

### 1 **Adverse Birth Outcomes**

2  
3 The period of gestation is a crucial determinant of an infant's health and survival for years to  
4 come. Two measures that may be used to understand the quality of an infant's gestation are the  
5 length of gestation (pregnancy length) and birth weight. Normal term pregnancies last between  
6 37 and 41 completed weeks, allowing for more complete development of an infant's organs and  
7 systems.<sup>1</sup> An infant is considered preterm if he or she is born before 37 completed weeks of  
8 gestation.<sup>1</sup> Birth weight is a composite determined by two factors: length of gestation and fetal  
9 growth (the rate at which an infant develops and increases in size). Infants may be born with a  
10 low birth weight simply because they were born prematurely, or they may be smaller than  
11 expected given their gestational age. Low birth weight is considered as less than 2,500 grams  
12 (about 5 pounds, 8 ounces).<sup>2</sup> Because birth weight alone does not always indicate whether an  
13 infant's fetal growth has been restricted, other measurements such as birth length, head  
14 circumference, and abdominal circumference are also used.

15  
16 Other adverse birth outcomes that are not discussed here include high birth weight, neonatal  
17 mortality, and birth defects, a specific group of adverse birth outcomes that include structural and  
18 functional abnormalities.

19  
20 Preterm and low birth weight infants are at greater risk for mortality and a variety of health and  
21 developmental problems. Conditions related to preterm birth and low birth weight are the second  
22 leading cause of infant death in the United States (after birth defects).<sup>3</sup> The infant mortality rate  
23 for low birth weight infants is about 25 times that of the infant mortality rate for normal weight  
24 babies. Likewise, the infant mortality rate for late preterm babies (34–36 weeks of gestation) is  
25 about three times the infant mortality rate for term babies, and the infant mortality rate for very  
26 preterm babies (less than 32 weeks of gestation) is 75 times that of term babies.<sup>3</sup> Low birth  
27 weight infants are more likely to have underdeveloped lungs and breathing problems; heart  
28 problems (which can lead to heart failure); immature and improperly functioning livers; too  
29 many or too few red blood cells (polycythemia or anemia); inadequate body fat, leading to  
30 trouble maintaining a normal body temperature; feeding problems; and increased risk of  
31 infection.<sup>2</sup> Preterm infants may experience complications such as acute respiratory,  
32 gastrointestinal, immunologic, and central nervous system problems. Longer-term motor,  
33 cognitive, visual, hearing, behavioral, social-emotional, health, and growth problems may not  
34 become apparent for years, and may persist throughout a child's life. The birth of a preterm or  
35 low birth weight infant can have significant emotional and economic effects on the infant's  
36 family.<sup>4</sup>

37  
38 For many years, the prevalence of both preterm birth and low birth weight have been increasing;<sup>5</sup>  
39 however, starting in 2006 this pattern seems to be partially reversing as the rate of preterm birth  
40 is now declining. A number of factors may be contributing to the increases, including increases  
41 in maternal age, rates of multiple births (e.g., twins, triplets), use of early Cesarean sections and  
42 labor inductions, and use of assisted reproductive technologies (e.g., in vitro fertilization).<sup>4</sup> The  
43 rates of multiple births have increased in recent decades. The rate of twin births increased 70%  
44 from 1980–2004, but has been essentially stable since that time. The rate of triplet and higher

## Health: Adverse Birth Outcomes

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1 order births increased 400% from 1980 to 1998, but since that time has been trending  
2 downward.<sup>6</sup> Multiple births run a higher risk of preterm birth and low birth weight. Other factors  
3 linked to preterm birth and low birth weight include fetal birth defects; chronic maternal health  
4 problems (e.g., high blood pressure); maternal use of tobacco, alcohol, and illicit drugs; maternal  
5 and fetal infections; placental problems; inadequate maternal weight gain; and socioeconomic  
6 factors (e.g., low income and poor education).<sup>7-11</sup>

7  
8 Rates of low birth weight and preterm birth can vary greatly by maternal race/ethnicity. Black  
9 women have consistently had higher rates of preterm and low birth weight babies.<sup>12</sup> While it has  
10 been suggested that race is a proxy for differences in socioeconomic status (SES), most studies  
11 that have controlled for differences in SES continue to find persistent birth outcomes differences  
12 between Black and White women.<sup>12-15</sup> Similarly, studies that have adjusted for other risk factors,  
13 such as risky behavior during pregnancy and use of prenatal care, have found these persistent  
14 Black-White differences in birth outcomes as well.<sup>3,16,17</sup>

15  
16 While much of the increasing frequency of preterm birth and low birth weight might be  
17 explained by changing maternal characteristics and obstetric practices, other factors—including  
18 environmental contaminants—may also play a role in the increasing rates.<sup>18</sup> A growing number  
19 of studies have examined the possible role that exposure to environmental contaminants may  
20 play in the causation of preterm birth and low birth weight. The evidence is particularly strong  
21 for environmental tobacco smoke (ETS) and lead. The U.S. Surgeon General has concluded that  
22 the evidence is sufficient to infer a causal relationship between maternal exposure to ETS and  
23 reductions in birth weight, and is suggestive of a causal relationship between exposure to ETS  
24 and preterm delivery.<sup>19</sup> The Institute of Medicine has that concluded there is sufficient evidence  
25 to suggest that maternal exposure to lead results in an increased risk of preterm birth.<sup>4</sup>

26  
27 The link between common air pollutants and adverse birth outcomes has received more attention  
28 in recent years. Particulate matter (PM), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), and  
29 carbon monoxide (CO) exposure have all been linked to decreased fetal growth, low birth  
30 weight, and preterm birth in a number of large epidemiological studies (many with 10,000+  
31 participants) in many different countries.<sup>20-34</sup> In such studies, researchers make an effort, when  
32 data are available, to adjust for other factors that may also lead to an increased risk of low birth  
33 weight or preterm birth, such as mother's age, smoking status, race, and income.<sup>35</sup> Other studies  
34 have linked proximity to traffic density during pregnancy to increased risk of preterm birth and  
35 low birth weight, although an extensive review study concluded that there is inadequate and  
36 insufficient evidence to infer a causal relationship.<sup>36-41</sup>

37  
38 In addition to air pollutants, several other environmental chemicals are suspected contributors to  
39 adverse birth outcomes. There is limited, yet growing evidence that prenatal exposure to  
40 phthalates may lead to adverse birth outcomes. A handful of studies find associations between  
41 prenatal exposure to some phthalates and preterm birth, shorter gestational length, and low birth  
42 weight.<sup>42-45</sup> A limited number of studies suggest that prenatal exposure to another class of  
43 chemicals, polychlorinated biphenyls (PCBs), may lead to preterm birth and low birth weight or  
44 otherwise restrict fetal growth.<sup>46-49</sup> One study examining women from the Danish National Birth  
45 Cohort found that exposure to PCBs from fatty fish consumption was associated with lower birth  
46 weight. The study found that infants born to highly exposed women weighed, on average, about

## Health: Adverse Birth Outcomes

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1 5.5 ounces less than infants born to women with relatively low PCB exposure.<sup>50</sup> Another study  
2 looked at a historical cohort of women who were pregnant prior to the 1979 ban of PCBs, and  
3 failed to see any relation between PCB exposure and low birth weight or shorter pregnancy  
4 length.<sup>51</sup> A growing number of human health studies have found associations between prenatal  
5 exposure to perfluorinated compounds (PFCs)—particularly PFOS and PFOA—and a range of  
6 adverse birth outcomes, such as low birth weight, decreased head circumference, reduced birth  
7 length, and smaller abdominal circumference, although the results of such studies are mixed.<sup>52-56</sup>  
8 Studies of disinfection byproducts in drinking water as possible causes of adverse birth outcomes  
9 are also conflicting, with recent evidence indicating that there may be no effect on preterm  
10 birth.<sup>57-59</sup> Studies of arsenic in drinking water and birth outcomes have produced similarly mixed  
11 results.<sup>60-62</sup> For the following environmental contaminants, there is some evidence from animal  
12 studies and a limited number of studies in humans of possible associations with adverse birth  
13 outcomes, particularly reduced fetal growth: benzene,<sup>63</sup> herbicides,<sup>64</sup> bisphenol A (BPA),<sup>65</sup>  
14 dioxins and dioxin-like chemicals,<sup>66</sup> and manganese.<sup>67</sup>

15  
16 This section presents two indicators of adverse birth outcomes: Indicator Birth1 presents the rate  
17 of preterm birth, and Indicator Birth2 presents the rate of term low birth weight. These two  
18 indicators were chosen because for each there is a wealth of quality data available.  
19

## 1 **Indicator Birth1: Percentage of babies born preterm, by** 2 **race/ethnicity, 1993–2007**

## 3 **Indicator Birth2: Percentage of babies born at term with low** 4 **birth weight, by race/ethnicity, 1993–2007**

5

### Overview

Indicator Birth1 shows the percentage of babies born preterm and Indicator Birth2 shows the percentage of babies who are born at term with low birth weight. Both graphs show separate lines for the different race/ethnicity groups. The data come from a national data system that collects data from birth certificates for virtually every baby born in the United States.

