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Disparities in Mortality Rates Among US Infants Born Late Preterm or Early Term, 2003–2005

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Abstract

The purpose of this study was to identify disparities in neonatal, post-neonatal, and overall infant mortality rates among infants born late preterm (34–36 weeks gestation) and early term (37–38 weeks gestation) by race/ethnicity, maternal age, and plurality. In analyses of 2003–2005 data from US period linked birth/infant death datasets, we compared infant mortality rates by race/ethnicity, maternal age, and plurality among infants born late preterm or early term and also determined the leading causes of death among these infants. Among infants born late preterm, infants born to American Indian/Alaskan Native, non-Hispanic black, or teenage mothers had the highest infant mortality rates per 1,000 live births (14.85,9.90, and 11.88 respectively). Among infants born early term, corresponding mortality rates were 5.69, 4.49, and 4.82, respectively. Among infants born late preterm, singletons had a higher infant mortality rate than twins (8.59 vs. 5.62), whereas among infants born early term, the rate was higher among twins (3.67 vs. 3.15). Congenital malformations and sudden infant death syndrome were the leading causes of death among both late preterm and early term infants. Infant mortality rates among infants born late preterm or early term varied substantially by maternal race/ ethnicity, maternal age, and plurality. Information about these disparities may help in the development of clinical practice and prevention strategies targeting infants at highest risk.

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The findings and conclusions in this paper are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Conflict of interest The authors have no conflict of interest to declare and have nothing to disclose.

Keywords

Infant mortality; Preterm infants; Disparities; Vital statistics

Introduction

In 2002, US infants born at 34–36 weeks gestation, often called “late preterm infants,” accounted for 74.4 % of all preterm births and 7.7 % of all singleton births [1]. Infants born late preterm have been found to have an infant mortality rate three times that of term infants (7.9 vs. 2.4 per 1,000 live births), to account for nearly 10 % of all infant deaths, and to be at greater risk for many neonatal complications than their term counterparts [2–7]. Neonatal complications include respiratory distress, hypothermia, hypoglycemia and jaundice [3, 4]. Although considered to be term infants, infants born after 37–38 weeks of gestation have a greater risk for morbidity and death than infants born after 39–40 weeks of gestation [8–11]. In part because of this greater risk, increasing interest exists in creating a subcategory for these infants called “early term” and assessing risks among them much as is already done for infants classified as “late preterm.” [8].

Disparities in infant mortality rates by race/ethnicity, maternal age and plurality are well established. When analyzing infants of all gestational ages together, rates have been found to be highest by race/ethnicity among infants born to non-Hispanic black and American Indian/ Alaskan Native mothers, highest by age among infants born to teenage mothers, and highest by plurality among infants who are twins or higher order multiples [5, 12–17]. However, the magnitude of these disparities specifically among infants born late preterm or early term has not been determined. Doing so may provide opportunities for targeted efforts to reduce infant mortality rates among those infants at highest risk and thereby also reduce overall infant mortality rates. Our main objective in this study was to identify disparities in neonatal, post-neonatal, and overall infant mortality rates among US infants born late preterm or early term by race/ethnicity, maternal age, and plurality.

Methods

Data Source

We analyzed data from the National Center for Health Statistics’ (NCHS), United States Period Linked Birth/ Infant Death Datasets for 2003–2005 [18]. The datasets include a file of all infants less than 1 year of age who died during a given calendar year (from which we drew the numerators for our mortality rate calculations), and a file of all infants born in the calendar year in which the deaths occurred (from which we drew the denominators).

Study Population

The potential study population consisted of all late preterm or early term live-born infants whose mothers resided in the United States at the time of their delivery. We defined late preterm as infants born at a gestational age recorded as 34, 35, or 36 weeks, and early term as infants born at a gestational age recorded as 37 or 38 weeks.

The NCHS edited gestational age reported in the public use data files, calculated primarily from the last menstrual period (LMP), was used for gestational age. Because LMP-based estimates of infant's gestational age at birth are subject to error because of factors such as maternal recall error, post-conception bleeding, and delayed ovulation, this estimate was then compared to the clinical/obstetric estimate also available in the public use data files. If the two estimates differed by more than 2 weeks, then the clinical/ obstetric estimate was used [19]. California did not report a clinical/obstetric estimate, so no births/deaths from California were included in this analysis [20–22]. Also excluded from this study were infants with missing birth weight or birth weight less than 500 g and infants with missing clinical or obstetric estimate of gestational age.

