Ohio Department of Children & Youth

ANNUAL REPORT

Infant Mortality

2023

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EXECUTIVE SUMMARY

Infant mortality is the death of an infant before his or her first birthday. The infant mortality rate (IMR) is the number of infant deaths per 1,000 live births. In 2023, Ohio infant mortality data showed that there continue to be significant differences in IMR by race and socioeconomic status. Non-Hispanic (NH) Black infants die at a rate 2.4 times higher than that of non-Hispanic (NH) White infants.

In 2023, while the total number of infant deaths (904) was down slightly compared to 2022 (914), the IMR remained the same at 7.1 both years. The IMR among NH Black infants increased to 13.7 in 2023 from 13.4 in 2022. The IMR among NH White infants remained the same at 5.7 compared with 2022. The IMR among Hispanic infants increased to 7.2 in 2023 from 6.1 in 2022. A detailed breakdown of infant mortality by all races and ethnicities is available on page 4 of this report.

Reducing infant mortality is a priority in the Ohio State Health Improvement Plan (SHIP).[1] The SHIP has a goal of achieving 6.0 or fewer infant deaths per 1,000 live births in every racial and ethnic group by 2028. The IMR not only serves as a key indicator of maternal and infant health but is also an important measure of the health status of a community. The following report presents results of analyses performed on Ohio infant deaths that occurred in 2023.

Section 1: General Findings

904 Ohio infants died before their first birthday in 2023

    503 Non- Hispanic White infant deaths   **275** Non- Hispanic Black infant deaths

7.1 Overall infant mortality rate (IMR)

    5.7 Non- Hispanic White IMR   **13.7** Non- Hispanic Black IMR

4.8 Overall neonatal mortality rate (NMR)

    3.9 Non- Hispanic White NMR   **8.4** Non- Hispanic Black NMR

The NH Black neonatal mortality rate has decreased an average of 3.2% per year.

2.4 Overall postneonatal mortality rate (PMR

    1.7 Non- Hispanic White PMR   **5.3** Non- Hispanic Black PMR

The NH Black postneonatal mortality rate has increased an average of 4.2% per year.

2.4 Black/White Infant Mortality Ratio

Section 2: A Deeper Look

- Prematurity remains the leading cause of death among all infants.
- Almost one-third (31%) of infants who died in 2023 were born before 24 weeks gestation despite only accounting for 0.3% of all live births.
- NH Black infants died from prematurity-related causes at three times the rate of NH White infants, from Sudden Infant Death Syndrome (SIDS) at nearly four times the rate of NH White infants, and from external injuries, including accidental suffocation and strangulation in bed at more than three times the rate of NH White infants.
- More than one-third (37%) of infants who died in 2023 died during the first day of life. Two-thirds (67%) died during the first 27 days of life.
- More than half (55%) of infants who died in 2023 were born to mothers who reported Medicaid[*] as their source of insurance during the birth hospitalization.
- Nearly half of infants who died were born with very low birth weight (less than 1,500 grams or about 3.3 pounds).

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[*]Medicaid insurance status as reported on the birth certificate.

PUBLIC HEALTH SURVEILLANCE 101

What is Surveillance?

Public health surveillance provides and interprets data to help prevent and control disease. According to the Centers for Disease Control and Prevention (CDC), "public health surveillance is the ongoing, systematic collection, analysis, and interpretation of health-related data essential to planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control." In public health, problems are identified by using surveillance systems to monitor health events and behaviors occurring among a population. After the problem has been identified, the next question is, "What is the cause of the problem?" To fully answer this question, more specific scientific research is needed.

The data presented in this report is public health surveillance data and is an important component in Ohio's response to the problem of infant mortality. However, this report acknowledges that the data included here does not fully explain the numerous and complex causes of infant mortality. Embedded within the persistent disparities in infant deaths is a history of inequities and social, economic, and environmental conditions. By understanding what's happened in the past, individuals and organizations can better understand what is causing today's disparities and identify solutions that move toward an equitable future.

How Do We Use Surveillance Data?

Surveillance data can be used to:

- Detect epidemics, health problems, and changes in health behaviors.
- Estimate the magnitude and scope of health problems.
- Measure trends and characterize disease.
- Inform development and assess effectiveness of programs and control measures.
- Develop hypotheses and stimulate research.

SECTION 1: GENERAL FINDINGS

Ohio Infant Mortality by Race and Ethnicity

Although the number of deaths declined in 2023, the overall IMR remained the same from 2022 due to the decline in the number of births in Ohio. In 2023, 904 Ohio infants died before their first birthday, a decrease of 10 from 2022 (Table 1, Figure 1). There were 503 non-Hispanic (NH) White infant deaths in 2023, a decrease of 16 from 2022. There were 275 NH Black infant deaths in 2023, an increase of 2 from 2022. 70 Hispanic infants died in 2023, compared with 55 in 2022 (Table 1, Figure 1).

Table 1: Ohio Infant Mortality* by Race and Ethnicity (2019 – 2023)

Race and Ethnicity	2019		2020		2021		2022		2023	
	Infant Deaths	IMR	Infant Deaths	IMR	Infant Deaths	IMR	Infant Deaths	IMR	Infant Deaths	IMR
Overall**	929	6.9	864	6.7	912	7.0	914	7.1	904	7.1
White, non-Hispanic	515	5.4	484	5.3	507	5.5	519	5.7	503	5.7
Black, non-Hispanic	314	14.0	273	12.8	289	13.9	273	13.4	275	13.7
American Indian/ Alaskan Native, non-Hispanic	2	***	3	***	1	***	0	***	1	***
Asian, non-Hispanic	22	5.1	15^	3.8	23	6.0	13^	3.3	16^	4.2
Native Hawaiian/Pacific Islander, non-Hispanic	1	***	0	***	2	***	2	***	0	***
Multiracial, non-Hispanic‡	28	7.0	34	8.7	33	8.4	48	12.2	35	8.4
Hispanic	46	6.0	50	6.5	52	6.3	55	6.1	70	7.2

Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.

*Infant mortality rate per 1,000 live births.

**The overall number of deaths includes deaths of unknown race and ethnicity. Therefore, the sum of the racial and ethnic categories will not match the overall number of deaths.

***Rates based on fewer than 10 infant deaths do not meet standards of reliability or precision and are suppressed.

^ Rates based on fewer than 20 infant deaths should be interpreted with caution.

‡The multi-race group includes infant deaths whose mother identified as combination of any two or more races. Due to different multiracial categories, which vary from year to year, inferences should be made with caution.

Figure 1: In 2023, the number of **non-Hispanic Black** and **Hispanic** infant deaths increased, while the number of other race/ethnicity groups decreased.

Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.

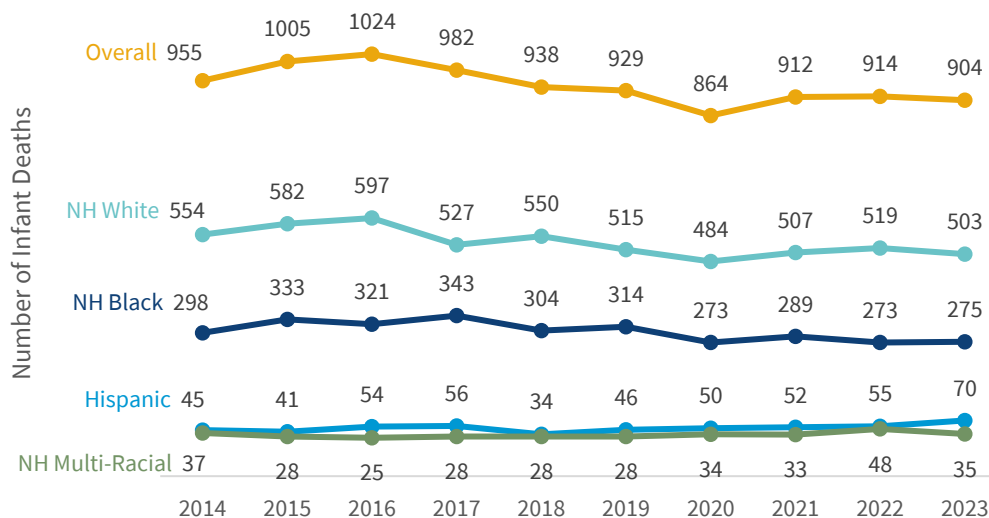The infant mortality rate is the number of infant deaths per 1,000 live births. Ohio's overall infant mortality rate was 7.1 per 1,000 live births in 2023 (Table 1, Figure 2). The NH Black infant mortality rate increased from 13.4 in 2022 to 13.7 in 2023, while the NH White infant mortality rate remained the same at 5.7 (Table 1, Figure 3). Ohio's Hispanic infant mortality rate increased to 7.2 infant deaths per 1,000 live births in 2023, compared with 6.1 in 2022 (Table 1, Figure 3). Ohio's SHIP, coordinated by the Ohio Department of Health, has set a 2028 overall infant mortality rate target of 6.0 infant deaths per 1,000 live births, in addition to target rates for specific populations.[1]

Figure 2: The **Overall** infant Mortality Rate (IMR) remained the same in 2023 compared to the previous year.

Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.
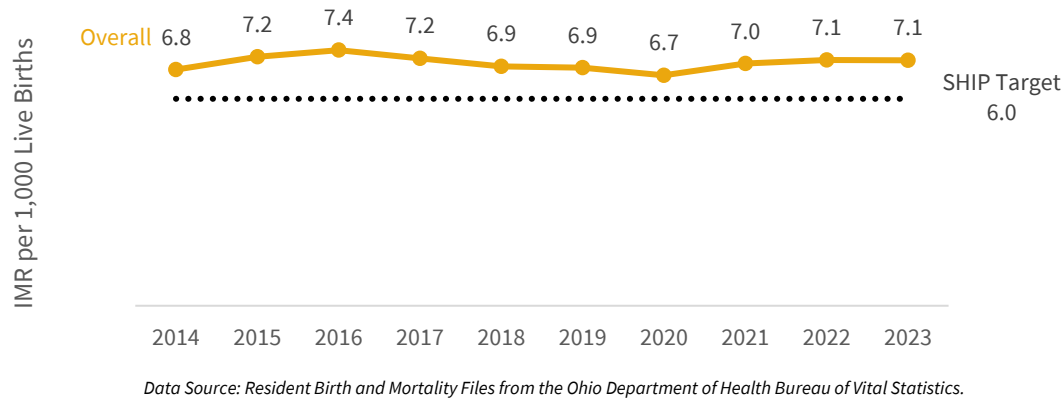
Figure 3: The **non-Hispanic Black** and **Hispanic** IMR increased, while the **non-Hispanic White** IMR did not change 2023.
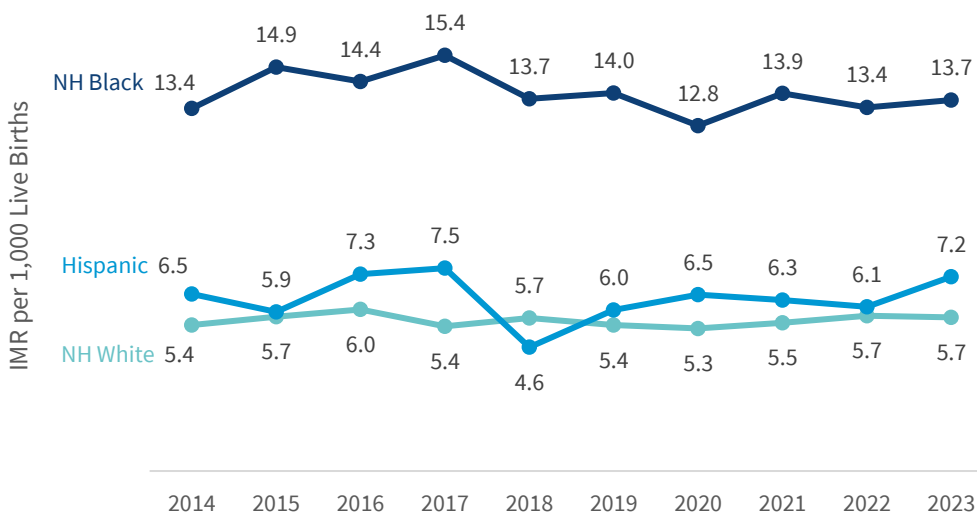
Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.
Note: American Indian/Alaskan Native, Asian, and Pacific Islander rates are suppressed because rates based on fewer than 10 infant deaths do not meet standards of reliability or precision and are suppressed.

There is a large disparity in infant mortality rates among NH Black and NH White infants. The Black/White infant mortality ratio remained 2.4 in 2023 compared with 2022. This means that NH Black infants are 2.4 times more likely to die than NH White infants in Ohio (Figure 4). Since 2014, the Black/White infant mortality ratio has remained stable.

