

Infant Mortality

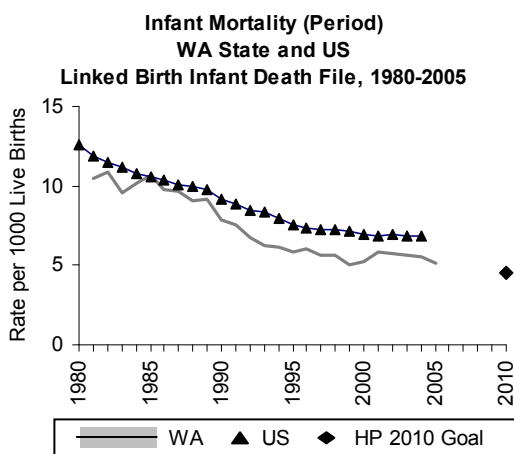
Definition: Death of a child younger than one year old. These deaths are often divided into two groupings: neonatal mortality (death of an infant within the first 27 days of life) and postneonatal mortality (death of an infant 28 – 364 days old). Period rates are the number of deaths in a given period per 1,000 live births in the same period.

Summary

Infant mortality is associated with maternal health, quality of and access to medical care, socioeconomic conditions, and public health practice.¹ In 2005, 420 Washington State children died in their first year of life. The state infant mortality rate for that year was 5.1 per 1,000 live births, compared to a 2004 national rate of 6.8 per 1,000. In Washington, black and American Indian and Alaska Native infants experience twice the infant mortality of other racial and ethnic groups, as they do nationally.

Time Trends

Washington's infant mortality rate has steadily declined since 1980, as has the national rate. The majority of this decrease occurred during 1980–1995, when the rate dropped from 11.8 to 5.8 deaths per 1,000 live births. Since then the rate of decrease has slowed. The rate was 5.1 in 2005.



The leading causes of infant death in Washington for 2003–2005 combined were birth defects, Sudden Infant Death Syndrome (SIDS), and preterm birth. Studies suggest that the

decrease in infant mortality over the past 25 years is attributable to technological advances in neonatal medicine, use of regionalized care systems, advances in prenatal diagnosis of severe birth defects, selected termination of affected pregnancies, and improved treatment of some birth defects.^{1, 2, 3}

Year 2010 Goals

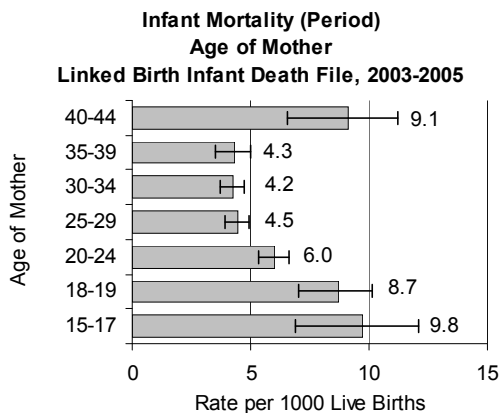
The national *Healthy People 2010* objective is to reduce infant mortality to no more than 4.5 deaths per 1,000 live births. Despite decreases in infant mortality, if the current trend continues, Washington will not meet the national objective.

Geographic Variation

In most Washington counties, fewer than 20 infants died during 2003–2005, and mortality rates for these counties fluctuate considerably even when combining three years. Therefore, county data are not reported here. County-level information on infant mortality is available at http://www.doh.wa.gov/ehsphi/chs/chs-data/infdeath/inf_VD.htm.

