and Breakthrough Series Methodology as a framework to guide improvement.

Key NYSPQC activities include:

- embedding evidence-based guidelines into practice;
- strengthening collaboration and communication within and among neonatal and obstetric providers, administrators, and organizations;
- fostering prepared and proactive care teams;

- assessing, conducting, and sharing surveillance and performance data on maternal and neonatal health indicators;
- evaluating and measuring performance continuously;
- setting priorities and implementing a comprehensive strategy for benchmarking and data driven quality improvement (QI) activities;
- providing topic-specific, intensive QI supportive activities, trainings, and toolkits that are all-inclusive packages to facilitate improved clinical outcomes, excellent patient care, and efficient resource allocation;
- researching best practices; and
- reassessing outcomes of performance improvement interventions continually.

Specific priorities set by the NYSPQC are implemented by all participating NYS birthing hospitals and partners to improve outcomes for perinatal care. Analysis of NYSPQC project data provided by participating birthing hospitals helps to improve services and systems related to perinatal health care.

Since the inception of the NYSPQC in 2010, participating hospital teams have focused on a range of topics, including: reducing the number of scheduled deliveries between 36 0/7 and 38 6/7 weeks gestational age occurring without a medical indication; increasing education on risk factors affecting scheduled deliveries without a medical indication; improving hospital obstetric practices so that all mothers of infants born between 23 0/7 and 34 0/7 weeks gestation receive appropriate antenatal corticosteroid treatment in order to reduce neonatal morbidity and mortality; improving the identification of maternal hemorrhage and maternal hypertension, as well as patient education on these topics; and support birthing hospitals to provide appropriate and respectful care to individuals with OUD during pregnancy, and improving the identification, standardization of therapy, and coordination of aftercare (i.e., plans of safe care) of infants with neonatal abstinence syndrome (see below for more details about the OUD-NAS project).

Newborn Bloodspot Screening Program (NBSP)

The NYS NBSP is a population-based program and public health system that identifies infants who may have a rare, but treatable disease through bloodspot screening shortly after birth. Within NYSDOH, the NBSP is housed and administered by the Wadsworth Center, NYS's public health laboratory. The NBSP currently performs laboratory testing for 50 diseases, following national recommendations for NBS programs. The program ensures that every newborn in the state receives newborn bloodspot screening as a public health service, with no fee for testing. The program also performs follow-up case management to ensure newborns with a positive screening result receive appropriate diagnostic testing and treatment. Specialty Care Centers are certified and monitored to ensure newborns have access to specialty care for disease-specific testing and management. In addition, the NBSP contracts with each of the state's 10 Inherited Metabolic Disease (IMD) Specialty Care Centers to enroll patients with an IMD diagnosis identified by newborn screening in the NYS Newborn Screening Patient Registry. These IMD Specialty Care Centers are responsible for entering and tracking NBS results for consented patients annually and for attending an annual meeting to discuss long-term follow-up data. Patients are monitored until age 18 years, when the individual must consent to continue participation until age 21. Based on provisional Vital Records data, the program screened 211,203 infants in 2021.

Maternal and Infant Home Visiting Programs

Home visiting programs are a cornerstone of public health efforts to support pregnant and parenting families. An extensive body of research demonstrates that evidence-based home visiting programs improve numerous short- and long-term outcomes for mothers, infants, and families.

Maternal, Infant and Early Child Home Visiting (MIECHV) Program

In NYS, Maternal and Infant Early Childhood Home Visiting (MIECHV) grant funds have supported the expansion of two specific evidence-based home visiting models: Nurse Family Partnerships (NFP) and Healthy Families New York (HFNY) Programs. These home visiting programs complement other evidence-based programs operating in New York communities, including Early Head Start, Parents as Teachers, and Home Instruction for Parents of Preschool Youngsters (HIPPY), as well as other traditional and emerging service models that include community outreach, home visits, and family support elements such as public health nursing, community health workers, and doulas.