Figure 4: The **NH Black/NH White infant mortality ratio*** did not change in 2023.
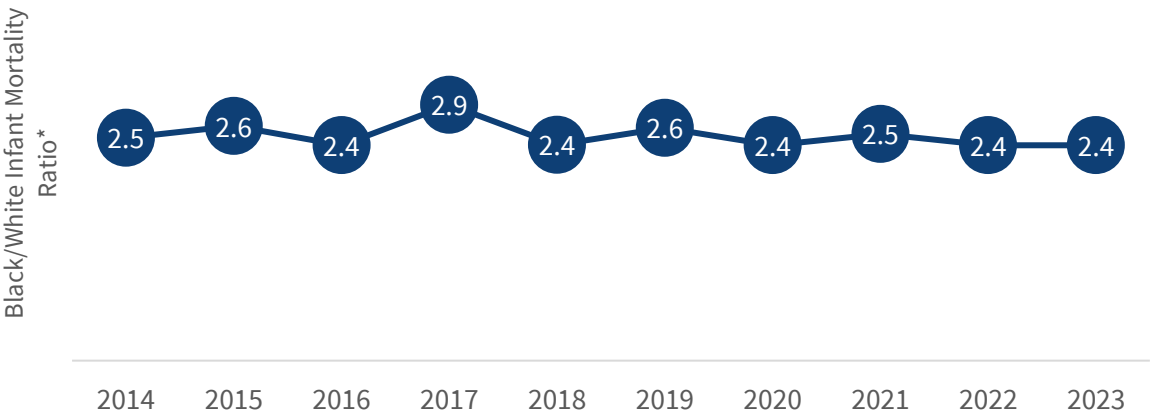
Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.
*Black infant mortality rate divided by the white infant mortality rate.

Ohio's Five-Year Infant Mortality Rate by County (2019 – 2023)

See Appendix A for Ohio five-year infant mortality rates by county and race.

Infant Mortality Rate per 1,000 Live Births

- 3.0 – 5.6
- 5.7 – 6.3
- 6.4 – 7.1
- 7.2 – 8.2
- 8.3 – 19.8
- Data Suppressed*
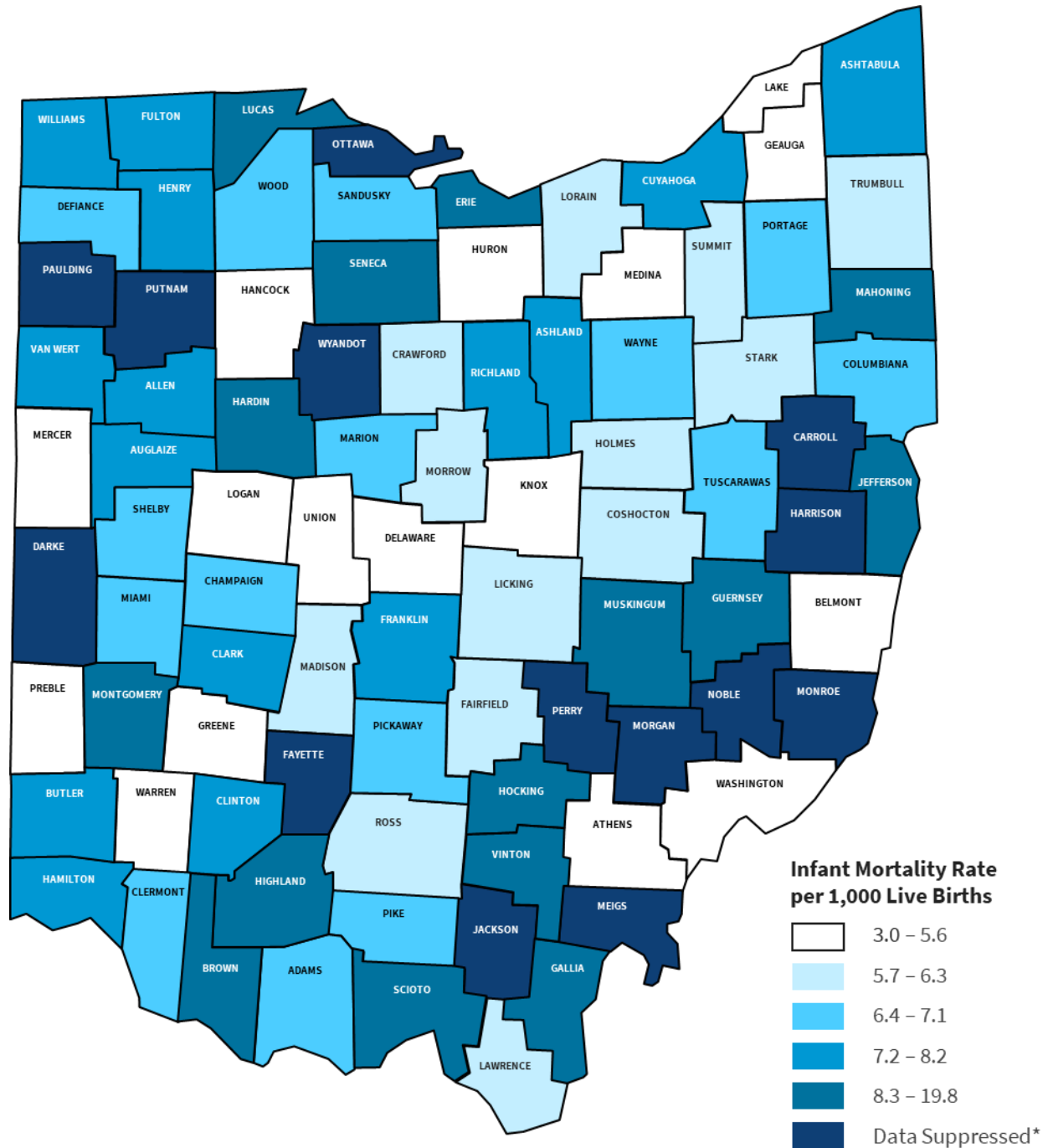
Data for counties with fewer than 10 infant deaths in the five-year period (2019-2023) are suppressed due to insufficient reliability and confidentiality requirements.

Ohio Neonatal and Postneonatal Mortality by Race and Ethnicity

Infant deaths comprise both neonatal and postneonatal deaths. Neonatal deaths occur during the first 27 days of life, and postneonatal deaths occur at 28 through 364 days of life. Neonatal deaths are the largest contributor to the overall infant mortality rate, accounting for about two-thirds of all infant deaths in Ohio. Neonatal mortality is associated with prematurity (birth before 37 weeks gestation), low birth weight, congenital anomalies, and health problems originating in the perinatal period, (the period immediately before and after birth) such as infections or birth trauma. See page 13 for cause-specific rates contributing to neonatal and postneonatal deaths in Ohio.

The overall neonatal mortality rates increased in 2023 —from 4.6 to 4.8. However, the NH Black and Hispanic neonatal mortality rates increased—from 7.6 to 8.4 and 4.6 to 4.7, respectively (Table 2, Figure 5). The NH White neonatal mortality rate remained the same (3.9).

Despite an increase in 2023, there has been a general downward trend in the NH Black neonatal mortality rate. From 2014 through 2023, the rate decreased by an average of 3.2% per year (Figure 5). There has not been a statistically significant[1] change in the neonatal mortality rate overall, or among the Hispanic and NH White populations.

Figure 5: In 2023, the **Hispanic** neonatal mortality rate (NMR) decreased,
while the **non-Hispanic Back** and **Overall** NMR increased.
The **non-Hispanic White** IMR remained the same.
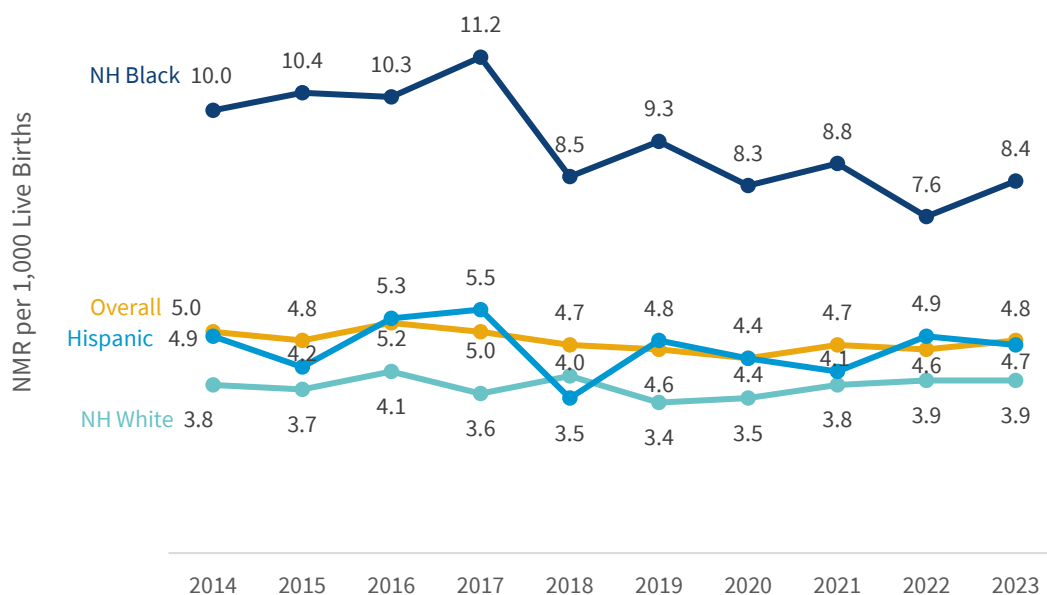
Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.

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[1] Statistical significance is a mathematical measure of the difference between groups. It's a way to determine if a result is likely due to chance or to a specific factor. A statistically significant result is unlikely to be explained by chance or random factors.

Postneonatal deaths make up one-third of all infant deaths. Common causes of death in the postneonatal period include congenital anomalies, injuries, and sudden unexpected infant death (SUID). The SUID category includes sudden infant death syndrome (SIDS), accidental suffocation and strangulation in bed (ASSB), and deaths where the cause is undetermined. In 2023, the SUID rate for NH Black infants was 3.1 deaths per 1,000 live births compared with 1.0 among NH White infants.

The overall postneonatal mortality rate decreased from 2.6 to 2.4 in 2023 (Table 2, Figure 6). The NH Black and NH White postneonatal mortality rates also decreased in 2023 — from 5.8 to 5.3 and 1.9 to 1.7, respectively (Table 2, Figure 6). However, the Hispanic postneonatal mortality rate increased from 1.2 in 2022 to 2.5 in 2023 (Table 2, Figure 6).

Despite seeing progress in 2023, the NH Black postneonatal mortality rate increased an average of 4.2% per year between 2014 and 2023. This increase in the postneonatal mortality rate largely offsets the progress we have seen in the neonatal mortality rate in the NH Black population. During the postneonatal period, NH Black infants are three times more likely to die than NH White infants. There has not been a statistically significant change in the postneonatal mortality rate overall or among the Hispanic and NH White populations.

Figure 6: In 2023, the **Hispanic** postneonatal mortality rate (PMR) increased, while the **Overall**, **non-Hispanic Black**, and **non-Hispanic White** PMR decreased.
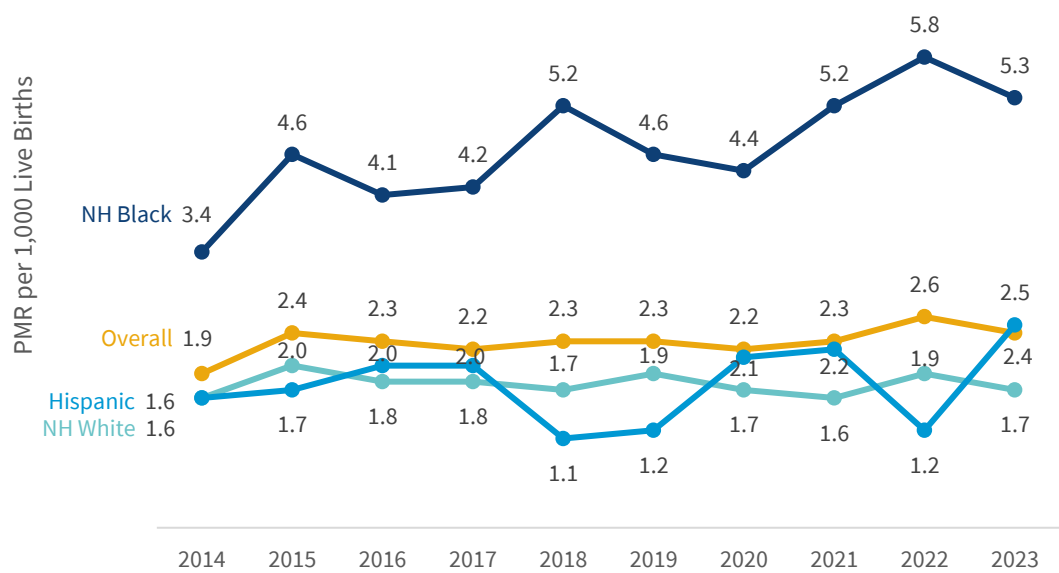
Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.

