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Infant Mortality by Selected Maternal Characteristics and Race and Hispanic Origin in the United States, 2019–2021

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Abstract

Objectives—This report presents infant mortality rates for selected maternal characteristics (prepregnancy body mass index, cigarette smoking during pregnancy, receipt of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) benefits during pregnancy, timing of prenatal care, and source of payment for delivery) for the five largest maternal race and Hispanic-origin groups in the United States for combined years 2019–2021.

Methods—Descriptive tabulations based on data from the linked birth/infant death files for 2019–2021 are presented. The linked birth/infant death file is based on birth and death certificates registered in all 50 states and the District of Columbia. Infant mortality rates are presented for each maternal race and Hispanic-origin group overall and by selected characteristics.

Results—Infant mortality rates varied across the five largest maternal race and Hispanic-origin groups and by selected maternal characteristics. For most race and Hispanic-origin groups, mortality rates were higher among infants of women with prepregnancy obesity compared with those of women who were normal weight, and were higher for infants of women who smoked cigarettes during pregnancy, received late or no prenatal care, or were covered by Medicaid as the source of payment for delivery. Overall, mortality rates were higher for infants of women who received WIC during pregnancy, but results varied across race and Hispanic-origin groups. Mortality rates for the maternal characteristics examined were generally highest among infants of Black non-Hispanic and American Indian and Alaska Native non-Hispanic women and lowest for Asian non-Hispanic women.

Keywords: BMI • WIC • prenatal care • National Vital Statistics System

Introduction

Infant mortality is often used as a measure of overall health across countries (1–3). Infant mortality rates vary by maternal race and Hispanic origin (4–7), as well as by maternal characteristics such as prepregnancy body mass index (BMI), source of payment for delivery, and timing of prenatal care (8–11). However, limited information has been available on differences in infant mortality rates by maternal characteristics for more detailed maternal race and Hispanic-origin groups. This report compares infant mortality rates by selected maternal characteristics overall and for the five largest maternal race and Hispanic-origin groups (non-Hispanic American Indian and Alaska Native [subsequently, American Indian and Alaska Native], non-Hispanic Asian [subsequently, Asian], non-Hispanic Black [subsequently, Black], non-Hispanic White [subsequently, White], and Hispanic).

Methods

This report uses data from the 2019–2021 period linked birth/infant death files. The period linked birth/infant death data set includes all infant deaths reported from death certificates and all live births reported from birth certificates (12). Data for this report are based on all infant death certificates that could be linked with the corresponding birth certificate—99.3% of the 20,814 infant deaths in 2019, 99.3% of the 19,578 infant deaths in 2020, and 98.9% of the 19,928 infant deaths in 2021 (12–14). Records are weighted to compensate for the 0.7% of infant death records in 2019 and 2020 and the 1.1% of infant death records in 2021 that could not be linked to their corresponding birth certificates. Data are based on the 2003 revision of the U.S. Standard Certificate of Live Birth (15,16). From 2019 through 2021, the overall infant mortality rate declined nearly 3%, from 5.58 to 5.44 (13,14). Data for 2019–2021 were combined to

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produce more reliable rates for subgroups with a small number of annual events. Rates with fewer than 20 deaths in the numerator are not shown.

The race and Hispanic-origin groups shown in this report follow the 1997 Office of Management and Budget standards (17). Race and Hispanic origin are reported separately on the birth certificate. Information on the mother's race or Hispanic origin is self-reported on the birth certificate.

Information on five race and Hispanic-origin groups (American Indian and Alaska Native, Asian, Black, White, and Hispanic) is presented. Due to small numbers of infant deaths, information for infants of Native Hawaiian or Other Pacific Islander women is not shown. Maternal characteristics presented are: prepregnancy BMI, prenatal receipt of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) benefits, source of payment for the delivery, tobacco use during pregnancy, and timing of initiation of prenatal care. These characteristics are presented because previous research has shown a potential association between these characteristics and infant outcomes (4–11). Some of these characteristics can be used as proxies for societal inequities by race (5–7,18–20).