Under the NYSDOH's MIECHV Initiative, local home visiting programs have been engaged in a variety of efforts to build capacity and improve effectiveness in key areas including increasing referrals, client enrollment, and retention; extending the duration of breastfeeding; and increasing home visitors' knowledge and skills related to key topics such as intimate partner violence, substance use, mental health, smoking cessation, self-care, and postpartum/interconception care.

The MIECHV Program is designed to improve health and developmental outcomes for at-risk children and families through evidence-based home visiting programs. It supports pregnant women and families and helps at-risk parents of children from birth to kindergarten entry tap the resources and hone the skills they need to raise children who are physically, socially, and emotionally healthy and ready to learn. Families that elect to participate in local, evidence-based home visiting programs receive advice, guidance, and other help from health, social service, and child development professionals. Through regular planned home visits, parents learn how to improve their family's health and provide better opportunities for their children.

Home visits may include support for preventive health and prenatal practices such as helping parents find suitable prenatal care, improve their diets, and reducing the use of tobacco, alcohol, and illegal substances. Home visitors can assist individuals through all stages of pregnancy and postnatal care, providing support for breastfeeding/chestfeeding and care for their babies. In addition, home visitors may provide health and development education by helping parents understand child development milestones and behaviors and by promoting parents' use of praise and other positive parenting techniques. Home visitors may also work with parents to set goals for their own future, continue their education, and find employment and childcare solutions.

Perinatal and Infant Community Health Collaboratives (PICHC)

The NYSDOH funds 26 PICHC programs statewide to support the development, implementation, and coordination of collaborative-based strategies to improve the health and well-being of individuals of reproductive age and their families. The PICHC works to implement evidence-based/informed strategies across the reproductive life course. Each PICHC employs community health workers (CHWs) from the communities they serve, to engage women in prenatal care and ongoing primary and preventive health care. The PICHC is a needs-driven, community-based collaborative approach to improving key perinatal and infant health outcomes, including preterm birth, low birth weight, infant mortality, and maternal mortality and eliminating racial, ethnic, and economic disparities in those outcomes. Using three

separate approaches – life course, social-ecology, and performance management – the PICHC develops strategies to address preconception, prenatal, postpartum, and interconception. Strategies for addressing these areas include individual, family, organization, and community level interventions to increase access to health insurance, engage people in their health care, coordinate multiple services, and promote opportunities for healthy behaviors. To drive system-level change, PICHC programs are funded to implement community mobilization to address social determinants of perinatal health. Each PICHC is funded to actively participate in an existing or lead a new community advisory board, consortium, or coalition with a focus on perinatal and infant health issues.

Improve and Expand Access to Prenatal and Postnatal Care

In alignment with evidence-based guidelines and best practices, access to comprehensive maternal and infant health services will be extended through new or expanded Medicaid reimbursement. Postpartum coverage for individuals eligible for either Medicaid or Child Health Plus will be expanded from 60 days to 12 months leading to more equitable health outcomes across the state. Furthermore, Medicaid expansion will include reimbursement for the following services provided to pregnant and postpartum populations registered dietitians who provide nutrition services, Community Health Workers and Patient Family Navigators for care coordination and peer support services, Bluetooth-enabled devices for telehealth/remote patient monitoring services, Midwifery services, and expanded coverage of non-invasive prenatal trisomy screening (NIPS) to include pregnant people of any age.

Reduce Sleep-related Infant Deaths

Sudden Unexpected Infant Death (SUID) is the leading cause of infant death after the first month of life and one of the leading causes of infant death overall. SUID may be attributed to various causes, including suffocation, asphyxia, entrapment, infection, ingestions, metabolic diseases, arrhythmia-associated cardiac channelopathies, and both unintentional and non-accidental trauma, as well as Sudden Infant Death Syndrome (SIDS) or may be of unknown cause.⁹ Sleep-related deaths represent the subset of SUIDs that occur during an unobserved sleep period.⁹ Because infants placed to sleep on their sides or stomachs (prone) are at increased risk of SIDS, the American Academy of Pediatrics (AAP) recommends a safe sleep environment that can reduce the risk of all sleep-related infant deaths. This includes supine positioning, use of a firm, non-inclined sleep surface, room sharing without bed sharing; and avoidance of soft bedding and overheating. Additional recommendations for SIDS risk reduction include human milk feeding; avoidance of exposure to nicotine, alcohol, marijuana, opioids, and illicit drugs; routine immunization; and use of a pacifier. In the AAP 2022 recommendations for reducing infant deaths in the sleep environment, new information is presented regarding non-inclined sleep surfaces, short-term emergency sleep locations, use of cardboard boxes as a sleep location, bed sharing, substance use, home cardiorespiratory monitors, and tummy time.⁹