Indicators Birth1 and Birth2 show the change in preterm and term low birth weight over time.

6

## 7 **The National Vital Statistics System**

8 The data for these indicators of preterm birth and low birth weight come from the National Vital  
9 Statistics System (NVSS), operated by the Centers for Disease Control and Prevention (CDC).  
10 The NVSS data are provided through contracts between the CDC and vital registration systems  
11 operated in each state, which are legally responsible for the registration of vital events including  
12 births, deaths, marriages, divorces, and fetal deaths. The collection and publication of this  
13 information is mandated by federal law. Together the CDC and the states have developed  
14 standard forms and procedures to use for the data collection. The NVSS captures virtually all of  
15 the births occurring in the United States.

16

17 Birth certificates provide information on characteristics of both the infant and his/her parents,  
18 including the weight of the infant and the length of gestation. Length of gestation is recorded in  
19 completed weeks, so for example a pregnancy of 36 weeks and 6 days would be recorded as 36  
20 weeks, and would therefore be considered preterm.<sup>4</sup> Pregnancy duration is most often estimated  
21 from the date of a woman's last menstrual period. Many factors, including age, levels of physical  
22 activity, and body mass, can cause variation in menstrual cycle timing, making this method of  
23 estimating gestational length subject to some error.<sup>4</sup>

## 24 **Data Presented in the Indicators**

25 Indicator Birth1 displays the trend in the percentage of preterm births for all births (singletons, as  
26 well as multiples), with a separate line for each maternal race/ethnicity group and a single line  
27 for all maternal races and ethnicities combined for the years 1993–2007.

28

29 Indicator Birth2 displays the trend in the percentage of low birth weight births at term among all  
30 births (singletons, as well as multiples), with a separate line for each maternal race/ethnicity  
31 group and a single line for all maternal races and ethnicities combined for the years 1993–2007.  
32 By highlighting the trend for only term births (babies with a gestational age of 37 completed

## Health: Adverse Birth Outcomes

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1 weeks or more), the attempt is to focus on babies who are truly small and to exclude babies  
2 whose low birth weight is simply a result of being born prematurely. Therefore, this indicator  
3 understates the total number of infants with low birth weight. Another effect of this choice is that  
4 the indicator will miss preterm babies who would still be of low birth weight even if they had  
5 been carried to term.

6  
7 Five maternal race/ethnicity groups are presented in these indicators: White non-Hispanic, Black  
8 non-Hispanic, Hispanic, American Indian/Alaska Native non-Hispanic, and Asian Pacific  
9 Islander non-Hispanic. Prior to the year 1993, not all states recorded Hispanic origin on birth  
10 certificates; for this reason, both Indicator Birth1 and Birth2 begin with data from the year 1993.  
11 Birth certificates do not include information on family or maternal income; therefore it is not  
12 possible to examine differences or trends by income level.

13  
14 The indicator graphs show data for all births, singletons and multiples combined. The rates for  
15 singletons and multiples are provided in supplemental data tables. Additional supplemental  
16 tables highlight differences in rates of preterm birth and term low birth weight by age of the  
17 mother.

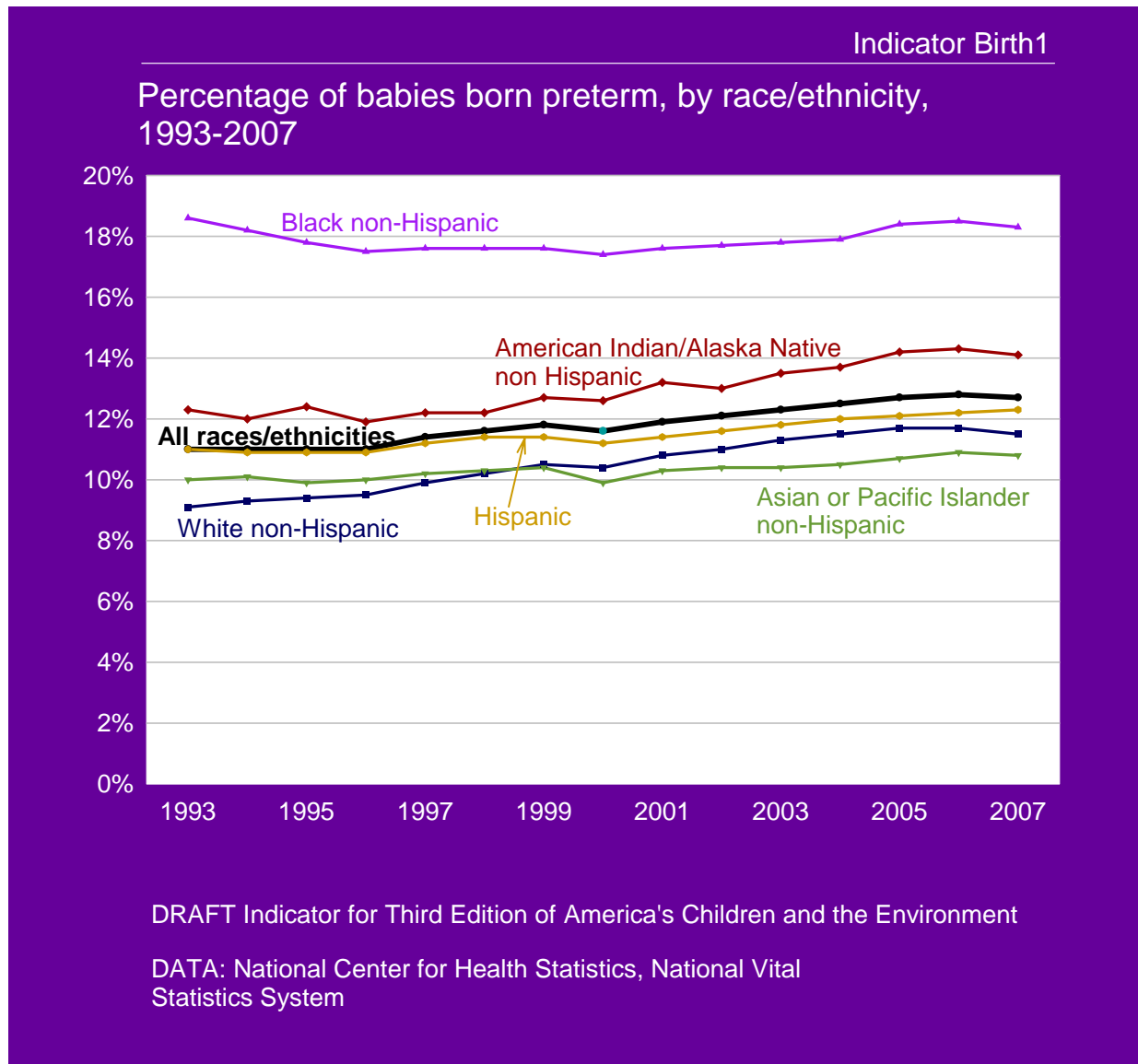
### 18 **Statistical Testing**

19  
20 Statistical analysis has been applied to the indicators to determine whether any changes in  
21 prevalence over time, or any differences in prevalence between demographic groups, are  
22 statistically significant. These analyses use a 5% significance level ( $p \leq 0.05$ ), meaning that a  
23 conclusion of statistical significance is made only when there is no more than a 5% chance that  
24 the observed change over time or difference between demographic groups occurred randomly. It  
25 should be noted that when statistical testing is conducted for differences among multiple  
26 demographic groups (e.g., considering both race/ethnicity and age), the large number of  
27 comparisons involved increases the probability that some differences identified as statistically  
28 significant may actually have occurred randomly.