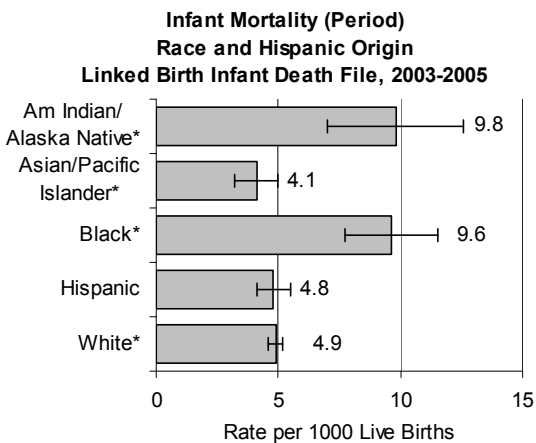
Age of Mother

In Washington from 2003–2005, babies born to mothers younger than 20 or older than 40 had significantly higher infant mortality rates than babies born to mothers ages 20–39. Because of the small numbers of deaths in specific age and race categories, it is not possible to determine whether this relationship holds for all racial groups and for infants of Hispanic origin.



Race and Hispanic Origin

According to Washington vital statistics data for 2003–2005, American Indians and Alaska Natives experienced an infant mortality rate of 9.8 per 1,000, and blacks experienced a rate of 9.6 per 1,000. Infant mortality rates were lowest for babies born to Asians and Pacific Islander women (4.1). While the mortality rate for infants born to black mothers has declined, it remains almost twice as high as the white rate (4.9). The mortality rate for American Indian and Alaska Native infants is also twice the white rate. Nationally, infant mortality among American Indians and Alaska Natives has been increasing since the early 1990s.⁴



* Non-Hispanic

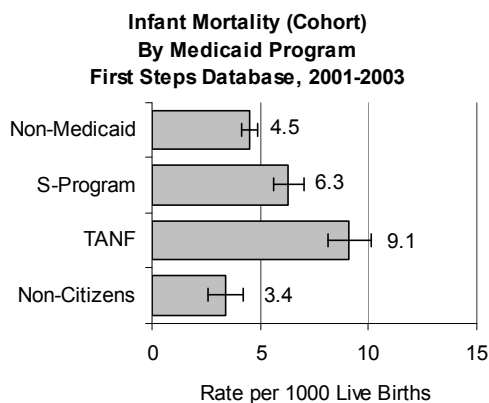
A national report using 2001–2003 data showed that Washington’s race-specific infant death rates were much better than the nation’s for blacks and slightly better than the nation’s for whites, Asians and Pacific Islanders, and babies of Hispanic origin. But they were worse than the nation’s for American Indians and Alaska Natives.⁵

Income

Research continues to associate lower maternal income with higher infant mortality rates. Medicaid coverage of prenatal care and delivery and receipt of welfare (Temporary Assistance for Needy Families—TANF) can be used as indicators of low income.

For 2001–2003, the cohort infant mortality rate for infants of low-income mothers receiving Medicaid and TANF was 9.1 deaths per 1,000 live births. Mothers of those infants generally had family incomes less than 50% of the federal poverty level. Among mothers who received Medicaid but not TANF (S-Program), the infant mortality rate was 6.3 per 1,000. These women have family incomes less than 185% of the federal poverty level. The infant mortality rate of mothers who did not receive Medicaid was 4.5 deaths per 1,000.

Low income is not always a risk factor for infant mortality, however. The lowest infant mortality rate (3.4 per 1,000) was among infants of low-income women receiving medical assistance who were not citizens. These women are predominantly of Hispanic origin and often have family incomes less than those of women receiving TANF.⁶ Lower infant mortality rates among infants of Hispanic women who were not born in the United States has often been reported, and it has been attributed to strong social support networks and the very low prevalence of adverse behaviors such as smoking during pregnancy.⁷



Other Measures of Impact and Burden

Causes of death. The three leading causes of infant death in Washington from 2003–2005 listed on death certificates were birth defects (27%), SIDS (11%), and preterm birth (10%). The next most frequent causes of death included maternal complications and complications of placenta, cord, and membranes, which together accounted for 10% of infant deaths. Injuries and violence such as

homicide, motor vehicle crashes, and choking or suffocation accounted for 6% of all infant deaths from 2003–2005.