The NYSDOH is working to promote safe sleep practices and prevent infant deaths caused by an unsafe sleep environment using several strategies including legislative and policy efforts, robust public awareness campaign using media outlets, hospital-based education programs regarding the American Academy of Pediatrics' recommended ABCs of Safe Sleep,⁹ as well as home-based visiting programs to support and educate mothers and caregivers during the prenatal and postpartum periods.

Legislative and Policy Efforts to Promote Safe Sleep Practices

Strong state legislation helps drive public health interventions for the reduction of infant mortality due to unsafe sleep practices. NYS regulates infant sleep position in child day care centers, which must place infants in a supine position, unless there is a physician waiver stating that the infant should be placed otherwise (22 NYCRR § 418-1.7), prohibits objects in the crib (22 NYCRR §418-1.7), and bans smoking in licensed childcare centers and family childcare homes (22 NYCRR § 418-1.11). Additionally, there are training requirements for licensed and registered daycare providers. Childcare providers in NYS must complete 30 hours of training every two years, which includes “prevention techniques in sudden infant death syndrome.” In 2019, a new law went into effect prohibiting the sale of certain non-mesh crib bumper pads and restricting their use in certain facilities and places of public accommodation, unless a medical professional has determined a bumper pad is medically necessary for a particular child (26 NYCRR §399-II*2). These laws were designed to protect infants from potentially deadly crib clutter and promote a safe sleep environment.

Legislation has also been focused on education at delivery. NYS has passed legislation which mandates consistent infant safe sleep education in all birthing hospitals. In July 2016, NYS passed legislation that requires all hospitals and birthing facilities in NYS to give new parents information on safe sleep upon admission (Public Health Law §2803-j). Hospitals and birthing facilities develop their own policies and procedures about the way the information is presented to new parents. They may opt to give parents a brochure on safe infant sleep or have them watch a video on safe sleep during the birth hospitalization. NYSDOH developed a [pamphlet on safe infant sleep](#), in 11 languages, that birthing facilities can download for free and use to fulfill this requirement. NYS legislation also requires every hospital and birthing center to deliver an informational leaflet on crib safety at the time of discharge. A May 2022 federal law (Public Law No: 117-116) banned inclined infant sleepers and crib bumpers, regardless of the date of manufacture as hazardous products under the Consumer Product Safety Act.

State-wide Safe Sleep Public Education Campaign

The NYSDOH, in collaboration with the Office of Children and Family Services (OCFS) and other partners, are working together to deliver a consistent message about safe infant sleep practices while educating new parents and infant caregivers. This message focuses on the ABCs of safe sleep, meaning infants should sleep **A**lone, on their **B**ack, in a safe **C**rib, and in a smoke-free home. This collaborative work has included the development and dissemination of co-branded materials (brochures, mirror clings, magnets, and posters) with OCFS; the development of a one-minute video in English and Spanish on the ABCs of safe sleep which is available on the NYSDOH YouTube channel, as well as on DVDs and flash drives for partner organizations; collaboration with the NYS Department of Motor Vehicles (DMV) to show the aforementioned safe sleep video in DMV office waiting rooms; working with the Office of Alcohol and Substance Abuse Services (OASAS) to provide brochures and other educational materials and share safe sleep videos and posters for use in residential treatment programs for substance abuse; a training webinar developed in collaboration with OASAS for staff at residential treatment facilities and homeless shelters; and collaboration with the OCFS on a special initiative with NYS Child Fatality Review Teams and participating birthing hospitals to offer “baby bags” that include one-piece sleepers, books, videos, brochures, door hangers, magnets, and clings.