29  
30 A finding of statistical significance for a health indicator depends not only on the numerical  
31 difference in the value of a reported statistic between two groups, but also on the number of  
32 observations in the survey and various aspects of the survey design. For example, if the  
33 prevalence of a health effect is different between two groups, the statistical test is more likely to  
34 detect a difference when data have been obtained from a larger number of people in those  
35 groups. A finding that there is or is not a statistically significant difference in prevalence between  
36 two groups or in prevalence over time is not the only information that should be considered when  
37 determining the public health implications of those differences.

38  
39 The NVSS records virtually all births in the United States—approximately 4 million per year.  
40 Because of this very large sample size, differences in birth outcomes that appear to be small in  
41 magnitude may be found to be statistically significant. Extensive research has been conducted  
42 with NVSS data to assess the presence of statistically significant trends and demographic  
43 differences, including analyses with much more detail than the one conducted here.<sup>18,68,69</sup>

# Health: Adverse Birth Outcomes



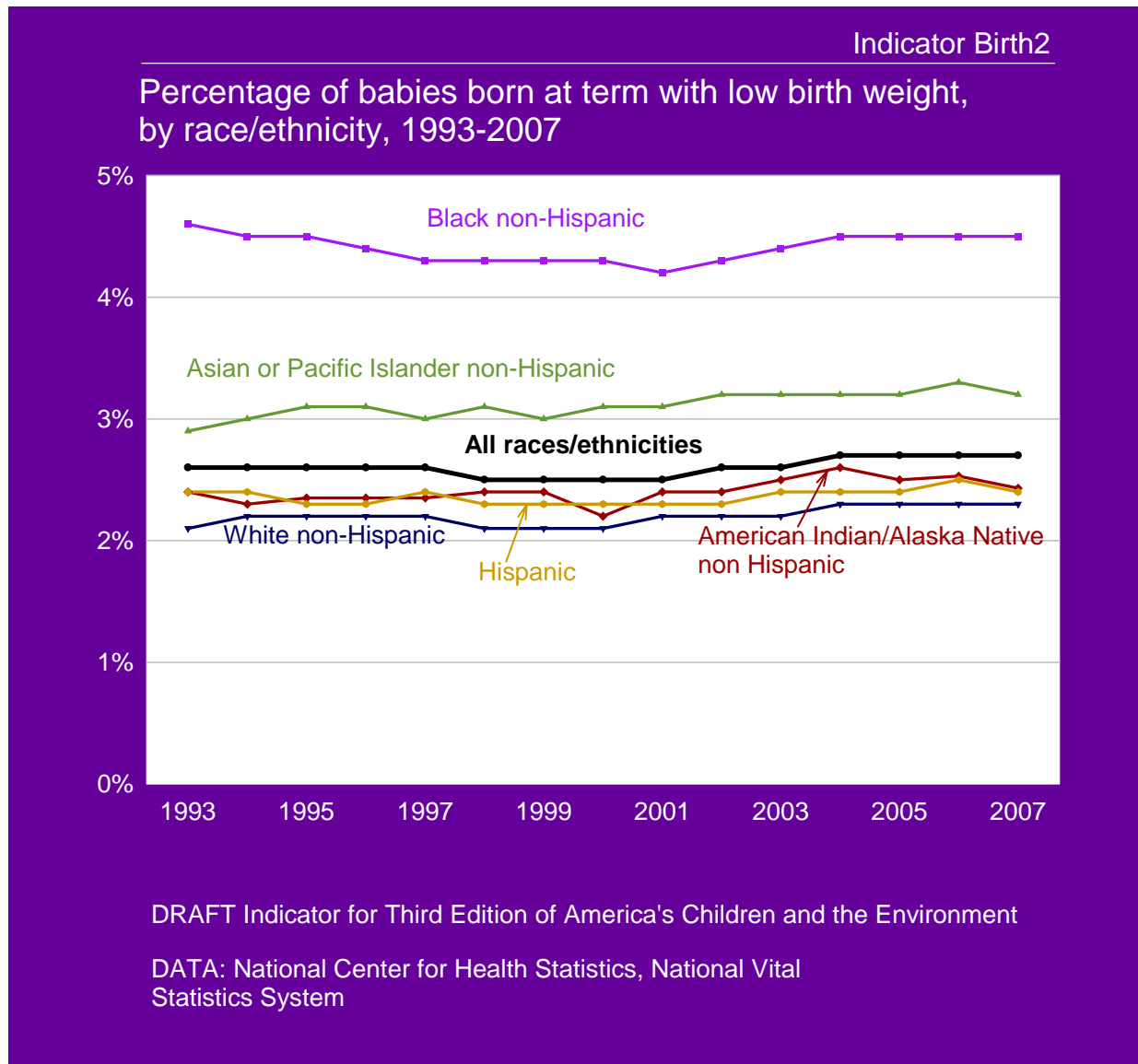
- 1
- 2
- 3 • Between 1993 and 2007, the rate of preterm birth rose from 11.0% of births in 1993 to 12.7%
- 4 of births in 2007. This increase was statistically significant.
- 5
- 6 • In 2007, Black non-Hispanic women had the highest rate of preterm birth, compared with
- 7 women of other races/ethnicities. Almost 1 in 5 infants born to Black non-Hispanic women
- 8 were born prematurely in that year.
- 9     o Statistical note: The rate of preterm birth for Black non-Hispanic women was
- 10 statistically significantly higher than for all other race/ethnicity groups.
- 11
- 12 • The preterm birth rate rose for each race/ethnicity group. The preterm birth rate for Black
- 13 non-Hispanic women fell slightly between 1993 and 2000, and after that began to rise back to
- 14 1993 levels.

## Health: Adverse Birth Outcomes

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- 1           ○ Statistical note: The increases in the rate of preterm birth for each race/ethnicity group  
2           were statistically significant. For Black non-Hispanic women, the decrease from 1993  
3           to 2000 and the increase from 2000 to 2007 were both statistically significant.  
4
- 5           ● Preterm birth rate trends vary depending on the age of the mother. Women ages 20 to 39  
6           years have the lowest rate of preterm birth, compared with women under 20 years and  
7           women 40 years and older. Each age group experienced an increase in the rate of preterm  
8           birth between 1993 and 2007; however, the increase for women under 20 years was  
9           comparatively smaller. (See Table Birth1a.)
- 10           ○ Statistical note: The differences between the preterm birth rates for the different age  
11           groups are statistically significant. The increases in the rate of preterm birth for all age  
12           groups were statistically significant as well.  
13
- 14           ● Twins, triplets, and other higher-order multiple birth babies are more than 5 times as likely to  
15           be born preterm compared to singleton babies (61.6% vs. 11.0% in 2007). The rates for both  
16           singletons and multiples have increased from 1993 to 2007. (See Table Birth1b)
- 17           ○ Statistical note: The increases for both singleton and multiple births are statistically  
18           significant.  
19

## Health: Adverse Birth Outcomes



- 1
- 2
- 3 • Between 1993 and 2007, the rate of term low birth weight stayed relatively constant between
- 4 2.5% and 2.7%. The rates of term low birth weight for each race/ethnicity group have also
- 5 stayed relatively constant over the period of 1993–2007.
- 6
- 7 • The rate of term low birth weight varies by race/ethnicity. The rate is highest for infants born
- 8 to Black non-Hispanic mothers and lowest for infants born to White non-Hispanic mothers.
- 9 ○ Statistical note: The rate of term low birth weight for Black non-Hispanic women was
- 10 statistically significantly higher than for all other race/ethnicity groups. The rate of
- 11 term low birth weight for White non-Hispanic women was statistically significantly
- 12 lower than for all other race/ethnicity groups except for American Indian/Alaska
- 13 Native non-Hispanic women.
- 14