Study Measures

Maternal and Infant Characteristics—Maternal characteristics from the variables available on the 1989 revision of the US Certificate of Live Birth examined for this study included race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, Asian/Pacific Islander or American Indian/Alaskan Native), maternal age (< 20, 20–24, 25–29, 30–34 or ≥ 35 years of age), and parity (1, 2, 3, 4, 5, or ≥ 6). Infant characteristics examined were sex, plurality (singleton or twin), and birth weight (500–999, 1,000–1,499, 1,500–1,999, 2,000–2,499, or ≥2,500g).

Primary Outcome—The primary outcome was death among infants born late preterm or early term. We classified deaths that occurred during the infants' first 27 days of life as "neonatal death," deaths that occurred from 28 to 364 days of life as "post-neonatal death," and deaths that occurred anytime from 0 to 364 days of life as "infant deaths" [6, 17]. We then stratified results (neonatal, post-neonatal, and overall infant mortality rates) by the maternal race/ethnicity, maternal age, and plurality categories described above.

Analysis

Among the infants who died during infancy and met inclusion criteria for the study, we assessed differences in the frequency distributions of the maternal and infant characteristics (maternal race/ethnicity, age and parity and infant sex, plurality and birth weight) between infants born late preterm and infants born early term. Using Pearson χ^2 tests, we considered p values <0.05 to be indicative of statistical differences.

In our primary analysis, we calculated mortality rates by race/ethnicity, and maternal age only among singleton infants. However, because a higher proportion of infants born late preterm are from multiple gestations, we performed a sub-analysis comparing mortality rates among singleton infants with rates among twins. Because infants from multiple births involving more than one other sibling are at higher risk for infant death and likely to receive additional monitoring and medical intervention, we did not include them in this sub-analysis.

We compared infant mortality rates by maternal race/ ethnicity, maternal age and plurality using confidence intervals and z-tests according to NCHS methods [5, 14, 15]. In these

comparisons, non-Hispanic white infants, infants born to mothers aged 25–29 years, and singletons were the reference populations.

We also identified the three leading causes of death among infants in each of the previously described demographic categories. The cause of death categories were based on the 130 Selected Causes of Infant Death adapted for use by the Division of Vital Statistics. The 130 Selected Causes of Infant Death is a specialized list of causes of death affecting infants, created by grouping and recoding the ICD-10 codes indicated as the underlying cause of death, from which 71 rankable causes of death can be derived [23].

All statistical analyses were conducted with SAS statistical software version 9.2 (SAS Institute, Cary, NC). This study was reviewed by the Emory University Institutional Review Board, which classified it as non-human subjects research and exempt from further review.

Results

Distribution of Characteristics

During 2003–2005, 874,532 US infants were born late preterm and 3,164,489 infants were born early term and met the inclusion criteria for this study: 7,092 of those infants born late preterm and 10,007 of those infants born early term died during infancy. No difference was found in the distribution of race/ethnicity or gender between the late preterm infants and early term infants who died during infancy with over 50 % born to non-Hispanic white mothers and slightly over 50 % male (Table 1). Significant differences existed in the categories of plurality and birth weight. Twins constituted 11.6 % of deaths among late preterm infants and 3.9 % among early term infants. Among late preterm infant deaths, 34.0 % weighed 2,000–2,499 g at birth and 39.7 % weighed ≥ 2,500 g, whereas among early term infant deaths 15.6 % weighed 2000–2499 g at birth and 77.0 % weighed ≥ 2,500 g.

Mortality Rates by Race/ethnicity

Among infants born late preterm, the infant mortality rate per 1,000 live births was highest for infants born to American Indian/Alaskan Native mothers [(14.85, (6.75 during the neonatal period and 8.10 during the post-neonatal period))] (Table 2). All of these rates were significantly higher than corresponding rates among infants born to non-Hispanic white mothers (8.20, 4.43 and 3.77, respectively). The overall infant mortality rate (9.90) and post-neonatal mortality rate (5.39) among infants born to non-Hispanic black mothers were also significantly higher than the overall and post-neonatal rates among infants born to non-Hispanic white mothers. Only the post-neonatal mortality rate among infants born to Hispanic mothers was significantly lower than the corresponding rate for infants born to non-Hispanic white mothers.