Safe Sleep brochures, crib cards, mirror clings, posters, and anatomical diagrams (in 11 languages) are stored in the NYSDOH materials distribution warehouse for hospitals, county health departments, home visiting agencies, etc. to order free of charge. The materials may also be downloaded and printed from the NYSDOH website: [NYSDOH Website - Safe Sleep](#).

Distribution of Safe Sleep Materials to Birthing Hospitals and Home Visiting Agencies to Improve Adoption of Safe Sleep Practices

Since 2017, NYSDOH has provided birthing hospitals and NYS-funded home visiting agencies with a variety of infant safe sleep resources to distribute to infant caregivers, including sleeping safely starter kits, cotton and fleece sleep sacks, ABC's of Safe Sleep pens, books with safe sleep messages in English and Spanish, brochures, crib cards, mirror clings, posters, anatomical diagrams, and "Follow the ABC's of Safe Sleep" coloring sheets and crayons. Many of the written materials have been translated into the 11 most common languages spoken in New York State. The purpose of providing these materials to hospitals and home visiting agencies was two-fold. The items themselves were designed to help make sleep safer for infants and distributing these items to families provided hospital staff and home visitors with an opportunity to educate/re-educate the families on safe sleep practices.

Respond to Increasing Use of Opioids

According to NYSDOH administrative data, the rate of opioid overdose deaths for females of reproductive age, 18 to 44 years old, has tripled, from 4.2 per 100,000 in 2010, to 12.7 per 100,000 in 2016. Furthermore, between 2010 and 2019, the incidence of Neonatal Abstinence Syndrome (NAS) among newborn hospitalizations in New York State (NYS) increased by 270%, from a rate of 1.9 cases per 1,000 newborn hospitalizations in 2010, to 4.6 cases per 1,000 newborn hospitalizations in 2019.¹⁰ Addressing the opioid epidemic is a public health priority in NYS. In 2014, the state established the Heroin and Opioid Task Force and enacted Combat Heroin legislation, establishing a multi-faceted response with a focus on prevention, harm reduction, treatment, recovery, and law enforcement. A collaborative approach is essential to addressing this complex issue. Several initiatives are underway at the state level, including efforts focused specifically to support individuals who are pregnant and their families.

NYSPQC Opioid Use Disorder (OUD) in Pregnancy and Neonatal Abstinence Syndrome (NAS) Project

In response to the growing incidence of opioid use during pregnancy, the NYSDOH's NYSPQC joined together with the American College of Obstetricians and Gynecologists (ACOG) District II, Healthcare Association of New York State (HANY), Greater New York Hospital Association (GNYHA), and the National Institute for Children's Health Quality (NICHQ) to work with NYS birthing hospitals through a quality improvement learning collaborative.

The NYS Opioid Use Disorder (OUD) in Pregnancy and Neonatal Abstinence Syndrome (NAS) Project, which began in November 2018, seeks to support birthing hospitals to provide appropriate and respectful care to individuals with OUD during pregnancy. This project seeks to improve early identification of OUD, standardization of therapy, and coordination of aftercare (i.e., plan of safe care) of infants with NAS. The project is achieving this goal by delivering provider and patient education; implementing universal verbal screening; improving the management of patients during labor, delivery, and immediately postpartum; coordinating discharge care; and collaborating across hospital teams to share and learn. The project's goal of improving the care of infants with NAS is being achieved by delivering provider and patient education; improving early identification of infants at risk; improving the management of patients using standardized NAS treatment protocols, including pharmacological and non-pharmacological management; coordinating discharge care; and collaborating across hospital teams to share and learn.

Thirty-nine NYS birthing hospitals from diverse geographic areas, and representing all levels of NYSDOH perinatal designations, are participating in the project. Teams from these hospitals are learning and applying key principles to improve care and implement the core interventions, and associated measures, as the primary focus of their work. These core interventions are based on currently available scientific evidence. As part of the improvement process, teams are also learning quality improvement strategies and collecting data that is sensitive to the changes they are testing and implementing, to track performance and results.