## Health: Adverse Birth Outcomes

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- 1 • Term low birth weight rates vary by the age of the mother. Women ages 20 to 39 years have  
2 the lowest rate of term low birth weight infants, while women under 20 years have the  
3 highest rate of term low birth weight infants. (See Table Birth2a.) These differences are  
4 statistically significant.  
5
- 6 • The rate of term low birth weight increased for women of all age groups: under 20, 20–39,  
7 and 40 and older. Women 40 years and older experienced the largest increase in the rate of  
8 term low birth weight, increasing from 2.9% in 1993 to 3.3% in 2007. These increases were  
9 statistically significant (See Table Birth2a.)  
10
- 11 • Twins, triplets, and other higher-order multiple birth babies are more than 5 times as likely to  
12 be born at term with low birth rate compared with singleton babies (12.3% vs. 2.4% in 2007).  
13 The rate of term low birth weight for singleton babies has increased slightly over the period  
14 of 1993–2007, while the rate of term low birth weight for multiples has decreased over the  
15 same time period. (See Table Birth2b)
- 16     ○ Statistical note: Both the increase in the rate of term low birth weight for singleton  
17         babies and the decrease in the rate for multiple babies are statistically significant.  
18  
19  
20

# Health: Adverse Birth Outcomes

## Data Tables

Table Birth1: Percentage of babies born preterm, by race/ethnicity, 1993-2007

1993-2000								
	1993	1994	1995	1996	1997	1998	1999	2000
All races/ethnicities	11.0%	11.0%	11.0%	11.0%	11.4%	11.6%	11.8%	11.6%
White non-Hispanic	9.1%	9.3%	9.4%	9.5%	9.9%	10.2%	10.5%	10.4%
Black or African-American non-Hispanic	18.6%	18.2%	17.8%	17.5%	17.6%	17.6%	17.6%	17.4%
Asian or Pacific Islander non-Hispanic	10.0%	10.1%	9.9%	10.0%	10.2%	10.3%	10.4%	9.9%
American Indian or Alaska Native non-Hispanic	12.3%	12.0%	12.4%	11.9%	12.2%	12.2%	12.7%	12.6%
Hispanic	11.0%	10.9%	10.9%	10.9%	11.2%	11.4%	11.4%	11.2%
Mexican	10.6%	10.6%	10.6%	10.5%	10.8%	11.0%	11.1%	11.0%
Puerto Rican	13.3%	13.4%	13.4%	13.2%	13.7%	13.9%	13.7%	13.5%
Unknown ethnicity	10.1%	11.0%	10.5%	9.8%	10.7%	10.5%	10.5%	10.8%
2001-2007								
	2001	2002	2003	2004	2005	2006	2007	
All races/ethnicities	11.9%	12.1%	12.3%	12.5%	12.7%	12.8%	12.7%	
White non-Hispanic	10.8%	11.0%	11.3%	11.5%	11.7%	11.7%	11.5%	
Black or African-American non-Hispanic	17.6%	17.7%	17.8%	17.9%	18.4%	18.5%	18.3%	
Asian or Pacific Islander non-Hispanic	10.3%	10.4%	10.4%	10.5%	10.7%	10.9%	10.8%	
American Indian or Alaska Native non-Hispanic	13.2%	13.0%	13.5%	13.7%	14.2%	14.3%	14.1%	
Hispanic	11.4%	11.6%	11.8%	12.0%	12.1%	12.2%	12.3%	
Mexican	11.2%	11.4%	11.7%	11.8%	11.8%	11.8%	11.9%	
Puerto Rican	13.7%	14.0%	13.8%	14.0%	14.3%	14.4%	14.5%	
Unknown ethnicity	11.3%	11.2%	12.8%	12.8%	13.2%	13.1%	13.6%	

DATA: National Center for Health Statistics, National Vital Statistics System

## Health: Adverse Birth Outcomes

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**Table Birth1a. Percentage of babies born preterm, by mother's age, 1993-2007**

1993-2000								
	1993	1994	1995	1996	1997	1998	1999	2000
< 20 years	14.3%	14.2%	13.8%	13.6%	13.8%	14.0%	14.1%	13.9%
20-39 years	10.4%	10.5%	10.5%	10.5%	10.9%	11.2%	11.3%	11.2%
40+ years	13.2%	13.7%	13.7%	13.8%	14.4%	14.9%	15.2%	15.1%
2001-2007								
	2001	2002	2003	2004	2005	2006	2007	
< 20 years	14.1%	14.0%	14.3%	14.5%	14.7%	14.8%	14.6%	
20-39 years	11.6%	11.7%	12.0%	12.1%	12.4%	12.4%	12.3%	
40+ years	15.6%	16.0%	16.3%	16.6%	16.8%	17.0%	17.2%	

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DATA: National Center for Health Statistics, National Vital Statistics System

**Table Birth1b. Percentage of babies born preterm, by all births, singletons, and multiples, 1993-2007**

1993-2000								
	1993	1994	1995	1996	1997	1998	1999	2000
All births	11.0%	11.0%	11.0%	11.0%	11.4%	11.6%	11.8%	11.6%
Singletons	9.9%	9.9%	9.8%	9.7%	10.0%	10.1%	10.3%	10.1%
Multiples	53.1%	54.0%	54.6%	55.6%	57.3%	58.4%	59.4%	58.7%
2001-2007								
	2001	2002	2003	2004	2005	2006	2007	
All births	11.9%	12.1%	12.3%	12.5%	12.7%	12.8%	12.7%	
Singletons	10.4%	10.4%	10.6%	10.8%	11.0%	11.1%	11.0%	
Multiples	59.4%	60.1%	61.2%	61.4%	62.1%	61.9%	61.6%	

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DATA: National Center for Health Statistics, National Vital Statistics System

**Table Birth2: Percentage of babies born at term with low birth weight, by race/ethnicity, 1993-2007**

1993-2000								
	1993	1994	1995	1996	1997	1998	1999	2000
All races/ethnicities	2.6%	2.6%	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%
White non-Hispanic	2.1%	2.2%	2.2%	2.2%	2.2%	2.1%	2.1%	2.1%
Black or African-American non-Hispanic	4.6%	4.5%	4.5%	4.4%	4.3%	4.3%	4.3%	4.3%
Asian or Pacific Islander non-Hispanic	2.9%	3.0%	3.1%	3.1%	3.0%	3.1%	3.0%	3.1%

## Health: Adverse Birth Outcomes

1993-2000								
American Indian or Alaska Native non-Hispanic	2.4%	2.3%	2.3%	2.3%	2.3%	2.4%	2.4%	2.2%
Hispanic	2.4%	2.4%	2.3%	2.3%	2.4%	2.3%	2.3%	2.3%
Mexican	2.3%	2.2%	2.2%	2.2%	2.2%	2.2%	2.1%	2.2%
Puerto Rican	3.4%	3.2%	3.3%	3.3%	3.3%	3.4%	3.1%	3.2%
Unknown ethnicity	2.5%	2.6%	2.4%	2.4%	2.4%	2.2%	2.5%	2.2%
2001-2007								
	2001	2002	2003	2004	2005	2006	2007	
All races/ethnicities	2.5%	2.6%	2.6%	2.7%	2.7%	2.7%	2.7%	
White non-Hispanic	2.2%	2.2%	2.2%	2.3%	2.3%	2.3%	2.3%	
Black or African-American non-Hispanic	4.2%	4.3%	4.4%	4.5%	4.5%	4.5%	4.5%	
Asian or Pacific Islander non-Hispanic	3.1%	3.2%	3.2%	3.2%	3.2%	3.3%	3.2%	
American Indian or Alaska Native non-Hispanic	2.4%	2.4%	2.5%	2.6%	2.5%	2.5%	2.4%	
Hispanic	2.3%	2.3%	2.4%	2.4%	2.4%	2.5%	2.4%	
Mexican	2.2%	2.2%	2.2%	2.3%	2.3%	2.4%	2.2%	
Puerto Rican	3.2%	3.2%	3.4%	3.2%	3.3%	3.4%	3.4%	
Unknown ethnicity	2.2%	2.3%	2.5%	2.6%	2.3%	2.8%	2.9%	

DATA: National Center for Health Statistics, National Vital Statistics System

**Table Birth2a. Percentage of babies born at term with low birth weight, by mother's age, 1993-2007**

1993-2000								
	1993	1994	1995	1996	1997	1998	1999	2000
< 20 years	3.4%	3.5%	3.5%	3.6%	3.6%	3.5%	3.5%	3.5%
20-39 years	2.5%	2.5%	2.4%	2.5%	2.4%	2.4%	2.4%	2.4%
40+ years	2.9%	3.1%	3.1%	3.1%	3.1%	3.0%	3.1%	3.2%
2001-2007								
	2001	2002	2003	2004	2005	2006	2007	
< 20 years	3.5%	3.5%	3.6%	3.7%	3.7%	3.7%	3.6%	
20-39 years	2.4%	2.4%	2.5%	2.5%	2.5%	2.6%	2.6%	
40+ years	3.2%	3.2%	3.2%	3.4%	3.4%	3.4%	3.3%	