Prepregnancy BMI is defined as the mother's weight before pregnancy divided by the mother's height (inches) squared, multiplied by 703 (21). BMI values under 18.5 are classified as underweight, 18.5 to 24.9 are classified as normal or healthy weight, 25.0 to 29.9 are classified as overweight, and values of 30.0 and over are classified as obese (22). Prepregnancy BMI is calculated from maternal height and prepregnancy weight immediately before pregnancy as reported by the mother. Subsequent text references to prepregnancy BMI omit the term prepregnancy.

Smoking during pregnancy is defined as cigarette smoking at any time while pregnant. The timing of prenatal care is determined by the month it began, based on the date of the first prenatal visit, date of birth, and gestational age. WIC is a nutritional program intended to help pregnant women, infants, and children through age 5 years in low-income households (23). The primary source of payment for the delivery categories shown are private insurance and Medicaid. Eligibility for Medicaid during pregnancy varies by state, from 138% through 380% of the federal poverty level (24). Women who have income below 185% of the federal poverty level and are at nutritional risk are eligible to receive WIC benefits while pregnant (25). Smoking during pregnancy and receipt of WIC are based on maternal self-report, whereas information on BMI, source of payment for delivery, and prenatal care are recommended to be obtained from the mother's medical records. Distributions for characteristics by race and Hispanic origin are presented in the Table.

Of the 11,025,479 births in the United States in 2019–2021, data were missing for 2.1% (230,056) for BMI, 0.9% (100,322) for maternal cigarette smoking during pregnancy, 1.1% (121,849) for WIC, 2.1% (236,172) for prenatal care, 0.7% (79,612) for source of payment, and 1.0% (106,114) for maternal Hispanic origin. Birth records with missing values for race (6.9% or 762,285) were imputed. Records with other missing information were excluded from analyses.

The infant mortality rate is the number of infant (younger than 1 year) deaths per 1,000 live births in a specified group. Differences in rates are tested for statistical significance using a two-tailed *z* test at the 0.05 level. Differences referred to in text are statistically significant unless otherwise stated.

Table. Distribution of maternal characteristics, by race and Hispanic origin: United States, 2019–2021

Characteristic	Non-Hispanic				Hispanic
	American Indian and Alaska Native	Asian	Black	White	
Number	81,387	671,650	1,595,775	5,647,000	2,639,096
Total percent	0.7	6.1	14.5	51.2	23.9
Body mass index:					
Underweight	2.0	5.7	2.8	2.8	2.2
Normal	28.9	58.3	30.3	44.0	33.3
Overweight	27.2	24.7	26.7	25.9	31.0
Obese	41.9	11.2	40.2	27.3	33.5
Smoked during pregnancy	13.8	0.4	4.4	7.9	1.4
WIC receipt[1]	48.1	17.3	49.1	20.7	48.9
Initiation of prenatal care:					
1st trimester	64.5	82.6	68.6	82.9	72.3
2nd trimester	22.7	12.9	22.2	12.5	19.5
3rd trimester or none	12.8	4.5	9.3	4.5	8.2
Source of payment for delivery:					
Medicaid	66.5	23.1	64.6	28.9	58.6
Private health insurance	21.9	70.4	30.1	64.2	31.3
Other	11.6	6.5	5.4	6.8	10.2

[1]WIC is the Special Supplemental Nutrition Program for Women, Infants, and Children.

NOTES: Race groups are non-Hispanic, single race. People of Hispanic origin may be of any race. Total percent does not add to 100 due to groups not included in analysis.

SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

Results

Infant mortality for the five largest maternal race and Hispanic-origin groups

- In 2019–2021, the overall infant mortality rate for the United States was 5.48 infant deaths per 1,000 live births. Infant mortality rates were highest among infants of Black women (10.52), followed by infants of American Indian and Alaska Native (7.69), Hispanic (4.84), White (4.42), and Asian (3.40) women (Table 1, Figure 1).