Table 2: Ohio Neonatal, Postneonatal, and Overall Infant Mortality (per 1,000 live births), by Race and Ethnicity (2019 – 2023)

Race/Ethnicity	Year	Neonatal Deaths	Neonatal Mortality Rate	Postneonatal Deaths	Postneonatal Mortality Rate	Total Infant Deaths	Infant Mortality Rate	Births
Overall	2019	614	4.6	315	2.3	929	6.9	134,564
	2020	574	4.4	290	2.2	864	6.7	129,320
	2021	616	4.7	296	2.3	912	7.0	129,925
	2022	585	4.6	329	2.6	914	7.1	128,315
	2023	605	4.8	299	2.4	904	7.1	126,969
NH White	2019	329	3.4	186	1.9	515	5.4	95,482
	2020	324	3.5	160	1.7	484	5.3	91,874
	2021	355	3.8	152	1.6	507	5.5	92,633
	2022	349	3.9	170	1.9	519	5.7	90,501
	2023	349	3.9	154	1.7	503	5.7	88,622
NH Black	2019	210	9.3	104	4.6	314	14.0	22,481
	2020	178	8.3	95	4.4	273	12.8	21,395
	2021	182	8.8	107	5.2	289	13.9	20,720
	2022	155	7.6	118	5.8	273	13.4	20,322
	2023	168	8.4	107	5.3	275	13.7	20,064
Hispanic	2019	37	4.8	9	*	46	6.0	7,729
	2020	34	4.4	16	2.1	50	6.5	7,672
	2021	34	4.1	18	2.2	52	6.3	8,229
	2022	44	4.9	11	1.2	55	6.1	9,058
	2023	46	4.7	24	2.5	70	7.2	9,745

Data Source: Resident Birth and Mortality Files from the Ohio Department of Health Bureau of Vital Statistics.
* Rates based on fewer than 10 infant deaths do not meet standards of reliability or precision and are suppressed.
** Rates based on fewer than 20 infant deaths should be interpreted with caution.
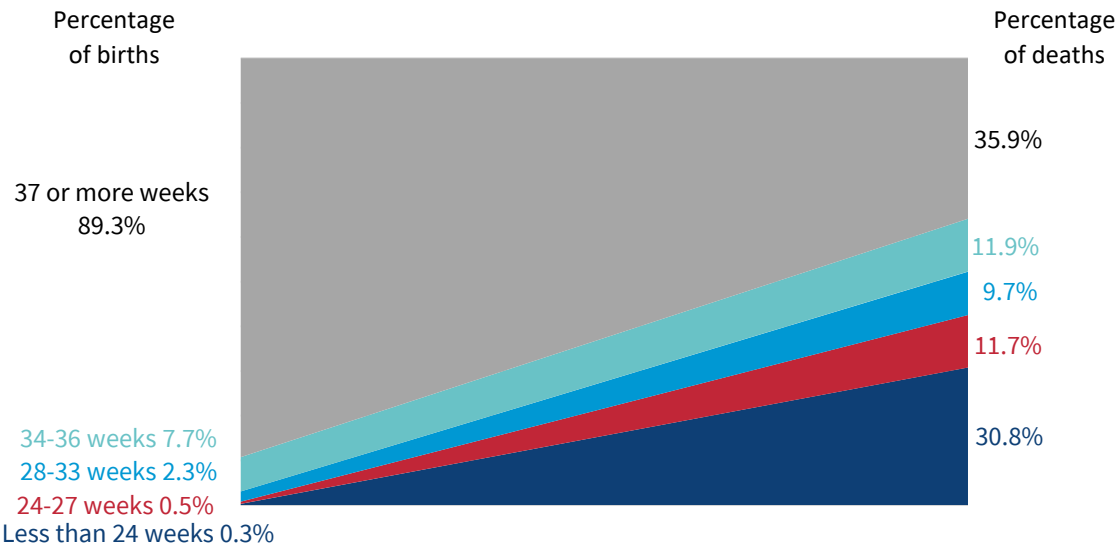
SECTION 2: A DEEPER LOOK

Note: In many instances, there are fewer than 10 Hispanic infant deaths in a particular subgroup (e.g., smoking in the third trimester) within a single year, which can cause high variability in percentages and rates and may not accurately reflect changes in characteristics associated with infant mortality. To account for this, the Ohio Department of Children and Youth combines data from 2019 to 2023 when examining Hispanic infant mortality, thus increasing the reliability of these numbers, and decreasing the impact of year-to-year variation. As these five-year Hispanic rates are not directly comparable to single year rates used to examine characteristics of infant mortality among non-Hispanic White and non-Hispanic Black infants, they are included in Appendix B of this report.

Infant Mortality by Gestational Age and Birthweight

Preterm birth is one of the most significant risk factors for infant mortality. While only 10.7% of all infants born to Ohio residents in 2023 were preterm (less than 37 weeks gestation), nearly two-thirds (64.1%) of infants who died in 2023 were born preterm (Figure 7). Among infants born preterm, those born at less than 24 weeks gestation made up only 0.3% of all infants born to Ohio residents in 2023 yet accounted for almost one-third (30.8%) of infant deaths in 2023 (Figure 7).

Figure 7. Ohio preterm infants die at a much higher rate than infants born full term.

Percentage of births

Percentage of deaths

37 or more weeks 89.3%
35.9%

11.9%
9.7%
11.7%

34-36 weeks 7.7%
28-33 weeks 2.3%
24-27 weeks 0.5%
Less than 24 weeks 0.3%
30.8%

Data source: Period Linked Infant Mortality File and Resident Birth File from the Ohio Department of Health, Bureau of Vital Statistics.

Birth at less than 24 weeks gestation was more common among NH Black infants. More than one-third (35.6%) of NH Black infants who died in 2023 were less than 24 weeks, compared to one-fourth (25.3%) of NH White infants.

Low birth weight (less than 2,500 grams, or about 5.5 pounds) is highly associated with preterm birth, but it can also be related to infection during pregnancy, maternal smoking, alcohol or drug abuse, and maternal age. In 2023, more than half (56%) of infants who died were born with low birth weights. Low birth weight was more common among NH Black infants who died (58%) when compared to NH White infants who died (55%) in 2023 (Figure 8).

Figure 8. Low birth weight* was more common among **non-Hispanic Black** infants who died.

NH Black — 58%
NH White — 55%

Data Source: Period Linked Infant Death File from the Ohio Department of Health, Bureau of Vital Statistics.
* Low birth weight: Less than 5.5 pounds (2,500 grams)

Overall, 41% of infants who died in 2023 had very low birth weights (less than 1,500 grams, or about 3.3 pounds). There is a similar disparity when compared to low birth weight among infants that died, with very low birth weight being more common among NH Black infants who died (44%) when compared to NH White infants that died (40%) (Figure 9).

Figure 9. Very low birth weight* was more common among **non-Hispanic Black** infants who died.
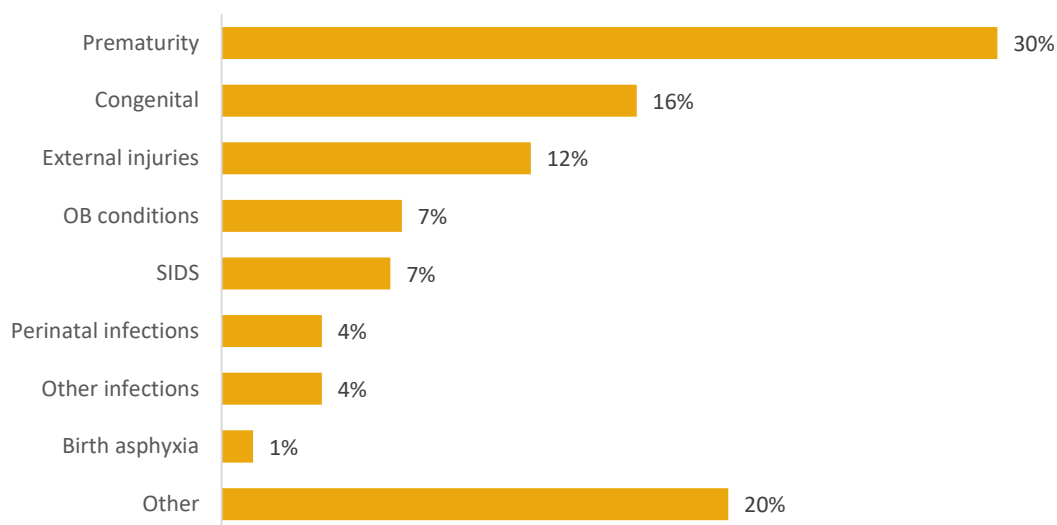

NH Black — 44%
NH White — 40%

Data Source: Period Linked Infant Death File from the Ohio Department of Health, Bureau of Vital Statistics.
* Very low birth weight: Less than 3.3 pounds (1,500 grams)

Leading Causes of Infant Death

The Ohio Department of Children and Youth uses the Modified Dollfus classification system to monitor the leading causes of infant deaths.[2] This system groups the underlying causes of death into the following categories: birth asphyxia, congenital anomalies (birth defects), external injuries (e.g., accidental suffocation and strangulation in bed), obstetric conditions, perinatal infections, other infections, prematurity-related conditions, and Sudden Infant Death Syndrome (SIDS). Causes of death that do not fall into these categories, such as neoplasms, anemias, or other conditions are classified as "other," and inferences regarding this category should be made with caution. Among all infant deaths in 2023, prematurity-related conditions were the most common cause of death (30%), followed by congenital anomalies (16%) and external injuries (12%) (Figure 10).

Figure 10. Prematurity-related conditions are the leading cause of infant death.

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.

In 2023, prematurity-related conditions were the leading cause of infant death among NH White (27%) and NH Black infants (33%). The remaining leading causes of death among NH White infants were congenital anomalies (19%), external injuries (10%), obstetric conditions (7%), and SIDS (6%). After prematurity-related conditions, the leading causes of death among NH Black infants were external injuries (15%), congenital anomalies (12%), SIDS (9%), and obstetric conditions (7%) (Figure 11).

Figure 11. Leading causes of death among **non-Hispanic White** and **non-Hispanic Black** infants in Ohio.
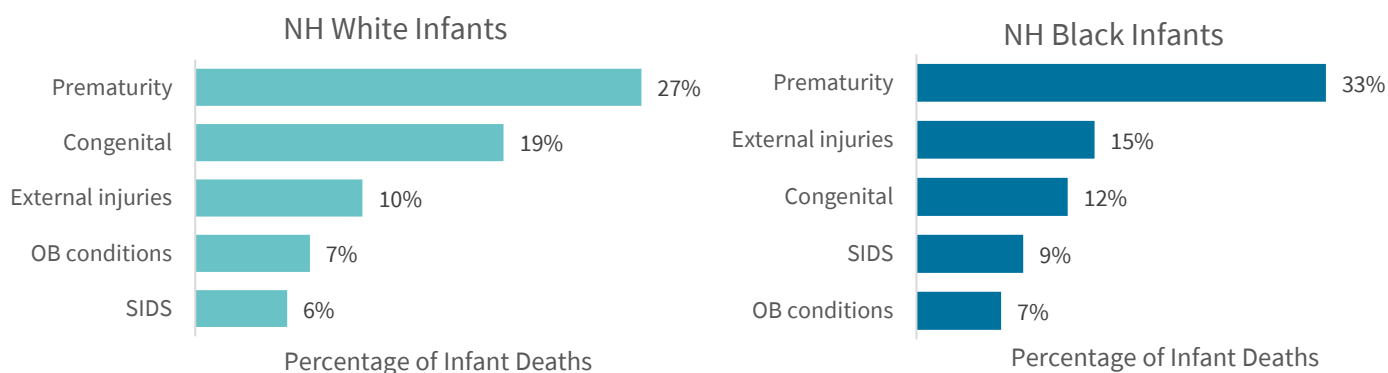
Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.

Note: Sleep-related deaths do not fall within a specific cause of death. Often, sleep-related infant deaths are approximated by sudden unexpected infant deaths (SUID), which includes SIDS (a Dollfus Classification). SUID is a term used to describe the sudden and unexpected death of a baby less than 1 year old in which the cause was not obvious before investigation. These deaths often happen during sleep or in the baby's sleep area. Case reviews conducted by county-level child fatality review boards determine whether an infant death was related to the sleep environment.