Birth defects. In Washington, infant mortality caused by birth defects has dropped by about a third, from a rate of 2.2 per 1,000 in the early 1980s to 1.4 per 1,000 since 2000. This decrease is likely explained by a combination of improved prenatal diagnosis and pregnancy management as well as improvements in neonatal technology and surgical repair of malformations.⁸ During this period, folic acid was found to prevent neural tube defects, which are conditions with very high mortality rates. To be effective in preventing neural tube defects, folic acid must be taken prior to pregnancy. Washington [Pregnancy Risk Assessment Monitoring System](#) (PRAMS) data for 2003–2005 show that during the three months before becoming pregnant, about 28% of women took a multivitamin daily. The rate ranged from 33% ($\pm 3\%$) of Asian and Pacific Islander mothers to 15% ($\pm 4\%$) of American Indian and Alaska Native mothers.

Sudden Infant Death Syndrome. SIDS continues to be a leading cause of infant mortality. After the Back to Sleep Campaign in the late 1980s, SIDS deaths in Washington declined from 2.6 deaths per 1,000 live births in 1980 to 0.5 per 1,000 in 2001. SIDS rates have continued to decrease, but some of the decrease in recent years may be due to changes in reporting practices of coroners and medical examiners, who may code a death as due to an unknown cause rather than SIDS.⁹

Very low birth weight. Very low birth weight (VLBW) infants weigh less than 1,500 grams (three pounds, five ounces) and are usually preterm (less than 37 weeks gestation). From 2003–2005, they accounted for less than 1% of all births but made up 44% of infant deaths in Washington. The deaths of VLBW infants are classified on the death certificate as due to preterm birth as well as several other causes of death, including deaths due to congenital malformations; maternal complications of pregnancy; complications related to the umbilical cord, placenta, or membranes; respiratory distress; cardiovascular disorders; and bacterial sepsis.

Black infants in Washington have twice the prevalence of VLBW as white infants. This difference has long been recognized in the United States as a whole, but the reasons for it are unclear.¹⁰ (See the chapter on [Singleton](#)

[Low Birth Weight](#) for a discussion about the contribution of medical, behavioral, and environmental risk factors to low birth weight.)

Multiple births. Twins, triplets, and other multiple births have nearly four times the risk of infant death as singletons. In 2005, multiple births accounted for 9% of infant deaths, while they comprised only 3% of births.

Risk and Protective Factors

In general, risk factors for infant mortality cluster together. Rates are highest for babies born to mothers who are black or American Indian and Alaska Native. Rates are also higher among babies born to mothers who have less than a high school education, smoke, have poor nutritional status, are younger than 20 or older than 40. Two important categories of risk—maternal and infant medical conditions and social and behavioral factors—are discussed below.

Maternal and infant medical risks. Risk factors that contribute to the many causes of infant mortality include medical conditions that precede the pregnancy and complications that occur during pregnancy and birth. Maternal medical risks include a history of preterm birth, uterine malformations, chronic diseases (such as hypertension, renal disease, and diabetes), genetic factors, and perinatal infections.¹¹ Additional risk factors include multiple gestation pregnancy (twins or more), inadequate pregnancy weight gain, and perinatal infections such as HIV, Hepatitis B, and sexually transmitted diseases.¹¹

In addition to low birth weight and prematurity, infant medical risks include birth defects, hemolytic disease, and infections such as Group B Strep.¹¹ Group B Strep disease remains a leading infectious cause of morbidity and mortality among newborns in the United States.¹²

Maternal stress during pregnancy has been associated with preterm delivery and is suggested as a cause of racial and ethnic disparities in preterm delivery.¹³ Washington PRAMS data from 2003–2005 show that 11% ($\pm 3\%$) of blacks and 20% ($\pm 4\%$) of American Indian and Alaska Native mothers experienced high stress in the 12 months prior to delivery compared to 6% ($\pm 2\%$) of white mothers. High stress was defined as experiencing at least six of 13 identified stressful life events.