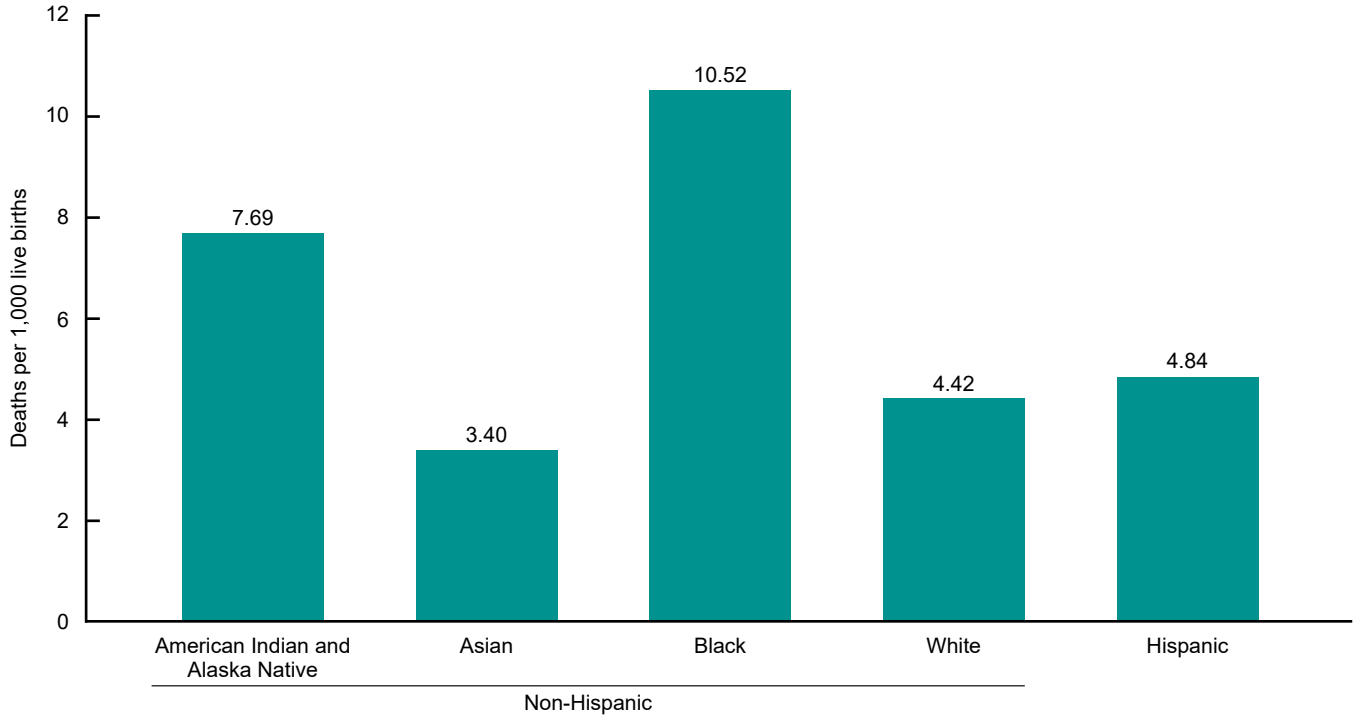
BMI and maternal race and Hispanic origin

- In 2019–2021, mortality rates for infants of women of all race and Hispanic-origin groups were highest for women with obesity (6.73 deaths per 1,000 live births) and lowest for women of normal weight (4.31) (Table 1).
- Mortality rates for infants of women with obesity were higher than the rates for those of normal weight women for most race and Hispanic-origin groups. However, no significant differences were seen across BMI categories for infants of American Indian and Alaska Native women. Rates for infants of Black and White women with obesity were not significantly different from those who were underweight.
- Among infants of underweight and normal weight women, mortality rates were lowest for infants of Asian women and highest for infants of Black women. For infants of overweight women, rates were lowest for infants of Asian and White women and highest for those of Black women.
- Among infants of women with obesity, mortality rates were lowest for those of White (5.34) women, followed by Asian (5.40) and Hispanic (5.57), and American Indian and Alaska Native (7.56) women, and were highest for infants of Black women (11.48).