Among early term infants, mortality rates were also significantly higher for infants born to American Indian/Alaskan Native [(5.69, 1.85 during the neonatal period and 3.84 during the post-neonatal period)] and black mothers (4.49, 1.36 and 3.13, respectively) than for infants born to white mothers (2.97,1.14 and 1.83, respectively) but the rates were only a third to a half as high as the rates for infants born late preterm (Table 3). Infants born to Asian/Pacific Islander mothers had significantly lower mortality rates (2.08, 0.91 and 1.17) than infants

born to white mothers while Hispanic mothers had significantly lower infant (2.61) and post-neonatal (1.55) rates but not neonatal rate.

Mortality Rates by Maternal Age

Among infants born late preterm the overall infant mortality rate and the post-neonatal mortality rate were highest for infants born to teenage mothers (11.88 and 6.77, respectively) and generally decreased with maternal age (Table 2). The neonatal mortality rates among infants born to teenage mothers (5.12) and infants born to mothers ≥35 years of age (5.23) were significantly higher than infants born to mothers aged 25–29 years (4.25). Among early term infants, all rates were significantly higher for infants born to mothers <24 years of age [<20 years: 4.82 overall (1.42 during the neonatal period and 3.40 during the post-neonatal period); 20–24 years: 4.22, 1.30 and 2.92, respectively] than for infants born to mothers 25–29 years of age (2.81, 1.11 and 1.70, respectively)], and the neonatal mortality rate was higher for infants born to mothers ≥35 years of age (1.26) than for infants born to mothers 25–29 years of age (Table 3).

Mortality Rates by Plurality

Among infants born late preterm, all mortality rates were significantly lower for twins [(5.62 overall, (2.33 during the neonatal period and 3.29 during the post-neonatal period))] than for singletons (8.59, 4.53 and 4.06, respectively) (Table 2). However, among early term infants, both the overall infant mortality rate and the neonatal mortality rate were significantly higher for twins (3.67 and 1.43, respectively vs. 3.15 and 1.17 for singletons) (Table 3).

Leading Causes of Death

In all categories of infants born late preterm, congenital anomalies were the most common cause of death and sudden infant death syndrome (SIDS) was the second most common (Table 4). Accidents were the third most common cause of death in all categories except infants born to Asian/Pacific Islander mothers and infants born to mothers ≥29 years of age, among whom diseases of the circulatory system were the third most common cause. The third most common causes of death among infants born to American Indian/Alaskan Native mothers were accidents and flu as they were each responsible for the same number of deaths among those infants.

Among infants born early term, congenital anomalies were the most common cause of death and SIDS was the second most common in all categories of infants except infants born to teenage mothers, for whom these two causes were reversed (Table 5). Accidents were the third most common cause of death in all categories of infants except infants born to mothers ≥35 years of age, for whom accidents were tied with diseases of the circulatory system.

Discussion

In general, we found disparities in infant mortality rates by race/ethnicity and maternal age that mirrored disparities found in previous studies among infants across all gestational ages [5, 12–15, 17]. Our finding that infant mortality rates among late preterm infants were higher for singletons than twins is inconsistent with studies that compare births of all

gestational ages [5], but consistent with findings from previous studies comparing infants of similar gestation [24,25]. So, while twin infants born extremely preterm (<25 weeks) and term (>37 weeks) have higher rates of mortality compared to singletons born extremely preterm and term, this association is reversed for infants born late preterm [24, 25].

Nationally, gestational age distributions for twins and singletons differ; twins are more likely to be born late preterm and singletons at term. However, twins are also more likely to deliver before 34 weeks gestation than their singleton counterparts [26, 27], and these infants born very preterm have higher mortality risks than infants born late preterm. The increase in the percentage of preterm and late preterm births during the 1990s and early 2000s, particularly among singletons, is often explained by higher rates of obstetric intervention resulting from maternal or fetal complications [1, 28, 29]. Thus, twins reaching late preterm delivery may be healthier than their singleton counterparts who may be more likely to deliver late preterm due to complications.

Mortality rates generally decreased with increasing maternal age up to 35 years. The greater risk for death among children of mothers aged 35 or older is largely attributable to many leading causes of neonatal death, including complications of birth and congenital anomalies being more common among children of older mothers [30, 31].