DATA: National Center for Health Statistics, National Vital Statistics System

## Health: Adverse Birth Outcomes

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1 Table Birth2b. Percentage of babies born at term with low birth weight, by all births,  
2 singletons, and multiples, 1993-2007  
3

1993-2000								
	1993	1994	1995	1996	1997	1998	1999	2000
All births	2.6%	2.6%	2.6%	2.6%	2.6%	2.5%	2.5%	2.5%
Singletons	2.3%	2.3%	2.3%	2.3%	2.3%	2.2%	2.2%	2.2%
Multiples	13.4%	13.0%	13.1%	13.0%	12.3%	12.1%	11.9%	12.0%
2001-2007								
	2001	2002	2003	2004	2005	2006	2007	
All births	2.5%	2.6%	2.6%	2.7%	2.7%	2.7%	2.7%	
Singletons	2.2%	2.3%	2.3%	2.3%	2.3%	2.4%	2.4%	
Multiples	12.2%	12.1%	12.0%	12.0%	12.0%	12.3%	12.3%	

4  
5 DATA: National Center for Health Statistics, National Vital Statistics System

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# Health: Adverse Birth Outcomes

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## 1 Metadata

2

Metadata for	<b>National Vital Statistics System (NVSS)</b>
Brief description of the data set	The National Vital Statistics System (NVSS) collects and disseminates data on births, deaths, marriages, divorces, and fetal deaths from vital event registration systems. The results of NVSS provide nearly complete data to track these vital statistics nationwide.
Who provides the data set?	Centers for Disease Control and Prevention, National Center for Health Statistics.
How are the data gathered?	Data are obtained from birth, death, marriage and divorce certificates collected by the various jurisdictions legally responsible for registration of these events.
What documentation is available describing data collection procedures?	See <a href="http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm">http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm</a> for user's guides by calendar year.
What types of data relevant for children's environmental health indicators are available from this database?	Births, deaths, marriages, and divorces. Demographic information. Cause of mortality. State and county (data prior to 2004 only). Births: birth order, period of gestation, method of delivery, birth weight, abnormal conditions of the newborn, congenital abnormalities.
What is the spatial representation of the database (national or other)?	Nearly complete national registration data have been collected since 1985. State and county locations are recorded until 2004.
Are raw data (individual measurements or survey responses) available?	Data for each calendar year are available for download and analysis from ( <a href="http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm">http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm</a> ) with records for each birth, death, marriage, or divorce certificate. Annual and monthly reports from the NVSS are available ( <a href="http://www.cdc.gov/nchs/nvss/nvss_products.htm">http://www.cdc.gov/nchs/nvss/nvss_products.htm</a> ). Raw NVSS data are also available from the National Bureau of Economic Research at <a href="http://www.nber.org/data/#demographic">http://www.nber.org/data/#demographic</a> . Personal identification data (e.g., names) is not available.
How are database files obtained?	Raw data: <a href="http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm">http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm</a> and <a href="http://www.nber.org/data/#demographic">http://www.nber.org/data/#demographic</a> . Queriable, less detailed data set including births, deaths, and fetal deaths, with broad response categories: CDC WONDER at <a href="http://wonder.cdc.gov">http://wonder.cdc.gov</a> . Prebuilt or user-built birth data tables are available at <a href="http://www.cdc.gov/nchs/VitalStats.htm">http://www.cdc.gov/nchs/VitalStats.htm</a> .
Are there any known data quality or data analysis concerns?	For approximately 0.5% of the birth records, the mother's race was not stated and in those cases the mother's race was statistically imputed. From 2003, some states allowed reporting of multiple races, and in those cases the multiple race was bridged to a primary race using statistical methods.
What documentation is available describing QA procedures?	See <a href="http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm">http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm</a> for user's guides by calendar year.
For what years are data	Online data: Births 1968-2007. Mortality multiple cause 1968-2007.

## Health: Adverse Birth Outcomes

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<b>Metadata for</b>	<b>National Vital Statistics System (NVSS)</b>
available?	Fetal death 1982-2005.
What is the frequency of data collection?	Continuous.
What is the frequency of data release?	Annually.
Are the data comparable across time and space?	Some response variables have response categories that have changed over time. Cause of mortality International Classification of Diseases coding systems have changed over time. Birth certificate categories changed between the 1989 and 2003 versions of the birth certificates.
Can the data be stratified by race/ethnicity, income, and location (region, state, county or other geographic unit)?	Race, ethnicity, State and county data are complete prior to 1989, contain county and city information only for counties with populations above 100,000 for 1989 to 2004, and contain no location information from 2005 forward. No income data.

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# Health: Adverse Birth Outcomes

1 **Methods**

2  
3 **Indicator**

4  
5 Birth1. Percentage of babies born preterm, by race/ethnicity, 1993-2007.  
6 Birth2. Percentage of babies born at term with low birth weight, by race/ethnicity, 1993-2007.

7  
8 **Summary**

9  
10 Since 1960, the National Center for Health Statistics, a division of the Centers for Disease  
11 Control and Prevention, has compiled birth certificate registration data from states and other U.S.  
12 jurisdictions. The National Vital Statistics System (NVSS) online database includes birth  
13 certificate data for virtually all U.S. births from 1968 to 2007. Indicator Birth1 uses the NVSS  
14 data from 1993 to 2007 to calculate the percentages of babies that are born preterm, defined as a  
15 period of gestation less than 37 completed weeks. Indicator Birth2 uses the NVSS data from  
16 1993 to 2007 to calculate the percentages of babies that are both born at term, defined as a period  
17 of gestation of at least 37 completed weeks, and have low birth weight, defined as a weight less  
18 than 2,500 grams (5 pounds, 8 ounces). Tabulated results give the percentages of preterm and  
19 term low birth weight babies by calendar year and maternal race/ethnicity. The supplementary  
20 tables Birth1a and Birth2a give the percentages of preterm and term low birth weight babies by  
21 calendar year and maternal age group (< 20, 20-39, and 40+). The supplementary tables Birth1b  
22 and Birth2b give the percentages of preterm and term low birth weight babies by calendar year  
23 and plurality (all, singleton, multiple).

24  
25 **Data Summary**

Indicator	Birth1. Percentage of babies born preterm, by race/ethnicity, 1993-2007. Birth2. Percentage of babies born at term with low birth weight, by race/ethnicity, 1993-2007.					
Time Period	1993-2007					
Data	U.S. birth certificates.					
Years (1993-1998)	1993	1994	1995	1996	1997	1998
Birth certificates	4,004,523	3,956,925	3,903,012	3,894,874	3,884,329	3,945,192
Missing gestation period	35,888	35,124	36,501	40,687	38,503	40,433
Missing gestation period and/or birth weight	39,074	38,026	38,897	43,321	40,810	43,045

## Health: Adverse Birth Outcomes

Indicator	Birth1. Percentage of babies born preterm, by race/ethnicity, 1993-2007. Birth2. Percentage of babies born at term with low birth weight, by race/ethnicity, 1993-2007.					
Years (1999-2004)	1999	2000	2001	2002	2003	2004
Birth certificates	3,963,465	4,063,823	4,031,531	4,027,376	4,096,092	4,118,907
Missing gestation period	42,987	43,392	39,874	41,295	43,883	43,047
Missing gestation period and/or birth weight	45,258	45,500	41,784	43,099	46,887	46,285
Years (2005-2006)	2005	2006	2007			
Birth certificates	4,145,619	4,273,225	4,324,008			
Missing gestation period	29,585	25,729	6,856			
Missing gestation period and/or birth weight	33,027	29,358	10,904			

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### Overview of Data Files

The following files are needed to calculate this indicator.