Smoking during pregnancy and maternal race and Hispanic origin

- Mortality rates were at least twice as high for infants of women who smoked during pregnancy (11.27 deaths per 1,000 live births) than for those who did not (5.08) overall, and for each of the race and Hispanic-origin groups (Table 1).
- Mortality rates for infants of women who smoked ranged from 9.91 for infants of White women to 19.42 for infants of Black women. Rates were not significantly different compared with Asian women for any other race and Hispanic-origin groups.
- Mortality rates for infants of women who did not smoke cigarettes were lowest for infants of Asian women (1.70) and highest for infants of American Indian and Alaska Native (5.02) and Black (5.16) women.

Figure 1. Infant mortality rate, by maternal race and Hispanic origin: United States, 2019–2021



NOTES: All differences between groups are statistically significant ($p < 0.05$). Race groups are non-Hispanic, single race. People of Hispanic origin may be of any race.
SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

WIC receipt and maternal race and Hispanic origin

- Although overall mortality rates were higher for infants of women who received WIC (5.85 deaths per 1,000 live births) in 2019–2021 than for infants of women who did not (5.13), this pattern was only found for infants of White women (5.82 compared with 3.97) (Table 1, Figure 2).
- In comparison, the mortality rates for infants of Black and Hispanic women who received WIC were lower than for those who did not receive WIC (8.82 compared with 11.74 and 4.12 compared with 5.39, respectively). Mortality rates for infants of American Indian and Alaska Native and Asian women were not significantly different by WIC receipt (Figure 2).
- Mortality rates for infants of women who received WIC ranged from a low of 3.25 for infants of Asian women to a high of 8.82 for infants of Black women.
- Mortality rates for infants of women who did not receive WIC ranged from a low of 3.35 for infants of Asian women to a high of 11.74 for infants of Black women.

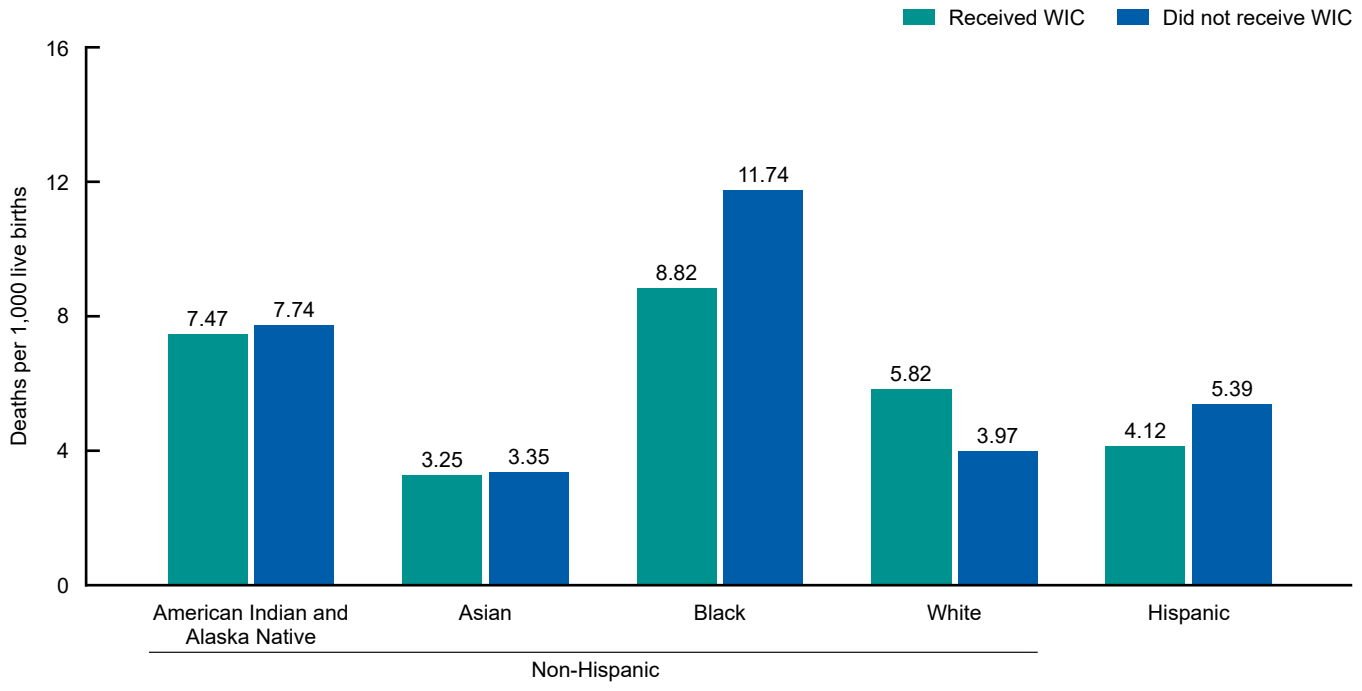
Timing of prenatal care and maternal race and Hispanic origin