There was an increase in the infant mortality rate for prematurity-related conditions from 1.8 in 2022 to 2.1 in 2023. Prematurity-related conditions continue to be the single greatest contributor to the overall infant mortality rate (7.1 per 1,000 live births). External injuries had a slight increase from 0.8 in 2022 to 0.9 in 2023. Decreases were observed among congenital anomalies (1.2 to 1.1), SIDS (0.6 to 0.5), perinatal infections (0.4 to 0.3) and other infections (0.4 to 0.3). There were no observed changes in the infant mortality rates due to obstetric conditions (0.5) and birth asphyxia (0.1) from 2022 to 2023 (Figure 12).

Figure 12. Prematurity-related conditions are the greatest contributor to the infant mortality rate.
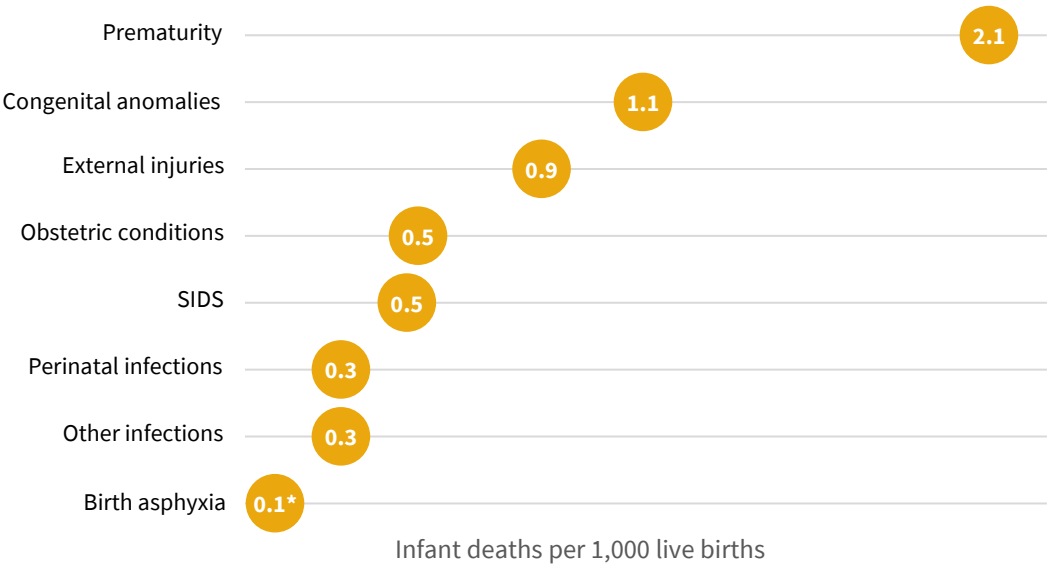
Infant deaths per 1,000 live births

Data Source: Period Linked Infant Mortality File and Resident Birth File from the Ohio Department of Health, Bureau of Vital Statistics.
*Rates based on fewer than 20 infant deaths should be interpreted with caution.

Prematurity-related conditions, the leading cause of death for both NH White and NH Black infants, saw increases in infant mortality rates for both groups from 2022 to 2023. While the increase among NH White infants was small – 1.3 in 2022 to 1.5 in 2023 – there was a greater increase observed among NH Black infants – from 3.8 in 2022 to 4.6 in 2023 (Figure 13). This increase in deaths due to prematurity-related conditions is the main driver for the increase in neonatal infant mortality among NH Black infants.

Congenital anomalies were the second leading cause of death for NH White infants and the third leading cause of death for NH Black infants. There was a slight decrease in deaths due to congenital anomalies among NH White infants – 1.2 in 2022 to 1.1 in 2023 – and an increase among NH Black infants – 1.3 in 2022 to 1.7 in 2023 (Figure 13).

External injuries were the third leading cause of death for NH White infants and the second leading cause of death for NH Black infants in 2023. NH White infants had a small increase from 0.5 in 2022 to 0.6 in 2023, while NH Black infants had a slight decrease from 2.1 in 2022 to 2.0 in 2023 (Figure 13). External injuries include infants who died from accidental suffocation and strangulation in bed (ASSB). Of the 51 NH White infant deaths due to external injury, 37 (72.5%) were due to ASSB. Of the 40 NH Black infant deaths due to external injuries, 28 (70.0%) were due to ASSB.

Obstetric conditions were the fourth leading cause of death for NH White infants and the fifth leading cause of death for NH Black infants. NH White infants saw no change in the cause-specific infant mortality rate of 0.4 in both 2022 and 2023. NH Black infants had a slight decrease from 1.0 in 2022 to 0.9 in 2023 (Figure 13).

SIDS is the fifth leading cause of death for NH White infants and the fourth leading cause of death for NH Black infants. Both saw slight decreases in the rates of SIDS; 0.4 in 2022 to 0.3 in 2023 for NH White infants, and 1.5 in 2022 to 1.2 in 2023 for NH Black infants (Figure 13). This decrease across both groups helped drive the decrease in postneonatal mortality for both groups and Ohio as a whole.

Figure 13. The rate of **prematurity-related conditions** increased for both NH White and NH Black infants. Significant disparities between NH White and NH Black infants persist.
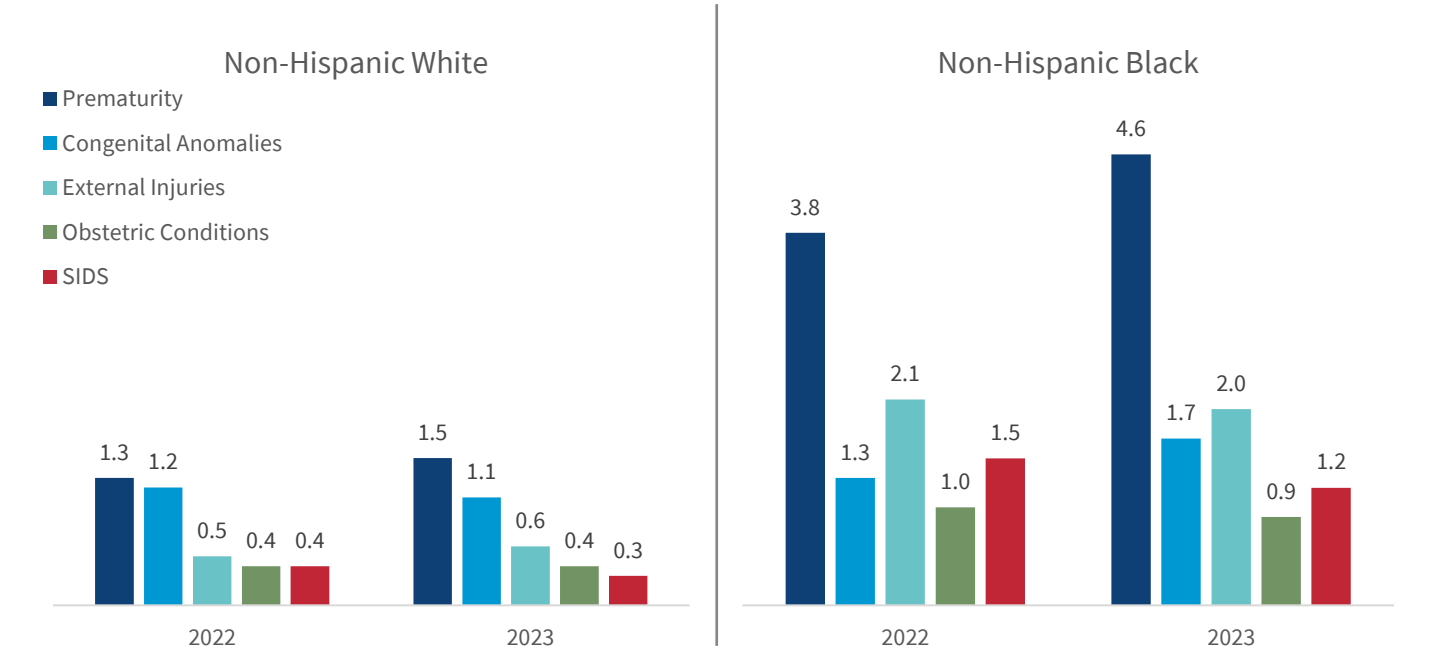
Data Source: Period Linked Infant Mortality File and Resident Birth File from the Ohio Department of Health, Bureau of Vital Statistics.

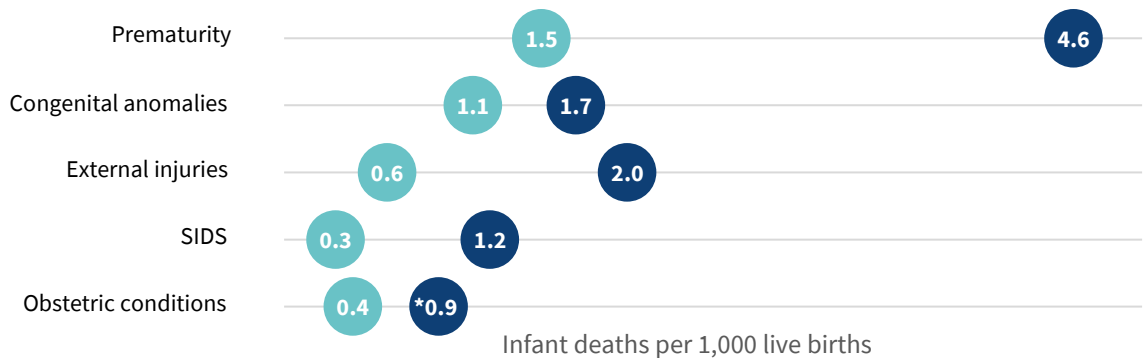NH Black infants were more likely to die from the five leading causes of death compared to NH White infants, though the disparity varies by specific cause. The greatest disparities observed were among infants who died of SIDS (B/W Ratio 3.8) and external injuries (B/W Ratio 3.5). NH Black infants were three times (B/W Ratio 3.0) as likely to die from prematurity-related conditions (Figure 14).

Figure 14. **Non-Hispanic Black** infants had higher cause-specific infant mortality rates for every cause of death category when compared to **non-Hispanic White** infants.

Cause	NH White	NH Black
Prematurity	1.5	4.6
Congenital anomalies	1.1	1.7
External injuries	0.6	2.0
SIDS	0.3	1.2
Obstetric conditions	0.4	*0.9

Infant deaths per 1,000 live births

*Data Source: Period Linked Infant Mortality File and Resident Birth File from the Ohio Department of Health, Bureau of Vital Statistics. Due to small numbers, rates for birth asphyxia are not shown here. *Rates based on fewer than 20 infant deaths should be interpreted with caution.*

Neonatal and Postneonatal Deaths – Timing and Cause of Death

The neonatal mortality rate for Ohio in 2023 was 4.8 per 1,000 live births while the postneonatal mortality rate was 2.4 per 1,000 live births. The leading causes of death vary between the two. Neonatal deaths are usually caused by conditions related to pregnancy and delivery such as conditions associated with prematurity and obstetrical conditions. These conditions can be reflective of mother's health status and experiences before and during pregnancy. Postneonatal deaths are more often associated with external factors such as SIDS and external injuries.

Among infants that died in 2023, one in eight (13%) died during the first hour of life. More than a third (37%) of all infants that died in 2023 (338 infants), died during the first day of life. More than half (53%) of all Ohio infants that died in 2023 (481 infants) died during the first week of life. In total, there were 605 infants that died during the first 27 days of life, accounting for two-thirds (67%) of infant deaths in 2023. There were 299 infants (33%) that died after the first month of life, but before their first birthday (Figure 15).

Figure 15. Two-thirds (67%) of infant deaths occurred during the first 27 days of life, with more than a third (37%) occurring during the first day of life.

Neonatal Deaths: 0 – 27 days

67%
of infant deaths were neonatal. 605 of 904 deaths.

53%
of infant deaths occurred during the first week of life.
481 of 904 deaths.

37%
of infant deaths occurred during the first day of life.
338 of 904 deaths.

13%
of infant deaths occurred during the first hour of life.
120 of 904 deaths.