In previous studies of the causes of infant death, Tom-ashek et al. [6] found that the three leading causes of death among late preterm US infants were congenital anomalies, SIDS, and accidents and Reddy et al. [11] similarly found that the leading causes among early term infants were birth defects, SIDS and accidents. Our results were consistent with both of these findings.

This study is the first of which we are aware to assess disparities in infant mortality rates among infants born late preterm or early term. A major strength of this study was the large size of our study population which allowed us to calculate statistically reliable infant mortality rates for specific subgroups of US infants. One potential limitation of our study was our exclusion of infants born in California because clinical or obstetric estimates of infants' gestational age at birth were not reported on California birth certificates during the study period. Although, LMP-based estimates of infant's gestational age at birth provided in the dataset are subject to error because of factors such as maternal recall error, post-conception bleeding, and delayed ovulation, the validity of the clinical or obstetric estimate reported on birth certificates has not been sufficiently evaluated [19]. Therefore, to assess the extent to which excluding infants born in California may have affected our results we repeated our analysis including infants born in California and using the NCHS edited gestational age reported in the public use data files, which is calculated from the estimated date of a woman's last menstrual period (LMP) except when information on LMP is missing or when the infant's birth weight is incongruent with the LMP based estimate of gestational age [20–22]. In general, the mortality rates we calculated using this measure of gestational age were slightly higher than the rates we calculated using clinical or obstetric gestational age estimates as a correction for error in the LMP based estimate, but disparities in rates by race/ethnicity, maternal age and plurality were similar (data not shown).

Although we were able to calculate adjusted infant mortality rates by gestational age and timing of death specific to different categories of race/ethnicity, maternal age and plurality, small numbers of deaths precluded further stratified analyses. Given the disparities in gestational age-specific infant mortality rates, future investigations should seek to understand reasons for early delivery whether by obstetric intervention or spontaneous delivery [32]. Indications for early delivery are complex and relate to maternal and fetal complications or pathology.

Conclusions

The disparities we observed in post-neonatal death rates are of particular concern, especially because SIDS and accidents (unintentional injuries) were among the three leading causes of post-neonatal deaths. Risk for SIDS and sleep-related accidental suffocation may be reduced if recommendations for safe infant sleep practices are followed [33]. Additionally, as congenital anomalies were the most common cause of infant death in nearly all categories, promotion of preconception heath and health care use for expectant mothers is crucial to attempt reductions in known risk factors for birth defects.

With the increase in late preterm birth, positive decreases in stillbirth and perinatal mortality have been seen [32]. However, our results indicated that more can still be done to address disparities in mortality rates among late preterm and early term infants. Knowledge of disparities in infant mortality rates among late preterm and early term infants can help health officials devise interventions that target infants at relatively high risk and thus help reduce overall infant mortality rates.

Abbreviations

LMP	Last menstrual period
NCHS	National center for health statistics
SIDS	Sudden infant death syndrome

References

1. Davidoff MJ, Dias T, Damus K, Russell R, Bettegowda VR, Dolan S, et al. Changes in the gestational age distribution among US singleton births: Impact on rates of late preterm birth to 2002. Seminars in Perinatology. 1992; 2006(30):8–15.
2. Bastek JA, Sammel MD, Pare E, Srinivas SK, Posen-cheg MA, Elovitz MA. Adverse neonatal outcomes: examining the risks between preterm, late preterm, and term infants. American Journal of Obstetrics and Gynecology. 2008; 199(367):e1–e8. [PubMed: 18928976]
3. Wang ML, Dorer DJ, Fleming MP, Catlin EA. Clinical outcomes of near-term infants. Pediatrics. 2004; 114:372–376. [PubMed: 15286219]
4. Mclntire DD, Leveno KJ. Neonatal mortality and morbidity rates in late preterm births compared with births at term. Obstetrics and Gynecology. 2008; 111:35–41. [PubMed: 18165390]
5. Mathews TJ, MacDorman MF. Infant mortality statistics from the 2005 period linked birth/infant death data set. National Vital Statistics Reports. 2008; 57(2):1–32. [PubMed: 18972721]
6. Tomashek KM, Shapiro-Mendoza CK, Davidoff MJ, Petrini JR. Differences in mortality between late-pre-term and term singleton infants in the United States, 1995–2002. Journal of Pediatrics. 2007; 151:450–456. [PubMed: 17961684]