Section 6: Discussion

While this surveillance report provides a summary of trends in NYS infant mortality, data alone cannot fully explain the complex and multifactorial issues associated with infant mortality. Economic, social, and environmental conditions; differences in health insurance coverage and access to care; structural and systemic racism and discrimination; as well as race, gender, poverty, and other social factors all contribute to infant mortality and have led to disparities in infant health outcomes.

Compared nationally in 2020, New York State (NYS) ranked 4th overall in infant mortality.³ Between 2016 and 2019, the number of NYS infant deaths declined by 12% from 4.36 deaths per 1,000 live births in 2016 to 3.85 deaths per 1,000 live births in 2019. The decline in infant mortality in NYS exceeded the overall national decline of 5% during the same period.²

Despite national and NYS efforts to combat and eliminate racial and ethnic disparities in infant mortality, these disparities continue to endure. In 2019, Non-Hispanic Black infants (10.62) were 2.4 times as likely to die in infancy as Non-Hispanic White infants (4.49). Furthermore, Non-Hispanic Native Hawaiian/Other Pacific Islander (8.19) and Non-Hispanic American Indian/Alaska Native (7.87) infants were both 1.8 times as likely to die in infancy as Non-Hispanic White infants (4.49).^{2,4} These disparities have increased marginally since 2016. In 2016, infant mortality rates for Non-Hispanic Black, Non-Hispanic American Indian/Alaskan Native, and Non-Hispanic White infants were 11.21, 8.61, and 4.87 deaths per 1,000 live births respectively.⁴ In NYS, from 2016 to 2019, infant mortality rates declined for all racial/ethnic groups except for Non-Hispanic Black infants. The infant mortality rate for Non-Hispanic Black infants increased slightly from 8.37 to 8.46 deaths per 1,000 live births. In contrast, infant mortality rates declined for Hispanic (3.93 vs. 3.41), Non-Hispanic White (3.52 vs. 3.07), Non-Hispanic Asian (3.03 vs. 1.66), and Non-Hispanic Other (6.99 vs. 6.44) infants.

The factors driving disparities in infant health are multifactorial and complex. These factors include employment status, income, housing, transportation, food security, access to healthy foods, stress, social supports, healthcare coverage, quality of medical care received which negatively affect the birthing person.⁵ Historic and persistent racism and discrimination also play a role in driving racial disparities in infant health. Even controlling for insurance status, income, age, and severity of conditions, people of color are less likely to receive routine medical procedures and experience a lower quality of care overall.⁶ Prioritizing equity in healthcare will be paramount in preventing the widening of disparities and advancing infant health.⁵

There are regional differences within NYS. New York City consistently had a lower infant mortality rate (in 2019 3.43 vs Rest of State 4.23 deaths per 1,000 live births) compared to the rest of the state. Upstate infant mortality rates were consistently higher when compared to those in the Downstate regions of Mid-Hudson, NYC, and Nassau-Suffolk.

Infants born to birthing individuals with higher education, private insurance, and a marital partner had the lowest infant mortality rates. Infants born to birthing persons in their teens or who were over 40 years of age are at higher risk of mortality which is supported by national data¹. This pattern is consistent among regions within NYS. Infant mortality was correlated with prematurity. For the extremely and very preterm, infant mortality rates have substantially declined which may reflect improvements in medical care and the effects of NY's coordinated system of perinatal regionalization where infants are delivered at the right level of care for the best outcomes. There has been a decrease in infant mortality for early term births. Infants born at full term have the lowest infant mortality rate. NYSDOH NYSPQC has focused considerable effort on supporting pregnant people and infants deliver at full term.

Although the NYS infant mortality rate is already lower than the Healthy People 2030 target of 5.0 deaths per 1,000 live births, racial, ethnic, and geographic disparities persist.¹ In the 2019 cohort, Non-Hispanic Black births comprise 14% of all births, but 31% of infant deaths which is an over-representation from this group. From 2016 to 2019, Non-Hispanic Black infants have the highest rate of infant mortality and were 2.8 times more likely to die than Non-Hispanic White infants. Disparity by race is seen in both Upstate and Downstate HSAs. NYC and Nassau-Suffolk had the greatest disparity between Non-Hispanic Black and Non-Hispanic White, with ratios of 3.4 and 4.0. Upstate ratios comparing the infant mortality rate for Non-Hispanic Black infants to Non-Hispanic White infants range from 2.3 to 2.9.