Birth data:

- NATLXXXX.DAT.Z, where XXXX denotes the four-digit year for years 1996 - 2006. Each file is a compressed file that when decompressed gives the national birth certificate data for a calendar year for births in the 50 U.S. states or Washington DC. The companion files with birth certificate data for U.S. territories were not used for these analyses. These files together with SAS code to extract and read these data files and convert them into SAS format were obtained from the National Bureau of Economic Research (NBER) at the url:  
<http://www.nber.org/data/vital-statistics-nativity-data.html>
- Natl2007us.zip. This file is a compressed file that when decompressed gives the national birth certificate data for the calendar year 2007 for births in 50 U.S. states and

## Health: Adverse Birth Outcomes

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1 Washington D.C. The SAS code to process 2006 year data was downloaded from NBER  
2 as described above and modified to process the 2007 year data contained in this file. This  
3 file was obtained from vital statistics data maintained online by the Centers for Disease  
4 Control and Prevention and available at the url:

5  
6 [http://www.cdc.gov/nchs/data\\_access/Vitalstatsonline.htm](http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm)  
7

8 The variables needed for this indicator are the calendar year, mother's age, mother's race,  
9 mother's ethnicity, length of gestation, plurality, and birth weight. The variable names and  
10 formats vary by year and are detailed below.  
11

### 12 13 **National Vital Statistics System (NVSS) Natality Data**

14  
15 The National Vital Statistics System (NVSS) is maintained by the National Center for Health  
16 Statistics, a division of the Centers for Disease Control and Prevention. The NVSS compiles  
17 national registration certificate data for births, deaths, marriages, divorces, and fetal deaths  
18 provided by various jurisdictions, including states. This indicator uses NVSS birth data to  
19 determine preterm and term low birth weight births.  
20

21 The Indicator Birth1 uses the gestation period variable GESTAT3 (GESTREC3 from 2003 to  
22 2007) coded as follows:  
23

- 24 • 1 = Under 37 weeks
- 25 • 2 = 37 weeks and over
- 26 • 3 = Not stated  
27

28 This variable is a recode of the variable DGESTAT (COMBGEST from 2003 to 2007)  
29 that ranges from 17 to 47 and provides the number of completed weeks of gestation of the  
30 mother. A preterm birth is defined as a birth with GESTAT3 = 1. Birth certificates with an  
31 unknown gestation period (GESTAT3 = 3) were excluded from the calculation of the Indicator  
32 Birth1.  
33

34 The Indicator Birth2 uses the gestation period variable GESTAT3 (GESTREC3 from 2003 to  
35 2007) and the birth weight variable BIRWT4 (BWTR4 for 2003 to 2007) coded as follows:  
36

- 37 • 1 = 1499 grams or less
- 38 • 2 = 1500 – 2499 grams
- 39 • 3 = 2500 grams or more
- 40 • 4 = Unknown or not stated  
41

42 This variable is a recode of the variable DBIRWT (DBWT for 2004 to 2007) that ranges from  
43 0227 to 8165 and gives the birth weight in grams. A term low birth weight birth has a gestation  
44 period of 37 or more completed weeks and a birth weight of less than 2,500 grams. Thus a term  
45 low birth weight birth is defined by GESTAT3 = 2 and BIRWT4 = 1 or 2 . Birth certificates with

## Health: Adverse Birth Outcomes

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1 an unknown gestation period (GESTAT3 = 3) and/or an unknown birth weight (BIRWT4 = 4)  
2 were excluded from the calculation of the Indicator Birth2.

3  
4 The birth plurality used the variable DPLURAL, coded as follows:

- 5
- 6 • 1 = Single
- 7 • 2 = Twin
- 8 • 3 = Triplet
- 9 • 4 = Quadruplet
- 10 • 5 = Quintuplet or higher
- 11

12 Singleton births are defined as births with DPLURAL = 1. Multiple births are defined as births  
13 with DPLURAL  $\geq$  2. In rare cases (e.g., 0.004 % of births in 2007) the plurality was not reported  
14 on the birth certificate and the value of DPLURAL was imputed to be 1 (singleton birth).

### 15 16 **Age, Race and Ethnicity**

17  
18 The mother's age, race, and ethnicity were obtained from each of the natality files and regrouped  
19 into categories, as follows:

#### 20 21 Years 1993–2002

- 22
- 23 ○ Mother's Age: The mother's age for 1993 to 2002 is characterized by the variable  
24 DMAGE. This variable ranges from 10 to 54 and gives the age of mother in single years.  
25 For these analysis, the following age groups for the mother were defined:  
26
  - 27 • Mother's age less than 20 years (DMAGE < 20);
  - 28 • Mother's age between 20 and 39 ( $20 \leq$  DMAGE < 40); and
  - 29 • Mother's age is 40 or greater (DMAGE  $\geq$  40).
- 30
- 31 ○ Mother's Race and Hispanic origin: The mother's race for 1993 to 2002 is characterized  
32 by the variable MRACE. MRACE is given the following values for the U.S. state and  
33 Washington DC data used for these analyses. For the years 1993 to 2002, multiple race  
34 responses were not available.
- 35

#### 36 MRACE

- 37
- 38 01 ... White
- 39 02 ... Black
- 40 03 ... American Indian (includes Aleuts and Eskimos)
- 41 04 ... Chinese
- 42 05 ... Japanese
- 43 06 ... Hawaiian (includes part-Hawaiian)
- 44 07 ... Filipino
- 45 18 ... Asian Indian



## Health: Adverse Birth Outcomes

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- 1 28 ... Korean
- 2 38 ... Samoan
- 3 48 ... Vietnamese
- 4 58 ... Guamanian
- 5 68 ... Other Asian or Pacific Islander in areas reporting codes 18-58
- 6 78 ... Combined other Asian or Pacific Islander, includes codes 18-68 for areas that do
- 7 not report them separately
- 8
- 9

10 The mother's Hispanic origin for 1993 to 2002 is characterized by the variable ORMOTH.  
11 ORMOTH assumes the following values:

12  
13 ORMOTH

- 14
- 15 0 ... Non-Hispanic
- 16 1 ... Mexican
- 17 2 ... Puerto Rican
- 18 3 ... Cuban
- 19 4 ... Central or South American
- 20 5 ... Other and unknown Hispanic
- 21 9 ... Origin unknown or not stated
- 22

23 Based on the above data, the following categories of the mother's race/ethnicity were defined:

- 24
- 25 • White non-Hispanic (MRACE = 1 and ORMOTH = 0);
- 26 • Black non-Hispanic (MRACE = 2 and ORMOTH = 0);
- 27 • American Indian/Alaskan Native (AIAN) non-Hispanic (MRACE = 3 and ORMOTH
- 28 =0);
- 29 • Asian or Pacific Islander (API) non-Hispanic (MRACE is 4, 5, 6, 7, 18, 28, 38, 48,
- 30 58, 68, or 78 and ORMOTH = 0);
- 31 • Hispanic Mexican American (ORMOTH = 1);
- 32 • Hispanic Puerto Rican (ORMOTH = 2);
- 33 • All Hispanic (ORMOTH = 1, 2, 3, 4, or 5); and
- 34 • Unknown ethnicity – (ORMOTH = 9).
- 35

36 In approximately 0.5% of the birth certificate records, the mother's race was not stated. In those  
37 cases, if the father's race was stated, then the father's race was used to impute the mother's race.  
38 Otherwise, the mother's race was imputed from the mother's race on the preceding record with a  
39 known mother's race. Thus a mother's race was assigned to all the records.

40  
41 Year 2003

- 42
- 43 ○ Mother's Age: The mother's age for the year 2003 is characterized by the variable
- 44 MAGER41. This variable is encoded as follows:
- 45

## Health: Adverse Birth Outcomes

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### 1 MAGER41

2  
3 01 = Under 15 years

4 02 = 15 years

5 03 = 16 years

6 04 = 17 years

7 ... ..

8 ... ..