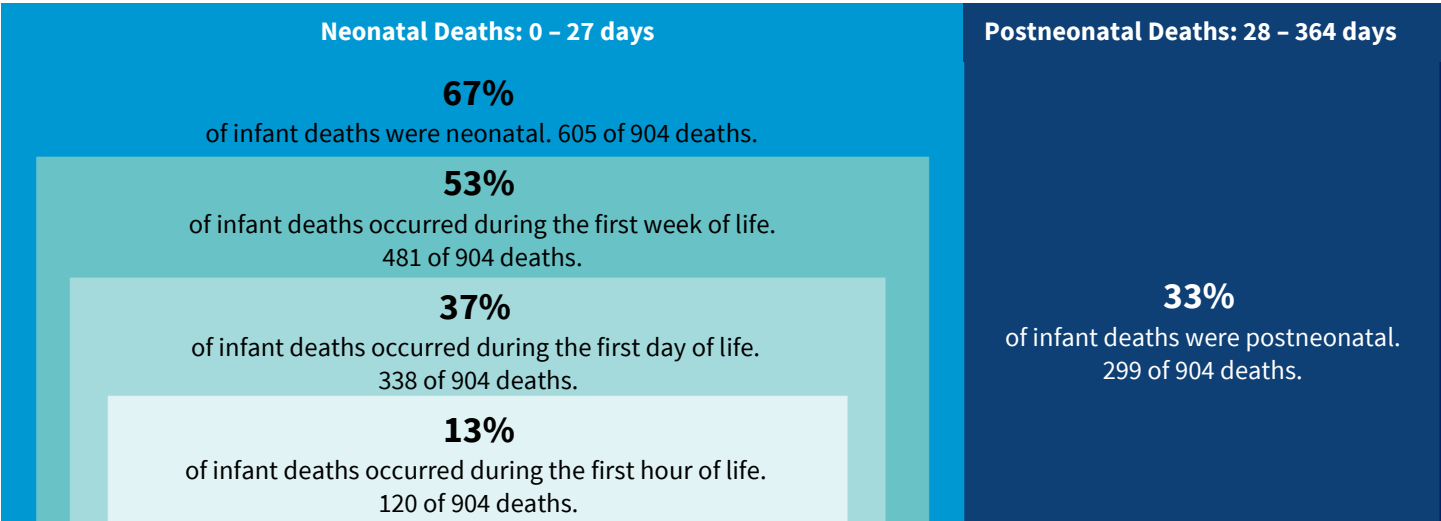**Postneonatal Deaths: 28 – 364 days**

33%
of infant deaths were postneonatal.
299 of 904 deaths.

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.

The three overall leading causes of death for neonates were prematurity-related conditions (43%), congenital anomalies (19%), and obstetric conditions (10%). The leading causes of death among postneonatal deaths were external injuries (30%), SIDS (18%), and congenital anomalies (11%) (Figure 16).

When comparing neonatal causes of deaths to postneonatal causes of death, there are considerable differences. Prematurity-related conditions and obstetric conditions together accounted for more than half of neonatal deaths, but together account for less than 5% of postneonatal deaths. The percentage of deaths caused by congenital anomalies for neonatal deaths is nearly double that of postneonatal deaths (19% and 11% respectively). External injuries, SIDS, and other infections accounted for less than 5% of neonatal deaths, but together account for more than half of postneonatal deaths.

Figure 16. The leading causes of death differed between neonatal and postneonatal infant deaths.

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.
*Percentages based on fewer than 20 deaths should be interpreted with caution.
**Due to low numbers of neonatal deaths due to SIDS and Other Infections, these percentages are suppressed.
***Due to low numbers of postneonatal deaths due to Obstetric Conditions and Perinatal Infections, these percentages are suppressed.

Pre-Pregnancy Maternal Characteristics Associated with Infant Death

Certain maternal health behaviors, characteristics, and health conditions are associated with increased risk of infant death. It is important that these issues be addressed in the pre-conception or inter-conception period. Culturally appropriate care and counseling are vital for modifying health behaviors and controlling health conditions. It is also important to identify the underlying societal factors that contribute to these behaviors and conditions.[3] See Appendix C for additional data on maternal characteristics.

Pre-Pregnancy Maternal Health Conditions

Among infants who died in 2023, 40% had mothers who were obese prior to pregnancy, 6% had mothers with pre-pregnancy hypertension, and 2% had mothers with pre-pregnancy diabetes (Figure 17).

Figure 17. Pre-pregnancy maternal health conditions among infants who died.
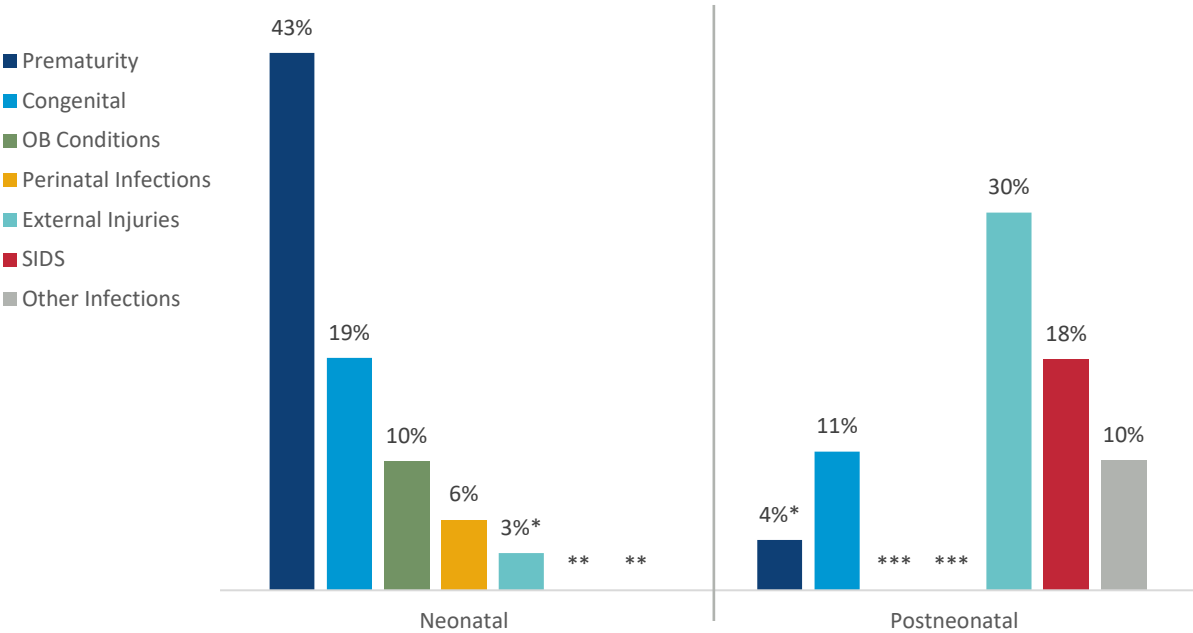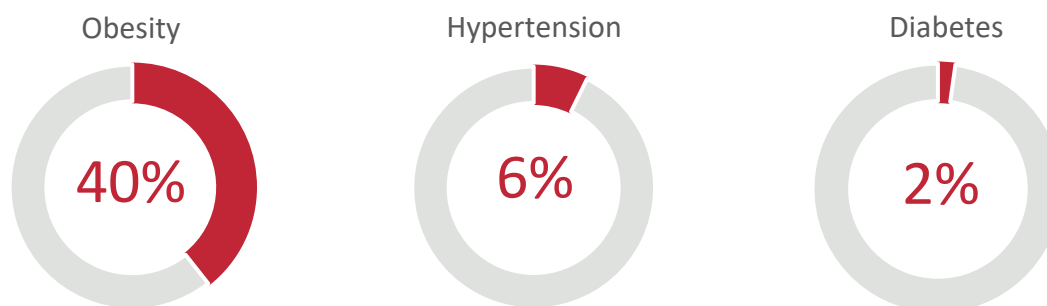
Obesity   Hypertension   Diabetes

40%   6%   2%

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.

Access to Care

More than half of infants who died (55%) were born to mothers who reported Medicaid as their source of insurance during the birth hospitalization (Figure 18). This is higher than the overall percentage of Ohio births in 2023 that reported Medicaid as their source of insurance[†] (39%).

Nearly one-third (31%) of infants who died had mothers who reported Medicaid insurance but also reported not participating in the Supplemental Nutrition Program for Women, Infants, and Children (WIC) during pregnancy (Figure 18). The program aims to reduce infant mortality by reducing the incidence of babies born at low birth weights and provides support services necessary for full-term pregnancies. This suggests that the mothers of these infants may have been eligible for WIC, but did not, or could not easily, access the program.

Lack of prenatal care in the first trimester was common. Overall, two-in-five infants who died (42%) were born to mothers who did not receive prenatal care during the first trimester (Figure 18). From 2022 to 2023 there was no change in the percentage of infants that died born to NH White women that received no prenatal care during the first trimester (40% in both 2022 and 2023), and there was an increase among infants that died born to NH Black women that received no prenatal care (38% in 2022 and 42% in 2023).

Figure 18. Access to care at time of birth among infants who died.

Presumed Medicaid   WIC participation   Medicaid, no WIC   No 1st Trimester Prenatal Care

55%   28%   31%   42%

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.

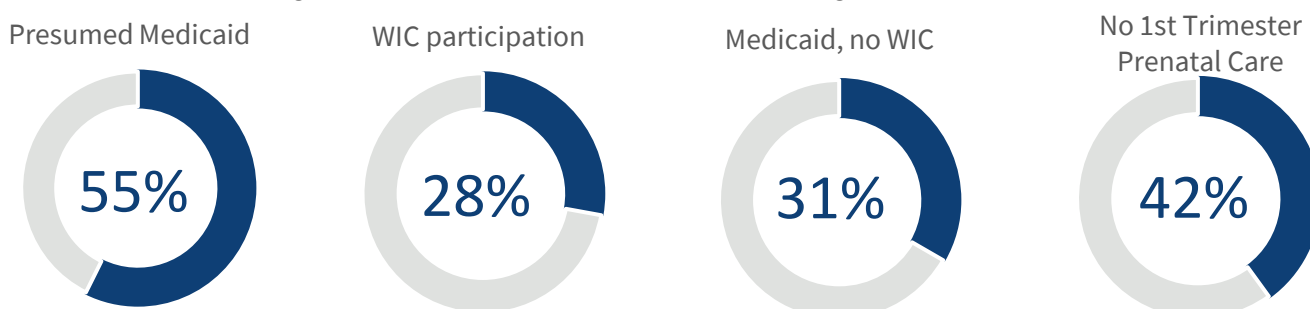[†] Medicaid insurance status as reported on the birth certificate

Maternal Weight

Forty percent (40%) of infants who died had mothers who were obese (body mass index (BMI) greater than 30kg/m2) prior to pregnancy (n=347). Among infants who died, pre-pregnancy obesity was more common in infants born to NH Black mothers (42%) compared with those born to NH White mothers (40%). For reference, 42% of women ages 19-44 in Ohio are considered obese, according to the 2023 Ohio Medicaid Assessment Survey.

Infant mortality rates were highest among infants born to mothers who were underweight (BMI less than 18.5) prior to pregnancy (9.1 infant deaths per 1,000 live births) but represented only 3.9% of infant deaths in 2023 (n=43). The second highest infant mortality rate was among infants born to mothers who were obese prior to pregnancy at 8.2, followed by infants born to overweight mothers at 6.1 (Figure 19). Within every BMI category, NH Black mothers experienced higher infant mortality rates than NH White mothers (Figure 20).

Figure 19: Mothers with normal BMI* had the lowest rate of infant mortality.

Underweight (BMI: Less than 18.5)	9.1
Normal (BMI 18.5-24.9)	6.0
Overweight (BMI: 25-29)	6.1
Obese (BMI Greater than 30)	8.2

Data Source: Period Linked Infant Mortality File and Resident Birth file from the Ohio Department of Health, Bureau of Vital Statistics.
*Normal BMI = Body mass index between 18.5 and 24.9.

Figure 20. Within every BMI category*, **non-Hispanic Black** mothers experienced higher infant mortality rates than **non-Hispanic White** mothers.

	non-Hispanic White	non-Hispanic Black
Underweight (BMI: Less than 18.5)	8.1	15.5^
Normal (BMI 18.5-24.9)	4.5	14.6
Overweight (BMI: 25-29)	5.1	10.5
Obese (BMI Greater than 30)	6.7	13.8

*BMI = Body mass index.
Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.
^Rates based on fewer than 20 infant deaths should be interpreted with caution.

Maternal Smoking

Twelve percent (12%) of infants who died in 2023 were born to mothers who reported smoking during the three months prior to pregnancy. Ten percent (10%) of infants who died were born to mothers who reported smoking during the first trimester of pregnancy, and 8% were born to mothers who smoked during the last three months of pregnancy (Figure 21).

Figure 21. Smoking was common before and during pregnancy among mothers whose infants died.