- In 2019–2021, overall mortality rates were highest among infants of women who received late or no care (10.75 deaths per 1,000 live births) and lowest among infants of women who received care in the first trimester (4.54) (Table 1). A similar pattern was seen across all race and Hispanic-origin groups. However, the magnitude of increase in infant mortality rates by trimester prenatal care began varied by race and Hispanic-origin group (Figure 3).
- Among infants of women who began care in the first trimester, mortality rates ranged from 2.98 for infants of Asian women to 9.33 for infants of Black women.
- Mortality rates for infants of women who began care in the third trimester or had no care were lowest for infants of Asian women (6.06), followed by infants of Hispanic (7.44), White (10.53), American Indian and Alaska Native (11.89), and Black (16.02) women.

Source of payment for delivery and maternal race and Hispanic origin

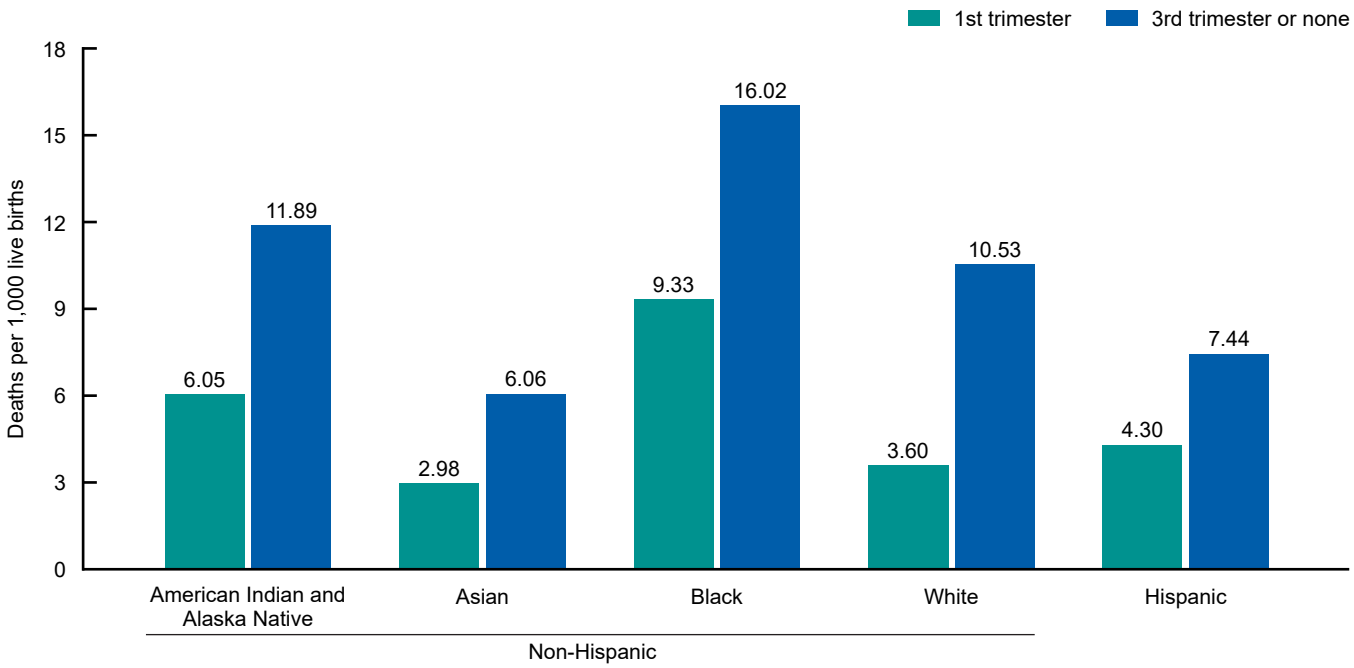