Trimester of prenatal care initiation affects infant mortality. Those that enter care in the first trimester have lower infant mortality rates. Infant mortality rates for prenatal care initiation in the second and third trimesters increased by trimester. Upstate had higher infant mortality rates when compared to Downstate for this subgroup. The same pattern was seen in both the neonatal and postneonatal periods.

Infant mortality rates declined in urban, suburban, and rural locales from 2016 to 2019. Urban areas consistently had lower infant mortality rates followed by suburban then rural. Factors associated with these disparities could be distance to care, ability to access the appropriate level of care, and availability of perinatal providers.

Certain maternal behaviors (smoking, alcohol consumption, and illegal substance use) and health conditions (depression, pre-pregnancy diabetes, and pre-pregnancy hypertension) are associated with increased infant mortality. The rates of tobacco use reported at any time during pregnancy and reported as occurring during the last three months of pregnancy have each declined by over 50% in the last ten years.¹⁰ However, tobacco use by a subset of individuals during pregnancy continues. The rate of neonatal mortality is higher than the postneonatal rate for all examined modifiable risks. Upstate had higher rates of infant mortality for the modifiable risks of smoking, alcohol consumption, diabetes, hypertension, and depression when compared to Downstate. Downstate had a higher infant mortality rate for the modifiable risk of drug use. Additionally, infant mortality associated with any of the modifiable risks, alone or in combination, occurred at higher rates in the Upstate NY region than Downstate, except for illegal drug use. While these geographic differences should be interpreted with some caution, it is important to note that the presence of any of these modifiable risks, alone or in combination, resulted in 2.2 times higher mortality rate compared to live births having no prenatal exposure to these modifiable risks. Modifiable behaviors provide an opportunity to intervene before and during pregnancy to improve maternal health and reduce infant morbidity and mortality. More

attention is needed to assess and address the social determinants of health associated with certain health conditions, (e.g., obesity, hypertension, and diabetes) so these conditions can be prevented or managed in people of reproductive age, ensuring they are at optimal health when they become pregnant.

Overall, the burden of infant mortality occurs in the neonatal period with two thirds of infant deaths occurring before 28 days. Diagnoses are also specific to this time period and include complications due to short gestation and low birth weight; congenital malformations; perinatal cardiovascular disorders; effects of maternal conditions on newborns; respiratory distress and other respiratory system disorders; perinatal infections; and complications of placenta, cord, or membranes, totaling more than three-quarters of neonatal deaths. About a third of infant deaths occur in the postneonatal period with the leading causes including SUID (a subset of which are sleep-related), congenital malformations, accidents, and short gestation/low birthweight.

While the NYS infant mortality rate has decreased over time, the SUID rate has not followed the same trend. Racial and ethnic disparities have been observed with Non-Hispanic Black birthing persons having a SUID rate more than twice that of Hispanic or non-Hispanic Whites (2.7 times and 2.2 times respectively). Other factors associated with high SUID rates include living in the Upstate region, lower educational attainment, being unmarried, starting prenatal care late, smoking, and maternal drug use.

Limitations:

Infant mortality rates were calculated for demographic, risk, and other characteristic variables by neonatal or postneonatal period of death, geographic region, and/or race/ethnicity as appropriate. We recognize that while these analyses provide some insight into the maternal and infant characteristics associated with mortality within the first year of life, the issues are complex. Further evaluation and collection of information not available through administrative data may provide additional insight. This type of analysis can be undertaken given additional time and resources but could not be accomplished within the scope of this reporting timeframe.

Section 7: Contributions and Acknowledgements

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Section 9: Appendix

Appendix A1 – New York State Health Service Areas (HSA) and Associated Counties



Appendix A2 – New York State Health Service Areas (HSA) by Code and Name

HSA Code	HSA Name
1	Western NY
2	Finger Lakes
3	Central NY
4	NY-Pennsylvania
5	Northeast NY
6	Mid-Hudson
7	New York City
8	Nassau-Suffolk