Smoking in 3 months prior to pregnancy
12%

Smoking during first trimester
10%

Smoking during last 3 months of pregnancy
8%

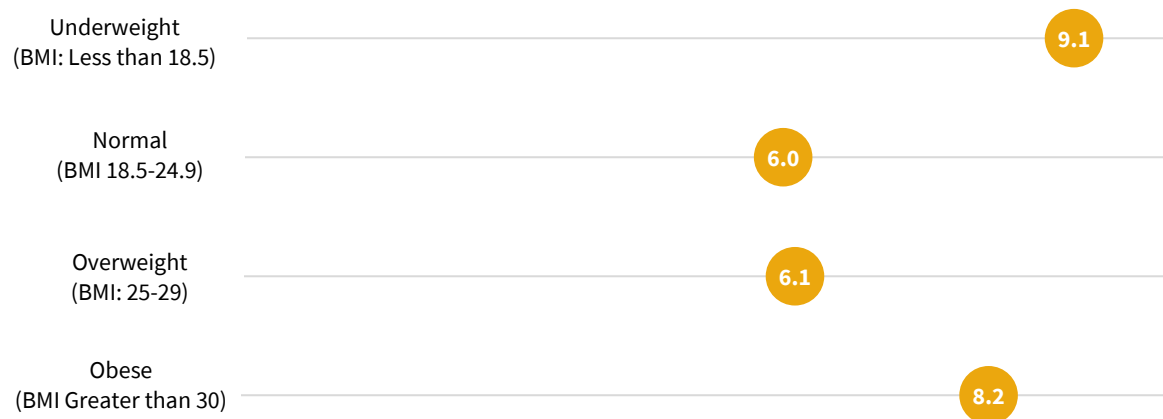*Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.*

Smoking, both before and during the first trimester, was more common among NH White mothers compared with NH Black mothers. Sixteen percent (16%) of infants who were born to NH White mothers and died had a mother who smoked before pregnancy, compared with 8% of those who were born to NH Black mothers. Similarly, 13% of NH White infants who died had mothers who smoked during the first trimester, compared with 7% of those born to Black mothers. Smoking during the last three months of pregnancy was less common among both NH White mothers and NH Black mothers – 10% and 6%, respectively (Figure 22).

Figure 22. **Non-Hispanic White** mothers were more likely to smoke cigarettes before and during pregnancy when compared to **non-Hispanic Black** mothers.
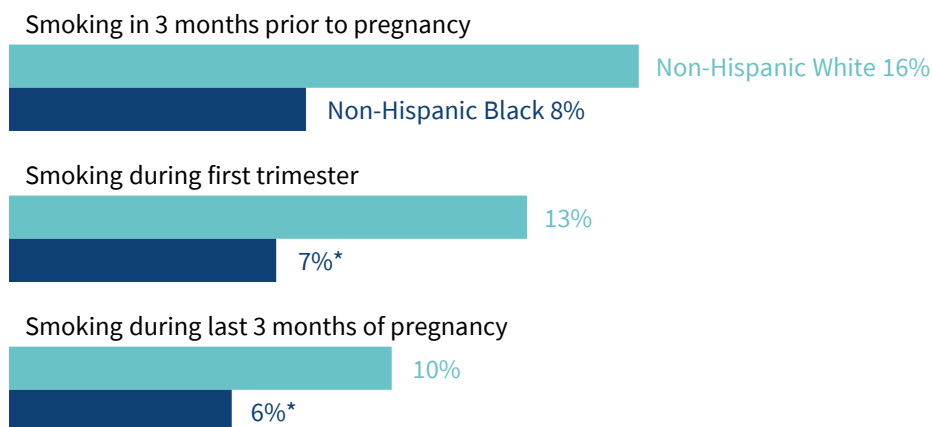
Smoking in 3 months prior to pregnancy
Non-Hispanic White 16%
Non-Hispanic Black 8%

Smoking during first trimester
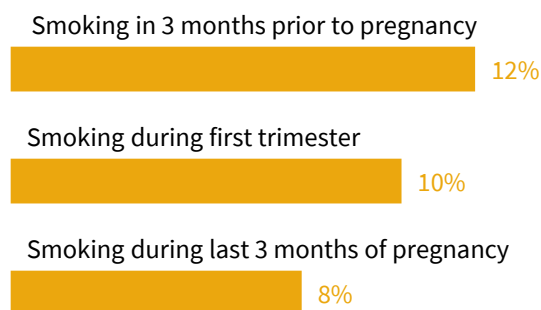13%
7%*

Smoking during last 3 months of pregnancy
10%
6%*

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.
*Percentages based on fewer than 20 infant deaths should be interpreted with caution.

Maternal Age

Infant mortality rates varied by maternal age groups. As in previous years, infants born to mothers younger than 20 years old experienced the highest infant mortality rate – 11.7 deaths per 1,000 births in 2023, and 12.8 in 2022. The second highest infant mortality rate was among infants born to mothers aged 40 and older (9.9) and the lowest was among infants born to mothers between the ages of 30 and 34 (6.0) (Figure 23).

Figure 23. Infants born to mothers younger than 20 years old experienced the highest infant mortality rate.

Infant deaths per 1,000 live births
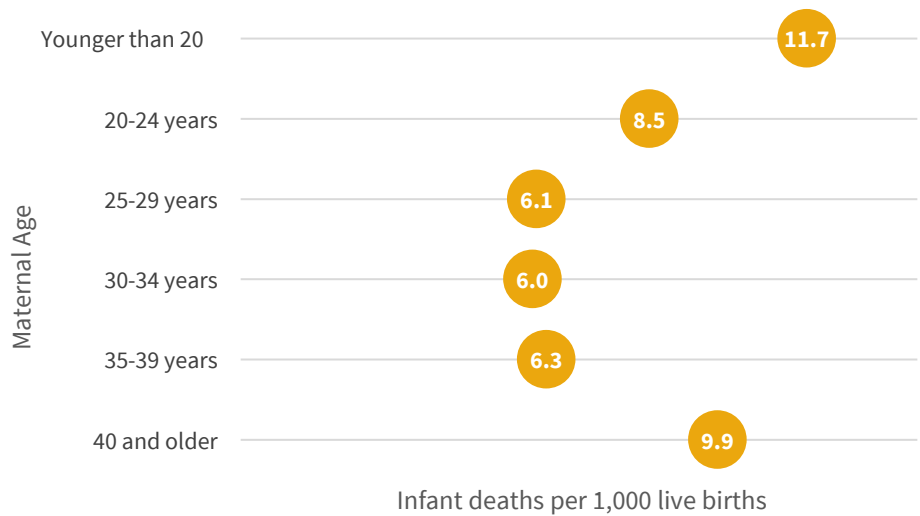
Data Source: Period Linked Infant Mortality File and Birth Comprehensive Protected File from the Ohio Department of Health, Bureau of Vital Statistics.

Across all age groups, infants born to NH Black mothers experienced higher infant mortality rates compared to infants born to NH White mothers. Infants born to NH Black mothers younger than 20 years old had the highest infant mortality rate at 16.3 infant deaths per 1,000 live births, compared to 11.7 among NH White mothers. The age group with the greatest disparity between NH Black and NH White infant mortality was among mothers aged 25 to 29 years old. The infant mortality rate for infants born to NH Black mothers aged 25 to 29 was 13.6 – nearly three times greater than the rate for infants born to NH White mothers aged 25 to 29 (4.7) (Figure 24).

Figure 24. Infants born to **non-Hispanic Black** mothers experienced higher infant mortality rates in every age group when compared to infants born to **non-Hispanic White** mothers.
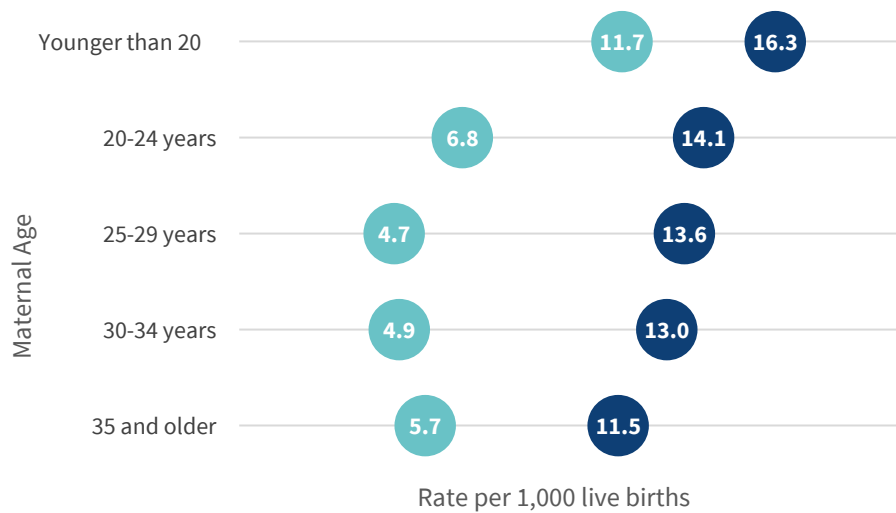
Rate per 1,000 live births

Data Source: Period Linked Infant Mortality File and Birth Comprehensive Protected File from the Ohio Department of Health, Bureau of Vital Statistics.

SECTION 4: METHODS AND REFERENCES

Methodology Update Regarding Race/Ethnicity Classification

Starting with the 2022 infant mortality report, the Department of Children and Youth's (DCY) made two key changes in the methodology used in its annual reports. Both changes, discussed in greater detail below, bring Ohio's infant mortality data into greater conformity with other states and national data collection methods and will allow for more meaningful comparisons to other jurisdictions. First, race classifications are based on single race as opposed to bridged race estimates used in the past. DCY is no longer able to access the bridged race variable in the Vital Statistics (VS) birth and death records because the National Center for Health Statistics (NCHS) discontinued the algorithm used to generate the bridged-race variable[‡] Second, DCY has updated the infant mortality rate calculation to more closely align with the national methodology used by the Centers for Disease Control and Prevention (CDC). The 10-year trends presented in this report reflect the new methodology to allow for comparisons across years. However, rates for previous years presented in this report will differ from infant mortality reports prior to 2022.

Beginning in 2022, the NCHS ceased providing bridged-race variables for vital statistic records (i.e., birth and death certificates). Bridged race was provided to allow for race data collected from 2003 Revised Standard Certificates of Birth and Death to be comparable to race data collected previously. Among other differences, selection of multiple races was not allowed on birth and death certificates prior to the 2003 revision. As a result of no longer having access to the bridged race variables, DCY modified the 2022 Infant Mortality Report race/ethnicity methodology to align with other states and national infant mortality reporting methodology, which leverages mothers' self-reported race and ethnicity on the birth certificate. Updating the methods will allow greater comparability between rates and data included in the report. The race and Hispanic-origin groups included are single-race American Indian and Alaska Native non-Hispanic, single-race Asian non-Hispanic, single race Black non-Hispanic, single-race Native Hawaiian or Other Pacific Islander non-Hispanic, single-race White non-Hispanic, multiracial non-Hispanic, and Hispanic.

In alignment with the CDC, DCY also modified the method for calculating the infant mortality rate (IMR). The number of infant deaths (numerator) was previously calculated using the infant's race reported on the death certificate. Beginning in 2022, the number of infant deaths was determined using the mothers' single race as reported on the birth certificate, which is linked to the infants' death certificate. If mother's race/ethnicity was not available, due to an unlinked birth certificate or missing information, then the infant's race/ethnicity was utilized. The number of births (denominator) remains based on the mother's single race as reported on the birth certificate.

OLD METHOD

$$IMR = \frac{(\text{Infant's bridged-race on death certificate})}{(\text{Mother's bridged-race on birth certificate})} \times 1{,}000$$

NEW METHOD

$$IMR = \frac{\begin{array}{c}(\text{Mother's single-race on birth certificate}\\ \text{linked to the infant's death certificate})\end{array}}{(\text{Mother's single-race on birth certificate})} \times 1{,}000$$

For more information on prior years' methodology, see the [2021 Ohio Infant Mortality Report](#) (Page 39).

[‡] Race bridging refers to making data collected using one set of race categories consistent with data collected using a different set of race categories, to permit estimation and comparison of race-specific statistics at a point in time or over time. More specifically, race bridging is a method used to make multiple-race and single-race data collection systems sufficiently comparable to permit estimation and analysis of race-specific statistics. Source: https://www.cdc.gov/nchs/nvss/bridged_race.htm

A detailed explanation of the NCHS bridged-race variables can be found [here](#).