Social and behavioral factors. According to *Women and Smoking: A Report of the Surgeon General* in 2001, eliminating maternal smoking could lead to a 10% reduction in infant deaths and a 12% reduction in deaths from perinatal complications.¹⁴

Babies born to mothers who are young, poorly educated, have absent or late prenatal care, smoke, or are at risk for preterm birth for any reason are more likely to die in the first year of life, especially from SIDS.^{15,16} From 2003–2005, the death rate for infants whose mother smoked during pregnancy was 8.1 per 1,000 compared to 4.8 for nonsmokers. The SIDS death rate for infants born to mothers who smoked during pregnancy was 2 per 1,000 compared to a SIDS rate of 0.4 per 1,000 for infants born to non-smokers.

Illicit drug use increases the incidence of fetal growth restriction, preterm birth, and adverse pregnancy outcome, all of which contribute to infant mortality. But other behaviors associated with drug use, including smoking, alcohol use, and domestic violence also contribute to risk.¹⁷ From 2002–2004, the mortality rate for babies born to Medicaid-identified substance users (alcohol and/or illicit drugs) was 11.4 per 1,000. This rate was significantly higher than the rate among Medicaid non-substance users, 6.2 per 1,000.¹⁸

Pregnancies occurring too close together or too far apart have been associated with perinatal death. Interpregnancy intervals shorter than 18 months and longer than 59 months increase the risk of adverse perinatal outcomes including low birth weight and preterm birth.¹⁹

Breastfed infants are less likely to die from any cause in the post-neonatal period.^{9,20} In Washington, disparities in breastfeeding rates exist. According to 2003–2005 Washington PRAMS data, 73% (±4%) of Asian and Pacific Islander women, 72% (±3%) of white women, 73% (±4%) of Hispanic women, 62% (±4%) of black women, and 57% (±5%) of Native American women reported breastfeeding at two months postpartum.

Risks for SIDS. Risk factors for SIDS include prone (on stomach) sleep position, sleeping on a soft surface, overheating, late or no prenatal care, young maternal age, preterm birth and/or low birth weight, and male gender.⁹ Recent evidence suggests that breastfeeding itself is not associated with a reduced risk of SIDS, but factors associated with breastfeeding (such as not smoking) are protective against SIDS.⁹

[Intervention Strategies](#)

No single intervention reduces all infant mortality. For example, folic acid reduces infant mortality caused by neural tube defects but not

the risk of SIDS. It is difficult to identify promising interventions because not all interventions have been fully evaluated.

Prenatal care. Prenatal care can reduce maternal, fetal, and infant morbidities and mortality by identifying and treating maternal conditions and behaviors that affect birth outcomes.²¹ Routine prenatal care includes screening and counseling for infections, violence, chronic medical conditions, substance abuse, and genetic risk factors.²²

But even early prenatal care can occur too late to address preexisting medical and behavioral factors that influence infant mortality. Recently, maternal fetal experts have recommended that preconception services should be provided at every health care encounter for women of childbearing age.^{23,21} Preconception care can increase opportunities to optimize pregnancy spacing, to prevent unintended pregnancies, and to identify modifiable risk factors associated with infant death. Data are not yet available to determine the effectiveness of this strategy.

Folic acid. Infants with neural tube defects, including spina bifida and anencephaly, have high morbidity and mortality rates. Preconception folic acid supplementation can prevent both the first occurrence and recurrence of neural tube defects.²⁴

WIC. Some research indicates that infants born to poor women who participate in nutrition programs such as the Supplemental Nutrition Program for Women, Infants, and Children (WIC) and Medicaid programs have lower rates of infant mortality than poor women who do not participate, but additional research is needed.²⁵ WIC provides nutrition education, referrals to health and social services, and checks to buy WIC-approved groceries.

High-risk neonatal care. Technical advances in high-risk obstetric and neonatal care in the past 20 years have contributed to the dramatic improvement in birth weight-specific mortality rates.^{1,3,26} High-risk newborns, especially very low birth weight newborns, have better outcomes when delivered at tertiary care facilities or perinatal regional centers.^{27,28,29}

Smoking. Pregnant women can be especially motivated to quit smoking.³⁰ A brief intervention of 5–10 minutes by a trained provider will increase cessation rates between 30% and 70% for light to moderate smokers, regardless of their racial and ethnic groups.^{31,32} The effectiveness of counseling is increased by referring the patient to a pregnancy-specific quitline.³¹ Heavy smokers who do not respond to a behavioral intervention might benefit from pharmacotherapy.³¹