7. Shapiro-Mendoza CK, Tomashek KM, Kotelchuck M, Barfield W, Nannini A, Weiss J, et al. Effect of late-preterm birth and maternal medical conditions on newborn morbidity risk. Pediatrics. 2008; 121:e223–e232. [PubMed: 18245397]
8. Fleischman AR, Oinuma M, Clark SL. Rethinking the definition of “term pregnancy”. Obstetrics and Gynecology. 2010; 116:136–139. [PubMed: 20567179]
9. Bates E, Rouse DJ, Mann ML, Chapman V, Carlo WA, Tita AT. Neonatal outcomes after demonstrated fetal lung maturity before 39 weeks of gestation. Obstetrics and Gynecology. 2010; 116:1288–1295. [PubMed: 21099593]
10. Reddy UM, Ko CW, &Willinger M. ‘Early’term births (37–38 weeks) are associated with increased mortality. American Journal of Obstetrics and Gynecology. 2006; 195(6 Suppl 1):S202.
11. Reddy UM, Bettegowda VR, Dias T, Yamada-Kushnir T, Ko CW, Willinger M. Term pregnancy: A period of heterogeneous risk for infant mortality. Obstetrics and Gynecology. 2011; 117:1279–1287. [PubMed: 21606738]
12. Sappenfield WM, Buehler JW, Binkin NJ, Hogue CJ, Strauss LT, Smith JC. Differences in neonatal and postneonatal mortality by race, birth weight, and gestational age. Public Health Reports. 1987; 102:182–192. [PubMed: 3104975]
13. Phipps MG, Blume JD, DeMonner SM. Young maternal age associated with increased risk of postneonatal death. Obstetrics and Gynecology. 2002; 100:481–486. [PubMed: 12220767]
14. Mathews TJ, MacDorman MF. Infant mortality statistics from the 2004 period linked birth/infant death data set. National Vital Statistics Reports. 2007; 55(14):1–32. [PubMed: 17569269]
15. Mathews TJ, MacDorman MF. Infant mortality statistics from the 2003 period linked birth/infant death data set. National Vital Statistics Reports. 2006; 54(16):1–29. [PubMed: 16711376]
16. Kitsantas P, Gaffney KF. Racial/ethnic disparities in infant mortality. Journal of Perinatal Medicine. 2010; 38:87–94. [PubMed: 20047527]
17. Tomashek KM, Qin C, Hsia J, Iyasu S, Barfield WD, Flowers LM. Infant mortality trends and differences between American Indian/Alaska Native infants and white infants in the United States, 1989–1991 and 1998–2000. American Journal of Public Health. 2006; 96:2222–2227. [PubMed: 17077400]
18. National Center for Health Statistics. Public use data file. 2003–2005 period linked birth/infant death dataset [Internet]. Hyattsville (MD): Centers for disease control and prevention, US Department of Health and Human Services; c2007 Available from: http://www.cdc.gov/nchs/data_access/Vitalstatsonline.htm [[cited 2009 Jan 22]]
19. Qin C, Dietz PM, England LJ, Martin JA, Callaghan WM. Effects of different data-editing methods on trends in race-specific preterm delivery rates, United States, 1990–2002. Paediatric and Perinatal Epidemiology. 2007; 2i(Suppl 2):41–49. [PubMed: 17803617]
20. National Center for Health Statistics. Detailed technical notes to the United States 2005 data-natality [Internet]. Hyattsville (MD): National Center for Health Statistics; 2008 Available from: http://wonder.cdc.gov/wonder/sci_data/natal/detail/type_txt/natal05/TechAppendix05.pdf [[cited 2009 Jan 22]]
21. National Center for Health Statistics. Technical appendix. Vital statistics of the United States, 2004, vol I natality [Internet]. Hyattsville (MD): National center for health statistics; Available from: http://www.cdc.gov/nchs/births.htm [[cited 2009 Jan 22]]
22. National Center for Health Statistics. Technical appendix. Vital statistics of the United States, 2003, vol I natality [Internet]. Hyattsville (MD): National Center for Health Statistics; Available from: http://www.cdc.gov/nchs/data/TechApp03_l-09.pdf [[cited 2009 Jan 22]]
23. Heron M. Deaths: leading causes for 2004. National Vital Statistics Reports. 2007; 56(5):1–95. [PubMed: 18092547]
24. Luke B, Brown MB. The changing risk of infant mortality by gestation, plurality, and race: 1989–1991 versus 1999–2001. Pediatrics. 2006; 118:2488–2497. [PubMed: 17142535]
25. Luke B, Brown MB. The effect of plurality and gestation on the prevention or postponement of infant mortality: 1989–1991 versus 1999ŕ2001. Twin Research and Human Genetics. 2007; 10:514–520. [PubMed: 17564510]
26. Raju TN. Epidemiology of late preterm (near-term) births. Clinics in Perinatology. 2006; 33:751–763. [PubMed: 17148002]