Calculation of Rates and Trends

This report contains data from the Birth and Infant Mortality Linked Period datasets that are part of Ohio's Vital Statistics System. The datasets were downloaded from the Secure InnovateOhio Platform (IOP) DataOhio Portal (DOP), a self-service online tool that allows authorized users to obtain the most recent public health data available about Ohio. The numerator for rates (deaths) is calculated from the Infant Mortality Linked Period dataset while the denominator (live births) is calculated from the Birth dataset. Race and ethnicity specific rates are determined using mothers' race and ethnicity. Rates and percentages for subcategories with fewer than 10 infant deaths are suppressed due to insufficient reliability and confidentiality requirements. Causes of infant death were categorized using modified Dollfus criteria, which organizes infant deaths by cause and amenability to prevention efforts.[2]

Trend analyses were conducted using Joinpoint software, which tests significant trends over time and identifies time points where changes in trends occur. References to rates increasing, decreasing, or being different from one another indicate that differences or changes are statistically significant at the p<0.05 level. When there appear to be observed differences between categories or differences over a period, but these differences are not statistically significant, they are noted in the text.

References

1. Health Policy Institute of Ohio. *Ohio 2020-2022 State Health Improvement Plan*.; 2020. https://odh.ohio.gov/static/SHIP/2020-2022/2020-2022-SHIP.pdf

2. Nakamura AM, Melanie Dove MS, Archana Minnal M, Mark Damesyn M, Michael Curtis DP. Infant Mortality: Development of a Proposed Update to the Dollfus Classification of Infant Deaths. Public Health Reports 2015; 130;632-642.

3. Office of the Surgeon General (OSG). (2020). *The Surgeon General's Call to Action to Improve Maternal Health.* US Department of Health and Human Services.

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APPENDIX A: OHIO FIVE-YEAR NEONATAL, POSTNEONATAL, AND INFANT MORTALITY, BY COUNTY (2019 – 2023)

| County | Neonatal Mortality | | Postneonatal Mortality | | Infant Mortality | | | |
	Neonatal Deaths	NMR	Postneonatal Deaths	PMR	Infant Deaths	IMR	Births	Black/White Ratio
Adams County	6	*	5	*	11	**6.8	1,613	*
Allen County	29	4.8	15	**2.5	44	7.3	6,042	2.8
Ashland County	13	**4.6	9	*	22	7.7	2,857	*
Ashtabula County	22	4.2	19	**3.7	41	7.9	5,178	*
Athens County	8	*	5	*	13	**5.6	2,327	*
Auglaize County	11	**4.2	8	*	19	**7.3	2,592	*
Belmont County	10	**3.3	7	*	17	**5.6	3,012	*
Brown County	11	**4.6	10	**4.2	21	8.8	2,374	*
Butler County^	103	4.8	54	2.5	157	7.3	21,645	1.5
Carroll County	3	*	6	*	9	*	1,265	*
Champaign County	9	*	5	*	14	**6.8	2,063	*
Clark County	47	6.0	17	**2.2	64	8.2	7,788	2.0
Clermont County	44	3.9	29	2.6	73	6.5	11,150	*
Clinton County	8	*	9	*	17	**7.3	2,336	*
Columbiana County	22	4.5	9	*	31	6.4	4,868	*
Coshocton County	5	*	8	*	13	**5.9	2,189	*
Crawford County	6	*	8	*	14	**6.3	2,213	*
Cuyahoga County^	342	5.2	179	2.7	521	7.9	65,813	2.9
Darke County	7	*	2	*	9	*	2,973	*
Defiance County	11	**5.4	2	*	13	**6.4	2,039	*
Delaware County	27	2.5	11	**1.0	38	3.6	10,689	*
Erie County	24	7.1	5	*	29	8.6	3,359	8.0
Fairfield County	37	4.3	12	**1.4	49	5.7	8,604	1.9
Fayette County	7	*	2	*	9	*	1,611	*
Franklin County^	451	5.1	199	2.3	650	7.4	87,694	2.6
Fulton County	15	**6.7	2	*	17	**7.6	2,223	*
Gallia County	9	*	6	*	15	**8.5	1,764	*
Geauga County	15	**3.3	6	*	21	4.6	4,573	*
Greene County	31	3.7	15	**1.8	46	5.5	8,400	*
Guernsey County	14	**6.5	4	*	18	**8.3	2,164	*
Hamilton County^	255	5.0	136	2.6	391	7.6	51,426	2.8
Hancock County	16	**3.8	3	*	19	**4.5	4,186	*
Hardin County	11	**5.9	5	*	16	**8.6	1,860	*
Harrison County	2	*	0	*	2	*	766	*
Henry County	9	*	2	*	11	**7.3	1,501	*

County	Neonatal Mortality		Postneonatal Mortality		Infant Mortality			
	Neonatal Deaths	NMR	Postneonatal Deaths	PMR	Infant Deaths	IMR	Births	Black/White Ratio
Highland County	15	**5.7	10	**3.8	25	9.5	2,634	*
Hocking County	7	*	8	*	15	**10.6	1,417	*
Holmes County	18	**4.5	7	*	25	6.2	4,011	*
Huron County	15	**4.6	3	*	18	**5.6	3,237	*
Jackson County	3	*	3	*	6	*	1,902	*
Jefferson County	18	**5.6	11	**3.4	29	9.1	3,190	*
Knox County	13	**3.6	5	*	18	**4.9	3,639	*
Lake County	27	2.6	15	**1.4	42	4.0	10,446	4.2
Lawrence County	12	**3.9	7	*	19	**6.2	3,066	*
Licking County	41	4.3	16	**1.7	57	6.0	9,547	*
Logan County	5	*	5	*	10	**3.9	2,564	*
Lorain County^	64	4.0	33	2.1	97	6.1	15,923	3.3
Lucas County^	150	6.0	103	4.2	253	10.2	24,804	2.8
Madison County	8	*	5	*	13	**5.8	2,223	*
Mahoning County^	65	5.5	33	2.8	98	8.3	11,755	3.7
Marion County	15	**5.2	8	*	23	6.4	3,567	*
Medina County	17	**2.1	8	*	25	3.0	8,265	*
Meigs County	4	*	5	*	9	*	1,036	*
Mercer County	11	**3.5	4	*	15	**4.8	3,126	*
Miami County	30	5.2	9	*	39	6.8	5,765	*
Monroe County	3	*	0	*	3	*	663	*
Montgomery County^	167	5.4	99	3.2	266	8.6	30,873	2.0
Morgan County	3	*	1	*	4	*	714	*
Morrow County	10	**5.3	1	*	11	**5.8	1,886	*
Muskingum County	28	5.7	16	**3.2	44	8.9	4,924	*
Noble County	3	*	0	*	3	*	707	*
Ottawa County	6	*	2	*	8	*	1,483	*
Paulding County	5	*	1	*	6	*	1,054	*
Perry County	5	*	4	*	9	*	2,001	*
Pickaway County	14	**4.5	7	*	21	6.8	3,102	*
Pike County	7	*	5	*	12	**7.0	1,711	*
Portage County	37	5.5	6	*	43	6.4	6,684	*
Preble County	8	*	3	*	11	**5.5	1,992	*
Putnam County	6	*	3	*	9	*	2,052	*
Richland County	40	5.9	9	*	49	7.2	6,794	*
Ross County	18	**4.8	5	*	23	6.1	3,779	*
Sandusky County	10	**3.4	11	**3.7	21	7.1	2,954	*

County	Neonatal Mortality		Postneonatal Mortality		Infant Mortality			
	Neonatal Deaths	NMR	Postneonatal Deaths	PMR	Infant Deaths^^	IMR	Births***	Black/White Ratio
Scioto County	20	5.3	18	**4.8	38	10.0	3,783	*
Seneca County	15	**5.1	10	**3.4	25	8.5	2,924	*
Shelby County	14	**4.5	7	*	21	6.8	3,092	*
Stark County^	76	3.8	48	2.4	124	6.3	19,759	2.9
Summit County^	108	3.9	60	2.2	168	6.1	27,582	3.1
Trumbull County	41	4.1	19	**1.9	60	6.0	10,019	*
Tuscarawas County	25	4.4	11	**2.0	36	6.4	5,640	*
Union County	13	**3.5	4	*	17	**4.6	3,664	*
Van Wert County	7	*	6	*	13	**7.7	1,684	*
Vinton County	10	**14.1	4	*	14	**19.8	707	*
Warren County	37	3.0	16	**1.3	53	4.3	12,307	*
Washington County	9	*	4	*	13	**4.5	2,860	*
Wayne County	30	4.2	16	**2.3	46	6.5	7,061	*
Williams County	10	**5.0	6	*	16	**8.0	1,998	*
Wood County	28	4.5	13	**2.1	41	6.6	6,242	*
Wyandot County	2	*	1	*	3	*	1,079	*
Total	2,995	4.6	1,527	2.4	4,522	7.0	649,093	2.5

Data Source: Ohio Department of Health, Bureau of Vital Statistics.

* Rates based on fewer than 10 deaths do not meet standards of reliability or precision and are suppressed.

** Rates based on fewer than 20 infant deaths should be interpreted with caution.

^ Ohio Equity Initiative County.

Note: The total for Ohio includes 1 neonatal death and 1 postneonatal (2 deaths in total) with unknown county of residence and 45 births with unknown county of residence.

APPENDIX B: FIVE-YEAR HISPANIC INFANT MORTALITY RATES (2019-2023)

Birth Weight

Figure A. Nearly half of Hispanic infants who died from 2019-2023 were born with very low birth weight.

Low Birth Weight — 60.1%

Very low birth weight — 44.7%

Percent

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.

Cause of Death

Figure B. Prematurity-related conditions and congenital anomalies account for more than half of all Hispanic infant deaths. (2019-2023)
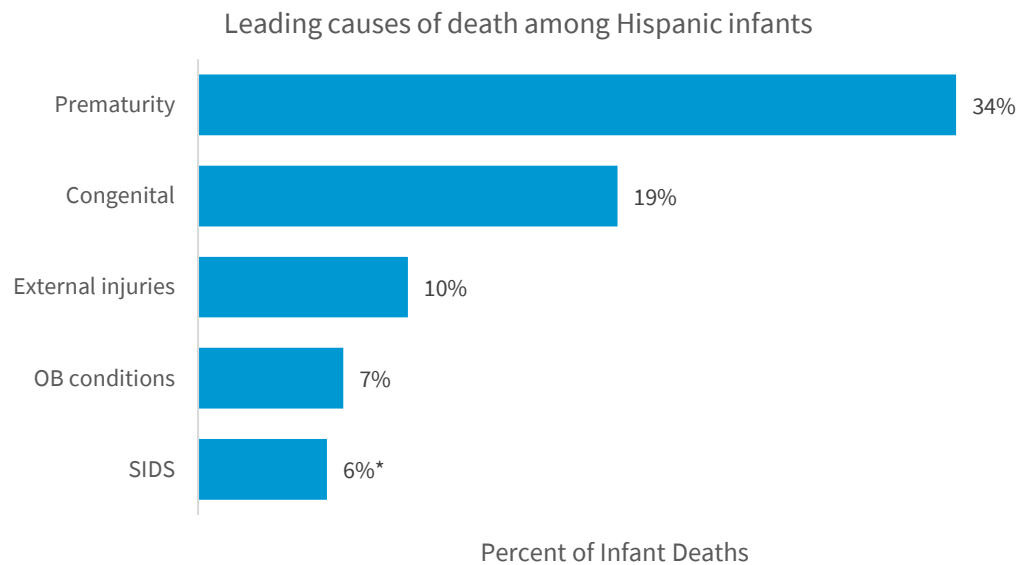
Leading causes of death among Hispanic infants

Prematurity — 34%

Congenital — 19%

External injuries — 10%

OB conditions — 7%

SIDS — 6%*

Percent of Infant Deaths

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.
* Percentages based on fewer than 20 deaths should be interpreted with caution.