In Washington, First Steps maternity support services providers are required to ask clients about tobacco use and secondhand smoke exposure throughout pregnancy and postpartum. Each client is offered an individualized intervention. The Department of Health funds the toll-free Washington Tobacco QuitLine—(877) 270-STOP—which has a specialized intervention protocol for pregnant women

SIDS risk reduction. Recently, the American Academy of Pediatrics updated recommendations for reducing the risk of SIDS, including putting babies to sleep on their backs, promoting pacifier use, and promoting infants sleeping nearby but not in same bed as caregivers.⁹ Caregivers who were advised by physicians to put infants on their backs to sleep were about three times more likely to do so than caregivers not given a recommendation.³³ Expectant and new parents in Washington receive education and written materials about providing a safe infant sleep environment from Maternity Support Services, WIC, CHILD Profile, and WithinReach.

Injury prevention. Strategies to prevent suffocation deaths in infants include putting infants to sleep in an appropriate crib environment, supervising infants while eating, and ensuring children play with age-appropriate toys. Use of infant car seats decreases injury and mortality from motor vehicle crashes.^{34,35,36}

Death review. Infant death reviews at the state and local levels are recommended by the American Academy of Pediatrics and others to study health problems, analyze services, and develop policy recommendations directed at preventing infant mortality.^{37,38} Of Washington's 35 local health jurisdictions, 19 have Child Death Review teams that review unexpected deaths of children from birth through age 17.

See Related Chapters: [Access to Prenatal and Preconception Care](#), [Singleton Low Birth Weight](#), [Unintended Pregnancy](#), [Adolescent Pregnancy and Childbearing](#), and [Nutrition](#)

Data Sources

Washington State Department of Health, Center for Health Statistics, Vital Registration System Annual Statistical Files, Linked Birth Infant Deaths 1980–2005, released December 2006.

Washington State Department of Social and Health Services, Research and Data Analysis Division, First Steps Database, 2001–2003

Pregnancy Risk Assessment Monitoring System (PRAMS) 2002–2004 Washington state data.

For More Information

Washington Department of Health, Division of Community and Family Health, Maternal and Infant Health Program: (360) 236-3505.

Technical Notes

Period or cohort rates. Infant death rates based on vital statistics data are period rates that use infant deaths in a given year or years as the numerator and infant births in the same year(s) as the denominator. Infant death rates based on Medicaid data are cohort rates that describe the experience of a birth cohort. The denominator includes all births in a specified time period (cohort) and the deaths before 365 days of age among those infants in the numerator. The deaths may occur in the same years as the cohort, or in the subsequent year.

Birth defects. An abnormality in structure, function, or body metabolism that is present at birth, such as cleft lip or palate, phenylketonuria, or sickle cell disease. The Washington State Birth Defects Registry collects data on anencephaly, spina bifida, cleft lip, cleft palate, hypospadias, omphalocele, gastroschisis, limb reduction defects, Down syndrome, autism, cerebral palsy, and fetal alcohol syndrome.

Sudden infant death syndrome (SIDS): Sudden, unexplained death of an infant from an unknown cause.

Race- and Hispanic origin-specific rates: Race- and Hispanic-origin specific rates of infant mortality are calculated using the mother's race and Hispanic origin. When Hispanic origin was missing, but a race was provided, infants were considered Non-Hispanic.

Endnotes

¹ Wise, P. (2003). The anatomy of a disparity in infant mortality. *Annual Review of Public Health*, 24, 341-362.

² U.S. Centers for Disease Control and Prevention. (1999). Achievements in public health, 1900-1999: Healthier mothers and babies. *Morbidity and Mortality Weekly Report*, 48, 849-858.

³ Fanaroff, A. A., Hack, M., & Walsh, M. C. (2003). The NICHD Neonatal Research Network: Changes in Practice and Outcomes During the First 15 Years. *Seminars in Perinatology*, 27, 281-287.