27. Lee YM, Cleary-Goldman J, D'Alton ME. The impact of multiple gestations on late preterm (near-term) births. Clinics in Perinatology. 2006; 33:777–792. [PubMed: 17148004]
28. Ananth CV, Joseph KS, Oyelese Y, Demissie K, Vintzileos AM. Trends in preterm birth and perinatal mortality among singletons: United States, 1989 through 2000. Obstetrics and Gynecology. 2005; 105(5 Pt 1):1084–1091. [PubMed: 15863548]
29. Demissie K, Rhoads GG, Ananth CV, Alexander GR, Kramer MS, Kogan MD, et al. Trends in preterm birth and neonatal mortality among blacks and whites in the United States from 1989 to 1997. American Journal of Epidemiology. 2001; 154:307–315. [PubMed: 11495853]
30. Hollier LM, Leveno KJ, Kelly MA, MC DD, Cunningham FG. Maternal age and malformations in singleton births. Obstetrics and Gynecology. 2000; 96(5 Pt 1):701–706. [PubMed: 11042304]
31. Hansen JP. Older maternal age and pregnancy outcome: A review of the literature. Obstetrical and Gynecological Survey. 1986; 41:726–742. [PubMed: 2950347]
32. Ananth CV, Gyamfi C, Jain L. Characterizing risk profiles of infants who are delivered at late preterm gestations: does it matter? American Journal of Obstetrics and Gynecology. 2008; 199:329–331. [PubMed: 18928971]
33. Moon RY. SIDS and other sleep-related infant deaths: expansion of recommendations for a safe infant sleeping environment. Pediatrics. 2011; 128:1030–1039. [PubMed: 22007004]

Table 1

Distribution of select characteristics among infants born late preterm or early term who died during infancy, United States, 2003–2005

Characteristics	Late preterm (n = 7,092) %	Early term (n = 10,007) %	*p* value
Maternal			
Race/ethnicity			0.11
Non-Hispanic white	54.4	56.4	
Non-Hispanic black	23.2	22.7	
Hispanic	16.4	15.3	
Asian/Pacific Islander	3.2	2.8	
American Indian/Alaskan Native	1.9	1.8	
Age (years)			<0.0001
<20	15.6	14.5	
20–24	30.3	33.4	
25–29	22.8	23.9	
30–34	17.4	16.2	
≥35	13.9	12.0	
Parity			<0.0001
1	32.9	30.0	
2	29.3	32.7	
3	19.2	20.4	
4	9.4	9.5	
5	4.2	3.8	
≥6	4.3	3.3	
Infant			
Sex			0.66
Male	56.9	56.6	
Female	43.1	43.4	
Plurality			<0.0001
Singleton	88.8	96.2	
Twin	11.2	3.9	
Birth weight (g)			<0.0001
500–999	1.3	0.3	
1,000–1,499	5.6	1.6	
1,500–1,999	19.3	5.6	
2,000–2,499	34.0	15.6	
≥2,500	39.9	77.0	

Percentages may not sum to 100 in each of the groups because of unknown or not stated data

Births in California, those with birthweight <500 g, and multiples greater than twin are excluded

Table 2

Infant, neonatal, and post-neonatal mortality rates among late preterm, live born US infants by maternal race/ethnicity[a], maternal age[a] and plurality, 2003–2005