Figure C. Prematurity-related conditions and congenital anomalies had the highest Hispanic infant mortality rates. (2019-2023)
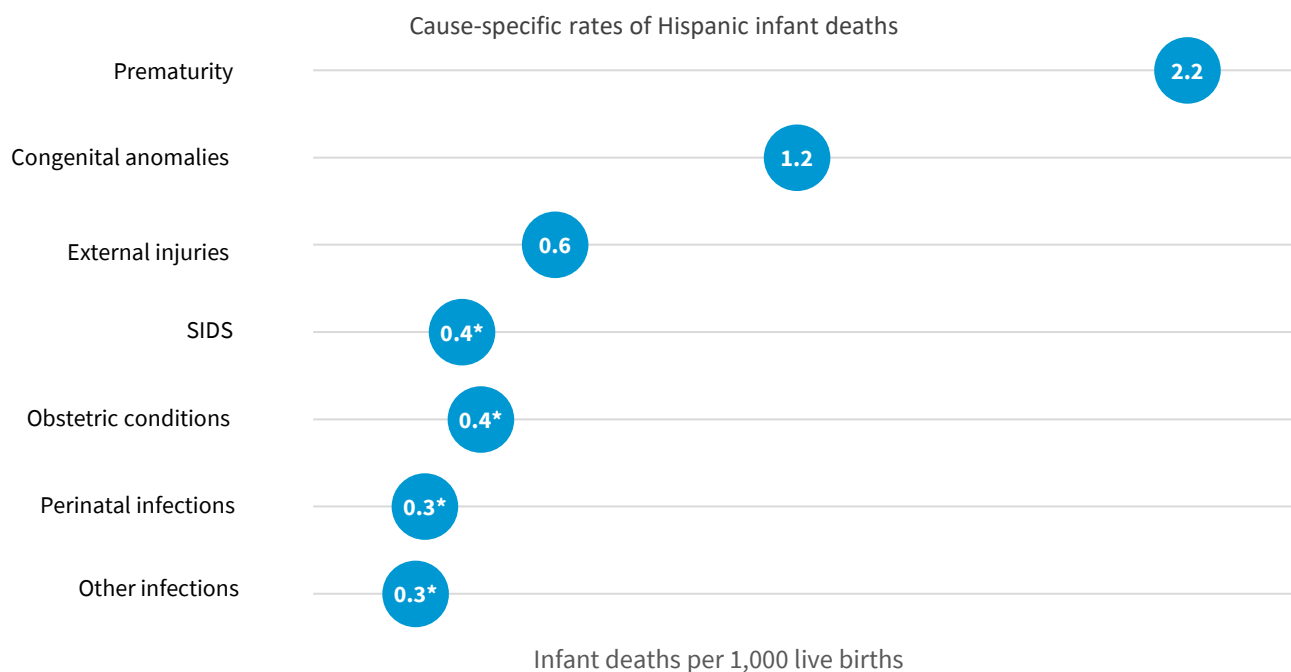
Cause-specific rates of Hispanic infant deaths

Cause	Rate
Prematurity	2.2
Congenital anomalies	1.2
External injuries	0.6
SIDS	0.4*
Obstetric conditions	0.4*
Perinatal infections	0.3*
Other infections	0.3*

Infant deaths per 1,000 live births

Data Source: Period Linked Infant Mortality File and Birth Comprehensive Protected File from the Ohio Department of Health, Bureau of Vital Statistics.
* Rates based on fewer than 20 deaths should be interpreted with caution.

Maternal Weight

Figure D. Hispanic mothers experienced similar rates of infant mortality regardless of BMI. (2019-2023)

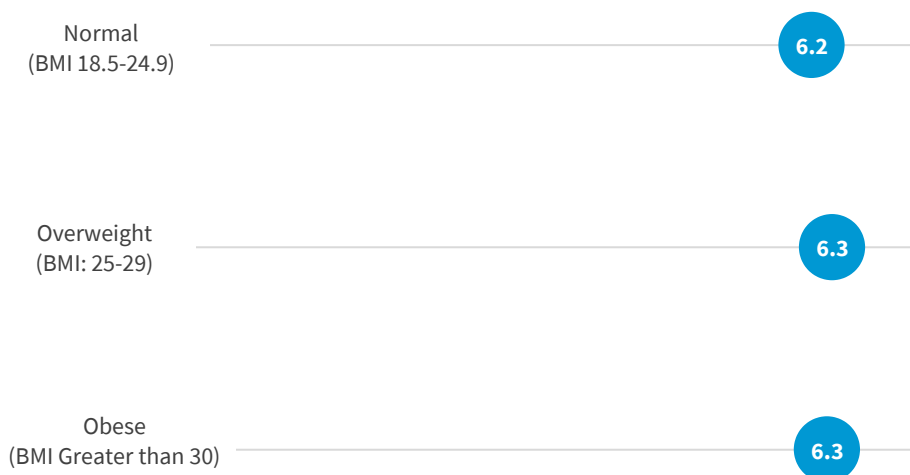| BMI category	Rate
Normal (BMI 18.5-24.9)	6.2
Overweight (BMI: 25-29)	6.3
Obese (BMI Greater than 30)	6.3

Data Source: Period Linked Infant Mortality File and Birth Comprehensive Protected File from the Ohio Department of Health, Bureau of Vital Statistics.
Note: Due to small numbers (<10) of Hispanic infant deaths to underweight mothers, these rates are suppressed and excluded from the figure.

Maternal Smoking

Figure E. Smoking was uncommon among Hispanic mothers whose infants died. (2019-2023)

Smoking in 3 months prior to pregnancy

7%

Smoking during first trimester

6%*

Smoking during last 3 months of pregnancy

4%*

Percent

Data Source: Period Linked Infant Mortality File from the Ohio Department of Health, Bureau of Vital Statistics.
* Percentages based on fewer than 20 deaths should be interpreted with caution.

Maternal Age

Figure F. Hispanic mothers aged 35 and older and mothers younger than 20 experienced the highest rates of infant mortality. (2019-2023)

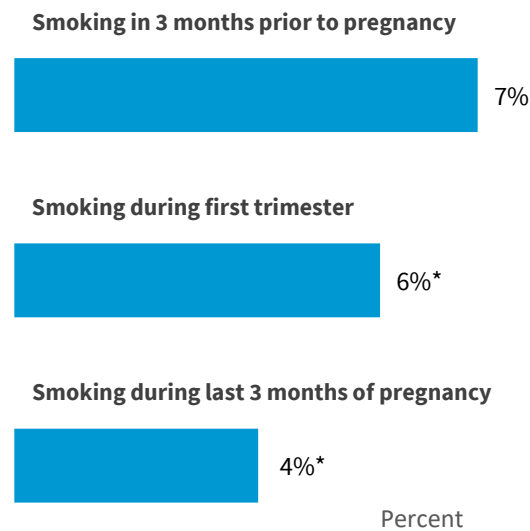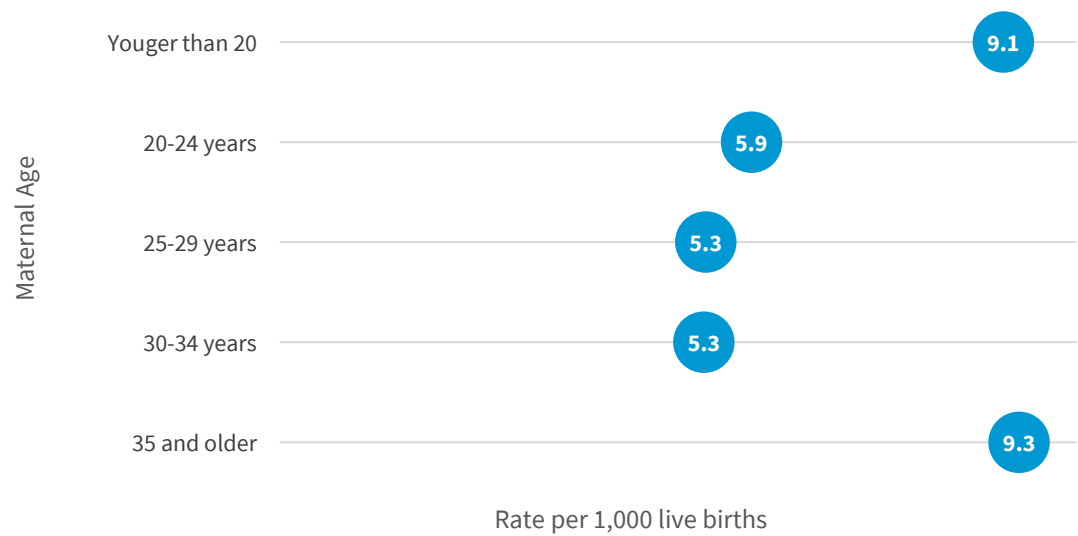| Maternal Age	Rate per 1,000 live births
Younger than 20	9.1
20-24 years	5.9
25-29 years	5.3
30-34 years	5.3
35 and older	9.3

Rate per 1,000 live births

Data Source: Period Linked Infant Mortality File and Birth Comprehensive Protected File from the Ohio Department of Health, Bureau of Vital Statistics.

APPENDIX C: ATTRIBUTES OF ALL 2023 INFANT DEATHS

Attribute	Percent	Numerator	Denominator
Behavioral			
Mother smoked pre-pregnancy	12.4	107	865
Mother smoked first trimester	10.4	90	865
Mother smoked third trimester	7.7	67	865
Interpregnancy interval <18 months	40.4	139	344
Interpregnancy interval <6 months	13.1	45	344
Social			
Low income (presumed Medicaid)	55.1	480	871
Education less than high school	19.1	165	866
Father not on birth certificate	33.8	306	904
Medical: Pre-pregnancy			
Obesity	40.2	347	864
Hypertension	5.8	52	898
Diabetes	2.3	21	898
Medical: Pregnancy			
Gestational hypertension	12.7	114	898
Gestational diabetes	5.6	50	898
Twin or higher order pregnancy	12.3	110	897
Healthcare and services			
No first trimester prenatal care	41.8	337	807
Born in wrong level hospital ***	8.5	72	851
WIC during pregnancy	30.4	261	859
No WIC but probably eligible	30.6	260	851
Maternal pregnancy history			
Prior pregnancy	72.1	630	874
Prior live birth	60.8	531	873
Prior preterm birth	11.4	102	898
Demographic: Mother's race/ethnicity			
Non-Hispanic Black	30.4	275	904
Non-Hispanic White	55.8	504	904
Hispanic	7.5	68	904
Demographic: Mother's age (years)			
< 18	2.6	23	879
18-19	4.8	42	879
20-24	23.4	206	879
25-29	26.3	231	879
30-34	25.9	228	879
35-39	12.9	113	879
40 or more	4.1	36	879
Demographic: County of Residence at Death ****			
OEI County	60.0	542	904
Large metro county	32.8	296	903
Metro county	56.0	506	903
Micro county	10.1	91	903
Rural county	1.1**	10	903

Attribute	Percent	Numerator	Denominator
Delivery: Gestational age			
Before 20 weeks	10.1	89	877
20-23 weeks	20.6	181	877
24-27 weeks	11.7	103	877
28-33 weeks	9.7	85	877
34-36 weeks	11.9	104	877
37 weeks or more	35.9	315	877
Delivery: Birth weight			
Less than 500 grams	20.9	170	814
500-999 grams	17.3	141	814
1,000-1,499 grams	7.7	63	814
1,500-1,999 grams	6.0	49	814
2,000-2,499 grams	10.1	82	814
2,500 or more grams	38.0	309	814
Small for gestational age (SGA)	21.8	176	809
Death: Timing			
Within first hour of life	13.2	119	903
By end of first day	24.1	218	903
By end of first week	15.8	143	903
By end of first month	13.7	124	903
Before first birthday	33.1	299	903
Death: Location			
Within hospital as inpatient	74.7	675	904
ER or outpatient	16.9	153	904
Dead on arrival	*	*	
Home	6.0	54	904
Hospice/nursing home/long term-care facility	*	*	
Other	1.1**	10	904
Dollfus cause of death category			
Prematurity	30.0	271	904
Congenital anomaly	16.0	145	904
External injuries	11.9	108	904
SIDS	6.5	59	904
Obstetric conditions	7.0	63	904
Perinatal infections	3.9	35	904
Other infections	3.9	35	904
Birth asphyxia	1.2**	11	904
Other	19.6	177	904

Note: The denominators for each attribute vary due to missing or unknown values in the Vital Statistics infant mortality period linked file.

*Figure does not meet standards of reliability or precision, based on fewer than 10 deaths in the numerator.

**Figures based on fewer than 20 deaths in the numerator should be interpreted with caution.

*** An infant born in a hospital without the appropriate level of care given the infant's gestational age and/or birth weight. Denominator includes infants born in a facility.

****County designations: Large Metro (Cuyahoga, Franklin, Hamilton); Metro (Allen, Ashland, Ashtabula, Athens, Belmont, Butler, Clark, Clermont, Columbiana, Delaware, Erie, Fairfield, Geauga, Greene, Hancock, Huron, Jefferson, Knox, Lake, Lawrence, Licking, Lorain, Lucas, Mahoning, Marion, Medina, Miami, Montgomery, Muskingum, Pickaway, Portage, Richland, Ross, Sandusky, Scioto, Seneca, Stark, Summit, Trumbull, Tuscarawas, Union, Warren, Wayne, Wood); Micro (Auglaize, Brown, Carroll, Champaign, Clinton, Coshocton, Crawford, Darke, Defiance, Fayette, Fulton, Gallia, Guernsey, Hardin, Henry, Highland, Hocking, Holmes, Jackson, Logan, Madison, Meigs, Mercer, Morrow, Ottawa, Perry, Pike, Preble, Putnam, Shelby, Van Wert, Washington, Williams, Wyandot); Rural (Adams, Harrison, Monroe, Morgan, Noble, Paulding, Vinton); OEI (Butler, Cuyahoga, Franklin, Hamilton, Lorain, Lucas, Mahoning, Montgomery, Stark, Summit).