⁴ Martin, J. A., Hamilton, B. E., Sutton, P. D., Ventura, S. J., Menacker, F., & Kirmeyer, S. (2006). Births: Final Data for 2004. *National Vital Statistics Reports*, 55(1). Hyattsville, MD: National Center for Health Statistics.

⁵ Mathews, T. J., & MacDorman, M. F. (2006). Infant mortality statistics from the 2003 period linked birth/infant death data set. *National Vital Statistics Reports*, 54(16). Hyattsville, MD: National Center for Health Statistics.

⁶ Cawthon, L. (2006, November 16). *Selected Measures by Medicaid Status for Live Births and for all Mothers with Deliveries (regardless of liveborn status), Washington State 2003-2005 (2001-2003 for Infant Mortality)*. First Steps Database. Olympia, WA: Washington State Department of Social and Health Services.

- ⁷ Page, R. (2004). Positive Pregnancy Outcomes in Mexican Immigrants: What Can we Learn? *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 33(6), 783-790.
- ⁸ Petrini, J., Damus, K., Russell, R., Poschman, K., Davidoff, M. J., & Mattson, D. (2002). Contribution of Birth Defects to Infant Mortality in the United States. *Teratology*, 66, S3-S6.
- ⁹ American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome. (2005). The Changing Concept of Sudden Infant Death Syndrome: Diagnostic Coding Shifts, Controversies Regarding the Sleeping Environment, and New Variables to Consider in Reducing Risk. *Pediatrics*, 116, 1245-1255.
- ¹⁰ U.S. Centers for Disease Control and Prevention. (2003). Infant Mortality—low birth weight among black and white infants – US, 1980-2000. *Morbidity and Mortality Weekly Report*, 51, 589-592.
- ¹¹ Blackburn, S. T. (2003). *Maternal, fetal, and neonatal physiology: A clinical perspective*. St. Louis: Saunders.
- ¹² U.S. Centers for Disease Control and Prevention. (2002, August 16). Prevention of Perinatal Group B Streptococcal Disease. *Morbidity and Mortality Weekly Report*, 51(RR11), 1-22.
- ¹³ Hogue, C. M., & Bremner, D. (2005). Stress Model for research into preterm delivery among black women. *American Journal of Obstetrics and Gynecology*, 192, S47-S55.
- ¹⁴ U.S. Centers for Disease Control and Prevention. (2001, March). *Women and Smoking: A Report of the Surgeon General*. Washington, DC: US Department of Health and Human Services, CDC, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.
- ¹⁵ Getahun, D., Amre, D., Rhoads, G., & Demissie, K. (2004). Maternal and Obstetric Risk Factors for Sudden Infant Death Syndrome in the United States. *Obstetrics and Gynecology*, 103(4), 646-652.
- ¹⁶ Sullivan, F., & Barlow, S. (2001) Review of Risk Factors for Sudden Infant Death Syndrome. *Pediatric and Perinatal Epidemiology*, 15, 144-200.
- ¹⁷ American College of Obstetricians and Gynecologists. (1999, November). Psychosocial Risk Factors: Perinatal Screening and Intervention. ACOG Educational Bulletin Number 255. Washington, DC.
- ¹⁸ Cawthon, L. (2007, January 10). *Infant Mortality among Medicaid Substance Users*. First Steps Database. Olympia, WA: Washington State Department of Social and Health Services.
- ¹⁹ Conde-Agudelo, A., Rosas-Bermudez, A., & Kafury-Goeta, A. C. (2006). Birth spacing and risk of adverse perinatal outcomes: a meta-analysis. *Journal of the American Medical Association*, 295(15), 1809-1823.
- ²⁰ Chen, A., & Rogan, W. J. (2004). Breastfeeding and the risk of postneonatal death in the United States. *Pediatrics*, 113, e435-e439.