	Number of live births	Number of infant deaths			Mortality rate per 1,000 live births		
		All	Neonatal	Post-neonatal	Infant	Neonatal	Post-neonatal
Race/ethnicity[a]							
Non Hispanic white	412,719	3,385	1,830	1,555	*8.20*	*4.43*	*3.77*
Non Hispanic black	147,124	1,456	663	793	9.90†	4.51	5.39†
Hispanic	132,613	1,063	614	449	8.02	4.63	3.39†
Asian/Pacific Islander	27,809	215	122	93	7.73	4.39	3.34
American Indian/Alaskan Native	8,146	121	55	66	14.85†	6.75†	8.10†
Maternal Age (years)[a]							
<20	86,757	1,031	444	587	11.88†	5.12†	6.77†
20–24	192,200	1,900	886	1,014	9.89†	4.61	5.28†
25–29	186,784	1,414	794	620	*7.57*	*4.25*	*3.32*
30–34	158,718	1,076	631	445	6.78†	3.98	2.80†
≥35	108,619	878	568	310	8.08	5.23†	2.85†
Plurality							
Singleton	733,079	6,299	3,323	2,976	*8.59*	*4.53*	*4.06*
Twins	141,454	793	329	464	5.62†	2.33†	3.28†

Italicized group is referent for each category

[a]Singletons only

†Significantly different from referent rate from *z*-test using NCHS methods

Table 3

Infant, neonatal, and post-neonatal mortality rates among early term, live born US infants by maternal race/ethnicity[a], maternal age[a] and plurality, 2003–2005

	Number of live births	Number of infant deaths			Mortality rate per 1,000 live births		
		All	Neonatal	Post-neonatal	Infant	Neonatal	Post-neonatal
Race/ethnicity[a]							
Non Hispanic white	1,823,200	5,417	2,087	3,330	*2.97*	*1.14*	*1.83*
Non Hispanic black	484,060	2,172	656	1,516	4.49†	1.36†	3.13†
Hispanic	570,388	1,490	605	885	2.61†	1.06	1.55†
Asian/Pacific Islander	131,490	273	119	154	2.08†	0.91†	1.17†
American Indian/Alaskan Native	31,810	181	59	122	5.69†	1.85†	3.84†
Maternal Age (years)[a]							
<20	294,026	1,418	417	1,001	4.82†	1.42†	3.40†
20–24	762,512	3,219	989	2,230	4.22†	1.30†	2.92†
25–29	824,021	2,315	913	1,402	*2.81*	*1.11*	*1.70*
30–34	728,229	1,542	683	859	2.12†	0.94†	1.18†
≥35	450,666	1,128	570	558	2.50†	1.26†	1.24†
Plurality							
Singleton	3,059,454	9,622	3,572	6,050	*3.15*	*1.17*	*1.98*
Twins	105,035	385	150	235	3.67†	1.43†	2.24

Italicized group is referent for each category

[a] Singletons only

† Significantly different from referent rate from *z*-test using NCHS methods

Table 4

Leading causes of infant deaths among late preterm US infants by maternal race/ethnicity[a], maternal age[a] and plurality, 2003–2005

	# of deaths	% of deaths	Cause of death (130 selected causes of infant death codes)
Maternal race/ethnicity[a]			
Non-Hispanic white	1,531	45.2	Congenital anomalies (Q00-Q99)[†]
	436	12.9	Sudden infant death syndrome (R95)
	173	5.1	Accidents (unintentional injuries) (V01-X59)
Non-Hispanic black	486	33.4	Congenital anomalies (Q00-Q99)[†]
	231	15.9	Sudden infant death syndrome (R95)
	84	5.8	Accidents (unintentional injuries) (V01-X59)
Hispanic	575	54.1	Congenital anomalies (Q00-Q99)[†]
	70	6.6	Sudden infant death syndrome (R95)
	36	3.4	Accidents (unintentional injuries) (V01-X59)
Asian/Pacific Islander	115	53.5	Congenital anomalies (Q00-Q99)[†]
	14	6.5	Sudden infant death syndrome (R95)
	8	3.7	Diseases of the circulatory system (I00–I99)
American Indian/Alaskan Native	49	40.5	Congenital anomalies (Q00-Q99)[†]
	15	12.4	Sudden infant death syndrome (R95)
	6	5.0	Accidents (unintentional injuries) (V01-X59)
	6	5.0	Flu/pneumonia (J10-J18)
Maternal age (in yearsf)[a]			
<20	355	34.4	Congenital anomalies (Q00-Q99)[†]
	163	15.8	Sudden infant death syndrome (R95)
	77	7.5	Accidents (unintentional injuries) (V01-X59)
20–24	706	37.2	Congenital anomalies (Q00-Q99)[†]
	316	16.6	Sudden infant death syndrome (R95)
	119	6.3	Accidents (unintentional injuries) (V01-X59)
25–29	654	46.3	Congenital anomalies (Q00-Q99)[†]
	155	11.0	Sudden infant death syndrome (R95)
	63	4.5	Accidents (unintentional injuries) (V01-X59)
30–34	551	51.2	Congenital anomalies (Q00-Q99)[†]
	87	8.1	Sudden infant death syndrome (R95)
	40	3.7	Diseases of the circulatory system (I00–I99)
≥35	512	58.3	Congenital anomalies (Q00-Q99)[†]
	51	5.8	Sudden infant death syndrome (R95)
	30	3.4	Diseases of the circulatory system (I00–I99)
Plurality			
Singletons	2,969	43.4	Congenital anomalies (Q00-Q99)[†]
	839	12.3	Sudden infant death syndrome (R95)