- Overall mortality rates were higher for infants of women covered by Medicaid (7.19 deaths per 1,000 live births) compared with those of women with private insurance as the source of payment for delivery (3.95). The same pattern was seen across all race and Hispanic-origin groups (Table 1, Figure 4).
- Mortality rates for infants of women covered by Medicaid were lowest for infants of Asian (4.06) women, followed by infants of Hispanic (5.15), White (6.68), American Indian and Alaska Native (8.51), and Black (11.07) women.

Figure 2. Infant mortality rate, by WIC receipt and maternal race and Hispanic origin: United States, 2019–2021



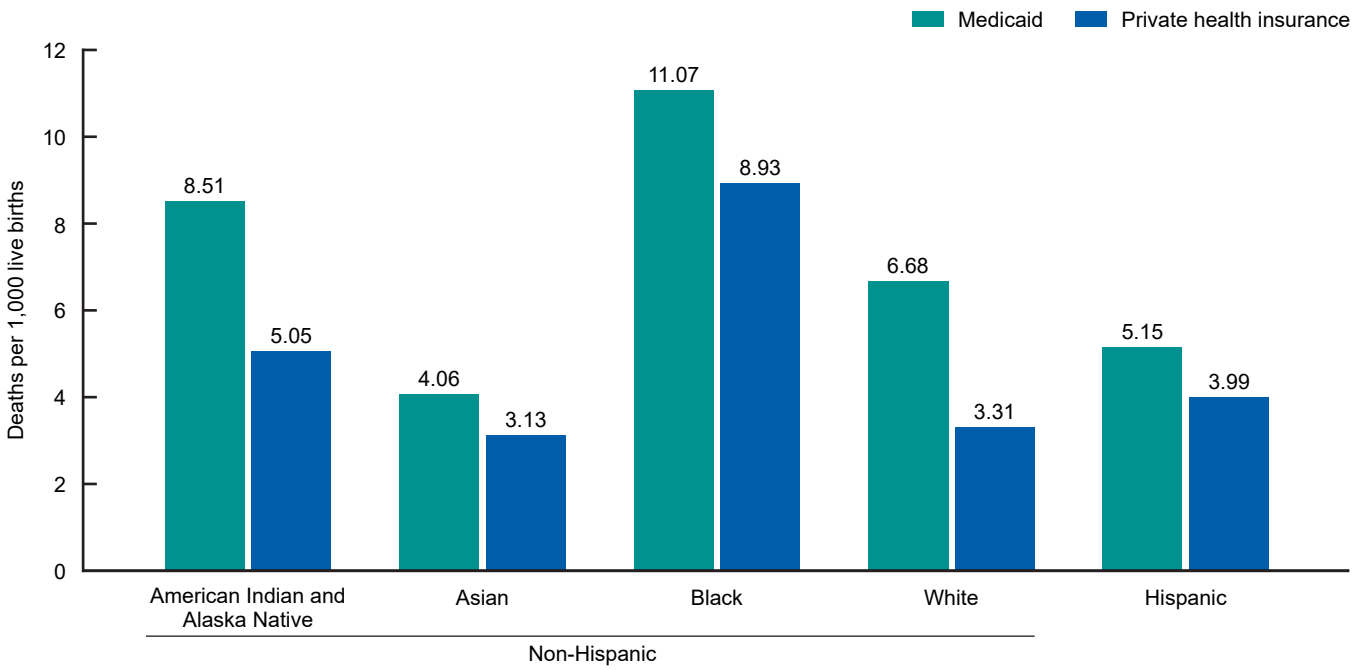
NOTES: WIC is the Special Supplemental Nutrition Program for Women, Infants, and Children. All differences between race and Hispanic-origin groups for both WIC categories are statistically significant ($p < 0.05$). Differences between "Received WIC" and "Did not receive WIC" within race and Hispanic-origin groups were statistically significant ($p < 0.05$) for all groups except for infants of American Indian and Alaska Native and Asian women. Race groups are non-Hispanic, single race. People of Hispanic origin may be of any race.
SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