- ²¹ Lu, M. C., Tache, V., Alexander, G. R., Kotelchuck, M., & Halfon, N. (2003). Preventing low birth weight: is prenatal care the answer? *Journal of Maternal-Fetal and Neonatal Medicine*, 13, 362-380.
- ²² Cunningham, F. G., Leveno, K. J., Bloom, S. L., Hauth, J. C., Gilstrap, L., & Wenstrom, K. D. (2005). *Prenatal Care in Williams Obstetrics*, (22nd ed., pp. 201-229). New York: McGraw Hill.
- ²³ U.S. Centers for Disease Control and Prevention. (2006). Recommendations to Improve Preconception Health and Health Care – United States: a report of the CDC/ATSDR Preconception Care Work Group and the Select Panel on Preconception Care. *Morbidity and Mortality Weekly Report*, 55(RR-6), 1-23.
- ²⁴ Neural Tube Defects. (2003, July). ACOG Practice Bulletin 44. Washington, DC.
- ²⁵ Moss, N., & Carver, K. (1998). The effect of WIC and Medicaid on infant mortality in US. *American Journal of Public Health*, 88(9), 1354-1361.
- ²⁶ Cooke, R. W. (2006). Preterm morbidity and mortality over 25 years. *Archives of Disease in Childhood. Fetal and Neonatal Edition*, 91(4), F293-F294.
- ²⁷ Phibbs, C. S., Baker, L. C., Caughey, A. B., Danielsen, B., Schmitt, S. K., & Phibbs, R. H. (2007). Level and Volume of Neonatal Intensive Care and Mortality in Very-Low-Birth-Weight Infants. *New England Journal of Medicine*, 356, 2165-2175.
- ²⁸ Cifuentes, J., Bronstein, J., Phibbs, C. S., Phibbs, R. H., Schmitt, S. K., & Waldemar, A. C. (2002). Mortality in Low Birth Weight Infants According to Level of Neonatal Care at Hospital of Birth. *Pediatrics*, 109, 745-751.
- ²⁹ Dobrez, D., Gerber, S., & Budetti, P. (2006). Trends in Perinatal Regionalization and the Role of Managed Care. *Obstetrics and Gynecology*, 108, 839-845.
- ³⁰ U.S. Department of Health and Human Services. (2001). Women and Smoking: A Report of the Surgeon General. Atlanta, GA.
- ³¹ American College of Obstetricians and Gynecologists. (2005, October). Smoking Cessation During Pregnancy. ACOG Committee Opinion Number 316. Washington, DC.
- ³² Melvin, C. L., Dolan-Mullen, P., Windsor, R. A., Pennington Whiteside, H., & Goldenberg, R. L. (2000, September). Recommended cessation counseling for pregnant women who smoke: a review of the evidence. *Tobacco Control*, 9(Suppl. 3), 80-84.
- ³³ National Institutes of Health. (2000, April 25). To reduce SIDS risk, doctor's advice most important in choice of placing infants to sleep on their backs. *National Institutes of Health News Alert*. <http://www.nichd.nih.gov/news/releases/bts.cfm>.
- ³⁴ Schnitzer, P. G. (2006). Prevention of unintentional childhood injuries. *American Family Physician*, 74(11), 1864-1869.
- ³⁵ Drago, D., & Dannenberg, A. (1999). Mechanical Suffocation Deaths in the United States, 1980-1997. *Pediatrics*, 103(5), e59.
- ³⁶ Task Force on Community Preventive Services. (2005). Motor Vehicle Occupant Injury. In S. Zaza, P. A. Briss, & K. W. Harris (Eds.), *The Guide to Community Preventive Services, What Works to Promote Health?* (pp. 329-384). New York: Oxford University Press. <http://www.thecommunityguide.org/library/book/>.
- ³⁷ Tomashek, K. M., Hsia, J., & Iyasu, S. (2003). Trends in Postneonatal Mortality Attributable to Injury, United States, 1988-1998. *Pediatrics*, 111(5, Part 2), 1219-1225.
- ³⁸ American Academy of Pediatrics Committee on Child Abuse and Neglect and Committee on Community Health Services. (1999). Investigation and Review of Unexpected Infant and Child Deaths. *Pediatrics*, 104(5), 1158-1160.