	# of deaths	% of deaths	Cause of death (130 selected causes of infant death codes)
Twins	344	5.0	Accidents (unintentional injuries) (V01-X59)
	265	33.3	Congenital anomalies (Q00-Q99)[†]
	150	18.9	Sudden infant death syndrome (R95)
	60	7.6	Accidents (unintentional injuries) (V01-X59)

[a] Singletons only

[†] Code represents congenital malformations, deformations, and chromosomal abnormalities

Table 5

Leading causes of infant mortality among early term US infants by maternal race/ethnicity[a], maternal age[a] and plurality, 2003–2005

	# of deaths	% of deaths	Cause of death (130 selected causes of infant death codes)
Maternal race/ethnicity[a]			
Non-Hispanic white	1,821	33.6	Congenital anomalies (Q00-Q99)[†]
	1,071	19.8	Sudden infant death syndrome (R95)
	477	8.8	Accidents (unintentional injuries) (V01-X59)
Non-Hispanic black	593	27.3	Congenital anomalies (Q00-Q99)[†]
	490	22.6	Sudden infant death syndrome (R95)
	215	9.9	Accidents (unintentional injuries) (V01-X59)
Hispanic	578	38.8	Congenital anomalies (Q00-Q99)[†]
	192	12.9	Sudden infant death syndrome (R95)
	104	7.0	Accidents (unintentional injuries) (V01-X59)
Asian/Pacific Islander	95	34.8	Congenital anomalies (Q00-Q99)[†]
	42	15.4	Sudden infant death syndrome (R95)
	17	6.2	Accidents (unintentional injuries) (V01-X59)
American Indian/Alaskan Native	53	29.3	Congenital anomalies (Q00-Q99)[†]
	35	19.3	Sudden infant death syndrome (R95)
	13	7.2	Accidents (unintentional injuries) (V01-X59)
Maternal age (in yearsf)[a]			
<20	344	24.3	Sudden infant death syndrome (R95)
	318	22.4	Congenital anomalies (Q00-Q99)[†]
	164	11.6	Accidents (unintentional injuries) (V01-X59)
20–24	822	25.5	Congenital anomalies (Q00-Q99)[†]
	780	24.2	Sudden infant death syndrome (R95)
	344	10.7	Accidents (unintentional injuries) (V01-X59)
25–29	801	34.6	Congenital anomalies (Q00-Q99)[†]
	420	18.1	Sudden infant death syndrome (R95)
	187	8.1	Accidents (unintentional injuries) (V01-X59)
30–34	673	43.6	Congenital anomalies (Q00-Q99)[†]
	191	12.4	Sudden infant death syndrome (R95)
	97	6.3	Accidents (unintentional injuries) (V01-X59)
≥35	552	48.9	Congenital anomalies (Q00-Q99)[†]
	109	9.7	Sudden infant death syndrome (R95)
	44	3.9	Diseases of the circulatory system (I00–I99)
	44	3.9	Accidents (unintentional injuries) (V01-X59)
Plurality			
Singletons	3,166	32.9	Congenital anomalies (Q00-Q99)[†]
	1,844	19.2	Sudden infant death syndrome (R95)

	# of deaths	% of deaths	Cause of death (130 selected causes of infant death codes)
Twins	836	8.7	Accidents (unintentional injuries) (V01-X59)
	114	29.6	Congenital anomalies (Q00-Q99)[†]
	76	19.7	Sudden infant death syndrome (R95)
	43	11.2	Accidents (unintentional injuries) (V01-X59)

[a] Singletons only

[†] Code represents congenital malformations, deformations, and chromosomal abnormalities