Figure 3. Infant mortality rate, by initiation of prenatal care and maternal race and Hispanic origin: United States, 2019–2021



NOTES: All differences between race and Hispanic-origin groups receiving care in the first trimester are statistically significant ($p < 0.05$). All differences between race and Hispanic-origin groups receiving care in the third trimester or receiving no prenatal care are statistically significant ($p < 0.05$), except between infants of American Indian and Alaska Native and White women. All differences between receiving care in the first trimester and receiving care in the third trimester or receiving no prenatal care within race and Hispanic origin groups were statistically significant ($p < 0.05$). Race groups are non-Hispanic, single race. People of Hispanic origin may be of any race.
SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

Figure 4. Infant mortality rate, by source of payment for delivery and maternal race and Hispanic origin: United States, 2019–2021



NOTES: All differences between race and Hispanic-origin groups for Medicaid are statistically significant ($p < 0.05$). All differences between race and Hispanic-origin groups for private health insurance are statistically significant ($p < 0.05$), except between infants of American Indian and Alaska Native and Hispanic women. All differences between Medicaid and private health insurance as the source of payment within race and Hispanic-origin groups were statistically significant ($p < 0.05$). Race groups are non-Hispanic, single race. People of Hispanic origin may be of any race.
SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

- Mortality rates for infants of women covered by private health insurance followed a similar pattern with rates lowest for infants of Asian (3.13) women, followed by infants of White (3.31), Hispanic (3.99), American Indian and Alaska Native (5.05), and Black (8.93) women.

Summary

Infant mortality rates varied across the five largest maternal race and Hispanic-origin groups and by maternal characteristics. Overall and across categories of maternal characteristics, infants of Asian women generally had the lowest mortality rates, while infants of American Indian and Alaska Native and Black women generally had the highest. Overall, mortality rates were highest among infants of women with obesity, women who smoked, women who received WIC, women who began care later in pregnancy, and women covered by Medicaid. These patterns were mostly observed across race and Hispanic-origin groups, with some exceptions. For example, infants of White women who received WIC had higher mortality rates than infants of women who did not receive WIC, while the reverse was found for infants of Black and Hispanic women. Infants of Black and American Indian and Alaska Native women had the highest mortality rates within nearly every category of BMI, WIC, source of payment, and prenatal care.

The distributions of maternal risk factors shown in this report differ across the maternal race and Hispanic-origin groups, which may contribute to some of the differences in infant mortality rates (Table). For example, the percentage of women with obesity was higher among American Indian and Alaska Native and Black women than for women of the other race and Hispanic-origin groups; mortality rates were highest for infants of women with obesity.