9 39 = 52 years

10 40 = 53 years

11 41 = 54 years

- 12  
13 ○ For these analyses, the following age groups for the mother were defined:

- 14  
15 ● Mother's age less than 20 years ( $\text{MAGER41} < 7$ );  
16 ● Mother's age between 20 and 39 ( $7 \leq \text{MAGER41} < 27$ ); and  
17 ● Mother's age is 40 or greater ( $\text{MAGER41} \geq 27$ ).  
18

- 19  
20 ○ Mother's Race and Hispanic origin: The mother's race for the year 2003 is characterized  
21 by two variables MRACE and MBACE for the U.S. state and Washington DC data used  
22 for these analyses. MRACE is used for states and years where multiple race responses are  
23 not available, and MBACE is used for states and years where multiple race responses  
24 are available.  
25

### 26 MRACE

27  
28 01 ... White

29 02 ... Black

30 03 ... American Indian (includes Aleuts and Eskimos)

31 04 ... Chinese

32 05 ... Japanese

33 06 ... Hawaiian (includes part-Hawaiian)

34 07 ... Filipino

35 18 ... Asian Indian

36 28 ... Korean

37 38 ... Samoan

38 48 ... Vietnamese

39 58 ... Guamanian

40 68 ... Other Asian or Pacific Islander in areas reporting codes 18-58

41 78 ... Combined other Asian or Pacific Islander, includes codes 18-68 for areas that do  
42 not report them separately

43 Blank --- Not reported.  
44

## Health: Adverse Birth Outcomes

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1 Beginning in 2003, some states started allowing multiple race responses for birth records. For  
2 example, In 2007, multiple race was reported by California, Colorado, Delaware, Florida, Georgia  
3 (for births based on the revised certificate only, which was implemented after January 1), Idaho,  
4 Indiana, Iowa, Kansas, Kentucky, Michigan (for births at most facilities), Nebraska, New Hampshire,  
5 New York state (excluding New York City), North Dakota, Ohio, Pennsylvania, South Carolina,  
6 South Dakota, Tennessee, Texas, Vermont, Washington, and Wyoming, which used the 2003  
7 revision of the U.S. Standard Certificate of Live Birth, as well as Hawaii, Minnesota and Utah, which  
8 used the 1989 revision of the U.S. Standard Certificate of Live Birth. These 27 states accounted for  
9 57% of U.S. births in 2007 and reported 1.7% of mothers as multiracial, with levels varying from 1%  
10 (Texas) to 35% (Hawaii). In order to provide uniformity and comparability of data across the  
11 years, NVSS bridged the multiple-race data according to the combination of races, Hispanic  
12 origin, sex, and age indicated on the birth certificate of the mother or father to obtain a single  
13 race for each birth record reporting multiple races in the NVSS datasets. For such records, the  
14 single race or bridged multiple race was given by the variable MBRACE. MBRACE is given the  
15 following values:

16  
17 MBRACE

- 18
- 19 01 White – single race
- 20 02 Black – single race
- 21 03 American Indian / Alaskan Native – single race
- 22 04 Asian Indian – single race
- 23 05 Chinese – single race
- 24 06 Filipino – single race
- 25 07 Japanese – single race
- 26 08 Korean – single race
- 27 09 Vietnamese – single race
- 28 10 Other Asian – single race
- 29 11 Hawaiian – single race
- 30 12 Guamanian – single race
- 31 13 Samoan – single race
- 32 14 Other Pacific Islander – single race
- 33 21 White – bridged multiple race
- 34 22 Black – bridged multiple race
- 35 23 American Indian / Alaskan Native – bridged multiple race
- 36 24 Asian / Pacific Islander – bridged multiple race
- 37 Blank Not on certificate

38  
39 A new variable CRACE was created by combining the data from MRACE and MBRACE using  
40 the following logic. CRACE is equal to MRACE if MRACE is not a missing value. Otherwise,  
41 CRACE is equal to MBRACE.

42  
43 The mother's Hispanic origin for 2003 is characterized by the variable UMHISP. UMHISP  
44 assumes the following values:

45  
46 UMHISP

## Health: Adverse Birth Outcomes

---

- 1
- 2 0 ... Non-Hispanic
- 3 1 ... Mexican
- 4 2 ... Puerto Rican
- 5 3 ... Cuban
- 6 4 ... Central or South American
- 7 5 ... Other and unknown Hispanic
- 8 9 ... Origin unknown or not stated
- 9

10 Based on the above data, following categories of the mother's race/ethnicity were defined:

- 11
- 12 • White non-Hispanic (CRACE = 1 or 21 and UMHISP = 0);
- 13 • Black non-Hispanic (CRACE = 2 or 22 and UMHISP = 0);
- 14 • American Indian/Alaskan Native (AIAN) non-Hispanic (CRACE = 3 or 23 and
- 15 UMHISP = 0);
- 16 • Asian or Pacific Islander (API) non-Hispanic (CRACE is 4, 5, 6, 7, 8, 9, 10, 11, 12,
- 17 13, 14, 18, 24, 28, 38, 48, 58, 68, or 78 and UMHISP = 0);
- 18 • Hispanic Mexican American (UMHISP = 1);
- 19 • Hispanic Puerto Rican (UMHISP = 2);
- 20 • All Hispanic (UMHISP = 1, 2, 3, 4, or 5); and
- 21 • Unknown ethnicity (UMHISP = 9).
- 22

23 In approximately 0.5% of the birth certificate records, the mother's race was not stated. In those  
24 cases, if the father's race was stated, then the father's race was used to impute the mother's race.  
25 Otherwise, the mother's race was imputed from the mother's race on the preceding record with a  
26 known mother's race. Thus a mother's race was assigned to all the records.

### 27 Years 2004 – 2007

- 28
- 29
- 30 ○ Mother's Age: The mother's age for 2004 to 2007 is characterized by the variable
- 31 MAGER. This variable ranges from 10 – 54 and gives the age of mother in single years.
- 32 For these analysis, the following age groups for the mother were defined:
- 33
- 34 • Mother's age less than 20 years ( $MAGER < 20$ );
- 35 • Mother's age between 20 and 39 ( $20 \leq MAGER < 40$ ); and
- 36 • Mother's age is 40 or greater ( $MAGER \geq 40$ ).
- 37
- 38 ○ Mother's Race and Hispanic Origin: Just as for 2003, the mother's race and Hispanic
- 39 origin category are given by the variables MRACE or MBRACE, and UMHISP
- 40 respectively. The categories of the mother's race/ethnicity were defined exactly as for the
- 41 year 2003.
- 42

### 43 **Calculation of Indicator**

44

## Health: Adverse Birth Outcomes

---

1 For each demographic group, the percentage of preterm births was calculated as the number of  
2 preterm births divided by the total number of births:

$$\begin{aligned} & \text{Percentage of preterm births} = \\ & \text{Number of preterm births for mothers in group} / \text{Number of births with a stated gestation} \\ & \text{period for mothers in group} \times 100\% \end{aligned}$$

7  
8 For each demographic group, the percentage of term low birth weight births was calculated as  
9 the number of term low birth weight births divided by the total number of births:

$$\begin{aligned} & \text{Percentage of term low birth weight births} = \\ & \text{Number of low birth weight births at term for mothers in group} / \text{Number of births with a} \\ & \text{stated gestation period and a stated birth weight for mothers in group} \times 100\% \end{aligned}$$

### 15 **Questions and Comments**

16  
17 Questions regarding these methods, and suggestions to improve the description of the methods,  
18 are welcome. Please use the “Contact Us” link at the bottom of any page in the America’s  
19 Children and the Environment website.

### 21 **Statistical Comparisons**

22  
23 Statistical analyses of the percentages of preterm or term low birth weight babies were used to  
24 determine whether the differences between percentages for different demographic groups were  
25 statistically significant. Using a logistic regression model, the logarithm of the odds that a given  
26 baby is preterm or term low birth weight is assumed to be the sum of explanatory terms for the  
27 mother’s age group and/or race/ethnicity. The odds that a given baby is preterm is the probability  
28 that the baby is preterm divided by the probability that the baby is not preterm (similarly for term  
29 low birth weight). Thus if two demographic groups have similar (or equal) percentages of  
30 preterm or term low birth weight births, then they will also have similar (or equal) values for the  
31 logarithm of the odds. Using this model, the difference in the percentage between different  
32 demographic groups is statistically significant if the difference between the corresponding sums  
33 of explanatory terms is statistically significantly different from zero. The uncertainties of the  
34 regression coefficients were calculated using the SAS® (SAS Institute, Cary, North Carolina)  
35 statistical software GENMOD procedure and a binomial logistic model, treating the births for  
36 each demographic subgroup as a random sample of births. A p-value at or below 0.05 implies  
37 that the difference is statistically significant at the 5% significance level. No adjustment is made  
38 for multiple comparisons.