Limitations

The percentage of missing data is low for the items presented in this report, but levels vary by item and maternal race and Hispanic-origin group. For example, in this report, missing BMI data ranged from 1.6% for births to White women to 2.7% for births to American Indian and Alaska Native women but ranged from 4.3% for infant deaths to American Indian and Alaska Native women to 6.2% for infant deaths to Black women. A recent report on BMI showed similar rates of missingness by maternal race and Hispanic origin (9).

Misreporting is a potential limitation when using birth certificate prenatal care and source of payment data. Validity studies fielded in three vital statistics jurisdictions found that agreement between birth certificate and hospital medical records for information on the day and month of first prenatal care visit, receipt of prenatal care in the first trimester, and the source of payment for delivery ranged from moderate (60.0%–74.9%) to substantial (75.0%–89.9%) exact agreement (26,27).

Conclusion

Infant mortality rates vary across race and Hispanic-origin groups and by maternal characteristics. Mortality rates are consistently higher for infants of American Indian and Alaska Native and Black women and lower for infants of Asian women across categories of maternal characteristics. Further, given the recent increase in the provisional 2022 infant mortality rate, there is a continued need to monitor deaths in disproportionately impacted populations (28). These findings demonstrate the importance of examining infant mortality by detailed race and Hispanic origin whenever possible to better focus efforts to improve infant outcomes.

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Detailed Table

Table 1. Infant mortality rate, by maternal characteristics and race and Hispanic origin: United States, 2019–2021

Characteristic	Total	Non-Hispanic				Hispanic
		American Indian and Alaska Native	Asian	Black	White	
Total	5.48	7.69	3.40	10.52	4.42	4.84
Body mass index						
Underweight	5.90	*	2.46	10.73	5.71	4.43
Normal	4.31	7.42	[1]2.71	8.90	3.65	[1]4.08
Overweight	4.97	[2]7.39	3.77	9.42	†3.99	[1]4.40
Obese	6.73	[2,3]7.56	5.40	[1]11.48	[1]5.34	†5.57
Smoked during pregnancy						
Yes	11.27	12.28	‡11.53	†19.42	†9.91	†11.08
No	5.08	5.02	1.70	‡5.16	2.53	2.70
WIC receipt[4]						
Yes	5.85	[5]7.47	[5]3.25	8.82	5.82	4.12
No	5.13	7.74	3.35	11.74	3.97	5.39
Initiation of prenatal care						
1st trimester	4.54	6.05	2.98	9.33	3.60	4.30
2nd trimester	6.40	9.08	3.83	‡9.82	6.08	4.67
3rd trimester or none	10.75	11.89	6.06	16.02	‡10.53	7.44
Source of payment for delivery[6]						
Medicaid	7.19	8.51	4.06	11.07	6.68	5.15
Private health insurance	3.95	5.05	3.13	8.93	3.31	‡3.99

* Estimate does not meet National Center for Health Statistics standards of reliability; based on fewer than 20 deaths in the numerator.
† Not significantly different from non-Hispanic Asian women ($p < 0.05$).
‡ Not significantly different from non-Hispanic American Indian and Alaska Native women ($p < 0.05$).
[1]Not significantly different from underweight ($p < 0.05$).
[2]Not significantly different from normal weight ($p < 0.05$).
[3]Not significantly different from overweight ($p < 0.05$).
[4]WIC is the Special Supplemental Nutrition Program for Women, Infants, and Children.
[5]Not significantly different from No ($p < 0.05$).
[6]Self-pay and other source of payment for delivery not shown.

NOTES: Rate is defined as infant deaths per 1,000 live births. Race groups are non-Hispanic, single race. People of Hispanic origin may be of any race.

SOURCE: National Center for Health Statistics, National Vital Statistics System, linked birth/infant death file.

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