39  
40 For these statistical analyses we used six race/ethnicity groups: White non-Hispanic; Black non-  
41 Hispanic; Asian or Pacific Islander non-Hispanic; American Indian or Alaska Native non-  
42 Hispanic; Hispanic; Unknown ethnicity. In addition, for specific comparisons between the  
43 Mexican and Puerto Rican subgroups, we applied a similar statistical analysis to only the data  
44 from Mexican or Puerto Rican using two ethnicity groups: Mexican; Puerto Rican. We also used  
45 three age groups: < 20, 20-39, and 40+.

## Health: Adverse Birth Outcomes

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1 For each type of comparison, we present unadjusted and adjusted analyses. The unadjusted  
 2 analyses directly compare a percentage between different demographic groups. The adjusted  
 3 analyses add other explanatory variables to the statistical model and use the statistical model to  
 4 account for the possible confounding effects of these other variables. For example, the  
 5 unadjusted race/ethnicity comparisons use and compare the percentages between different  
 6 race/ethnicity pairs. The adjusted analyses add age terms to the statistical model and compare the  
 7 percentages between different race/ethnicity pairs after accounting for the effects of the age  
 8 group. For example, if White non-Hispanics tend to be older when they have babies compared to  
 9 Black non-Hispanics, and if the probability of preterm births strongly depends on the mother's  
 10 age only, then the unadjusted differences between these two race/ethnicity groups would be  
 11 significant but the adjusted difference (taking into account age) would not be significant.

12  
 13 Comparisons of the percentages of preterm and term low birth weight births between pairs of  
 14 race/ethnicity groups in the year 2007 are shown in Table 1. For the unadjusted comparisons, the  
 15 only explanatory variables are terms for each race/ethnicity group. For these unadjusted  
 16 comparisons, the statistical tests compare the percentage for each pair of race/ethnicity groups.  
 17 For the adjusted comparisons ("Adjusted for age"), the explanatory variables are terms for each  
 18 race/ethnicity group together with terms for each age group. For these adjusted comparisons, the  
 19 statistical test compares the pair of race/ethnicity groups after accounting for any differences in  
 20 the age distributions between the race/ethnicity groups.

21  
 22 Additional comparisons of the percentages of preterm and term low birth weight births are  
 23 shown in Table 2. The AGAINST = "age" unadjusted p-value compares the percentages for  
 24 different age groups in the year 2007. The adjusted p-value includes adjustment terms for  
 25 race/ethnicity in the model. The AGAINST = "year" p-value examines whether the linear trend  
 26 in the percentages is statistically significant; the adjusted model for trend adjusts for  
 27 demographic changes in the populations from year to year by including terms for age and  
 28 race/ethnicity. The p-values for AGAINST = "year" and specific values of SUBSET examine  
 29 whether the trend for that race/ethnicity or age group demographic subset is statistically  
 30 significant. The trend analyses are presented for the trend from 1993 to 2007. Overall trend  
 31 analyses are presented for all births, singleton births, and multiple births. To address an issue of  
 32 particular interest in the indicator, results of trend analysis for preterm births to Black non-  
 33 Hispanic mothers are also presented for 1993-2000 and 2000-2007.

34  
 35 For more details on these statistical analyses, see the memorandum by Cohen (2010).<sup>1</sup>

36  
 37 Table 1. Statistical significance tests comparing the percentages of preterm or term low birth  
 38 weight births between pairs of race/ethnicity groups for the year 2007.

39

Variable	RACE1	RACE2	P-VALUES	
			Unadjusted	Adjusted for age
Preterm	White non-Hispanic	Black non-Hispanic	< 0.0005	< 0.0005
Preterm	White non-Hispanic	AIAN non-Hispanic	< 0.0005	< 0.0005

---

<sup>1</sup> Cohen, J. 2010. *Selected statistical methods for testing for trends and comparing years or demographic groups in other ACE health-based indicators*. Memorandum submitted to Dan Axelrad, EPA, 5 November, 2010.

## Health: Adverse Birth Outcomes

Variable	RACE1	RACE2	P-VALUES	
			Unadjusted	Adjusted for age
Preterm	White non-Hispanic	API non-Hispanic	< 0.0005	< 0.0005
Preterm	White non-Hispanic	Hispanic	< 0.0005	< 0.0005
Preterm	White non-Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Preterm	Black non-Hispanic	AIAN non-Hispanic	< 0.0005	< 0.0005
Preterm	Black non-Hispanic	API non-Hispanic	< 0.0005	< 0.0005
Preterm	Black non-Hispanic	Hispanic	< 0.0005	< 0.0005
Preterm	Black non-Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Preterm	AIAN non-Hispanic	API non-Hispanic	< 0.0005	< 0.0005
Preterm	AIAN non-Hispanic	Hispanic	< 0.0005	< 0.0005
Preterm	AIAN non-Hispanic	Unknown ethnicity	0.059	0.048
Preterm	API non-Hispanic	Hispanic	< 0.0005	< 0.0005
Preterm	API non-Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Preterm	Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Preterm	Mexican	Puerto Rican	< 0.0005	< 0.0005
Term low birth weight	White non-Hispanic	Black non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	White non-Hispanic	AIAN non-Hispanic	0.250	0.746
Term low birth weight	White non-Hispanic	API non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	White non-Hispanic	Hispanic	0.001	0.270
Term low birth weight	White non-Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Term low birth weight	Black non-Hispanic	AIAN non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	Black non-Hispanic	API non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	Black non-Hispanic	Hispanic	< 0.0005	< 0.0005
Term low birth weight	Black non-Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Term low birth weight	AIAN non-Hispanic	API non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	AIAN non-Hispanic	Hispanic	0.713	0.955
Term low birth weight	AIAN non-Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Term low birth weight	API non-Hispanic	Hispanic	< 0.0005	< 0.0005
Term low birth weight	API non-Hispanic	Unknown ethnicity	0.012	0.002
Term low birth weight	Hispanic	Unknown ethnicity	< 0.0005	< 0.0005
Term low birth weight	Mexican	Puerto Rican	< 0.0005	< 0.0005

1  
2 Table 2. Other statistical significance tests comparing the percentage of preterm and term low  
3 birth weight births.  
4

Variable	From	To	Against	Subset	P-VALUES	
					Unadjusted	Adjusted*
Preterm	2007	2007	age		< 0.0005	< 0.0005
Preterm	2007	2007	race		< 0.0005	< 0.0005
Preterm	1993	2007	year		< 0.0005	< 0.0005
Preterm	1993	2007	year	White non-Hispanic	< 0.0005	< 0.0005
Preterm	1993	2007	year	Black non-Hispanic	< 0.0005	< 0.0005
Preterm	1993	2007	year	AIAN non-Hispanic	< 0.0005	< 0.0005
Preterm	1993	2007	year	API non-Hispanic	< 0.0005	< 0.0005
Preterm	1993	2007	year	Hispanic	< 0.0005	< 0.0005
Preterm	1993	2007	year	Unknown ethnicity	< 0.0005	< 0.0005

## Health: Adverse Birth Outcomes

Variable	From	To	Against	Subset	P-VALUES	
					Unadjusted	Adjusted*
Preterm	1993	2007	year	< 20	< 0.0005	< 0.0005
Preterm	1993	2007	year	20-39	< 0.0005	< 0.0005
Preterm	1993	2007	year	40+	< 0.0005	< 0.0005
Preterm	1993	2000	year	Black non-Hispanic	< 0.0005	< 0.0005
Preterm	2000	2007	year	Black non-Hispanic	< 0.0005	< 0.0005
Preterm	1993	2007	year	Singleton	< 0.0005	< 0.0005
Preterm	1993	2007	year	Multiple	< 0.0005	< 0.0005
Term low birth weight	2007	2007	age		< 0.0005	< 0.0005
Term low birth weight	2007	2007	race		< 0.0005	< 0.0005
Term low birth weight	1993	2007	year		< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	White non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	Black non-Hispanic	0.505	0.019
Term low birth weight	1993	2007	year	AIAN non-Hispanic	0.002	0.003
Term low birth weight	1993	2007	year	API non-Hispanic	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	Hispanic	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	Unknown ethnicity	0.016	0.028
Term low birth weight	1993	2007	year	< 20	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	20-39	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	40+	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	Singleton	< 0.0005	< 0.0005
Term low birth weight	1993	2007	year	Multiple	< 0.0005	< 0.0005

\*For AGAINST = "age," the p-values are adjusted for race/ethnicity.

For AGAINST = "year," the p-values are adjusted for age and race/ethnicity.

1  
2  
3  
4