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Infant Mortality and Low Birthweight in North Carolina: The Last 10 Years

by

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ABSTRACT

Objectives: This report uses matched birth and infant death certificates to examine recent changes in birthweight distribution as well as birthweight- and cause-specific infant mortality. The purpose is to discern trends and patterns in the ten years since high infant mortality promoted expanded maternal and child care programs, including the expansion of Medicaid coverage for pregnant women.

Methods: Data are for white and minority infants born in 1987-88 and 1995-96. Information presented includes the percentage decline in overall infant mortality that was attributable to improved survival in specific birthweight and cause-of-death categories.

Results: For both whites and minorities, North Carolina's low-birthweight and infant death rates have consistently exceeded those of the nation. For both race groups, the state's percentage of births in low-birthweight categories has risen while the infant death rate has declined. The fall in mortality reflects declining risk of death in all but the smallest birthweight category (under 500 grams) and substantial reductions in death from respiratory conditions, SIDS, and birth defects.

Conclusion: Great progress has been made in reducing birthweight-specific infant mortality. However, our state's worsening birthweight distribution is cause for concern. Increases in multiple births have contributed to the increasing percentage of live births in North Carolina that are low birthweight. A recent study found maternal smoking and minority race to be strong predictors of low birthweight. Low birthweight is a multi-faceted problem and more than medical interventions are needed to improve it.



Introduction

The purpose of the present report is to examine changes in birthweight- and cause-specific infant mortality over the past decade, using two-year infant death rates, and to examine changes in the percentages of live births in low birthweight categories. The base years are 1987-88, a period of high infant mortality. In 1988, only one state (Georgia) had a higher infant death rate than North Carolina. This finding provided the impetus for developing new maternal and child care initiatives, including the expansion of Medicaid coverage for pregnant women.

Methods

The linking of birth and infant death certificates is a useful and widely used method for examining risk factors associated with poor birth outcomes.¹ These risk factors are from information collected on the birth certificate and include sociodemographic, behavioral, and medical factors influencing fertility and pregnancy outcome. Birthweight is an important dimension used in this paper to analyze infant mortality.

In this report, the numerator used in calculating mortality risks is the number of deaths among infants **born during the period of study**, so these risks will differ slightly from the mortality rates published in standard North Carolina vital statistics reports. Also, death data for the 1996 birth cohort are provisional, so mortality risks may differ slightly from the final results for this birth cohort.

Because of the wide disparity in infant mortality risks by race, this report provides separate analyses for white and minority infants. We also examine the age-specific components of infant mortality. Neonatal deaths are those occurring during the first 28 days of life; postneonatal deaths are those occurring between 28 days and one year of age.

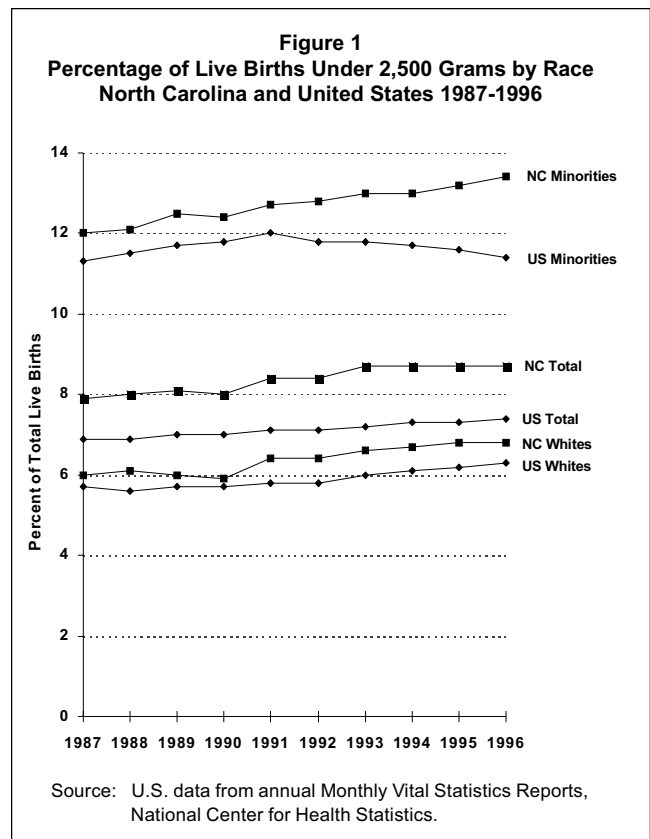
A method for partitioning differences in mortality rates was used to determine the percentage decline in overall infant mortality that was attributable to improved survival in specific birthweight categories.² Similarly, the percentage decline in overall infant mortality that was attributable to a particular cause of death was obtained by dividing the absolute change in mortality risk **for that cause** by the absolute change in overall mortality risk.

Results

As shown in Figures 1 and 2 respectively, North Carolina's low-birthweight and infant death rates for both whites and minorities have consistently exceeded the nation's. Moreover, for both whites and minorities, the state's low-birthweight rate has risen. Despite this increase in low birthweight, both whites and minorities in North Carolina have experienced reduced infant mortality over the past decade.

Trends in Low Birthweight

As shown in Figure 3, both whites and minorities have experienced increases in the percentages of live births in low birthweight categories. Overall, the percentage low birthweight (<2,500 grams) increased from 8.0 in 1987-88 to 8.7 in 1995-96. The numbers and percentages for 1987-88 and 1995-96 are detailed in Table 1, where it is seen that increases have occurred at all levels of low birthweight. The increase in the percentage of births under 2,500 grams was about 9 percent overall, 12 percent for whites and 10 percent for minorities. In 1995-96, the percentage low birthweight remained about twice as high for minorities (13.3%) as for whites (6.8%). The racial difference is even greater at the low end of the birthweight distribution.



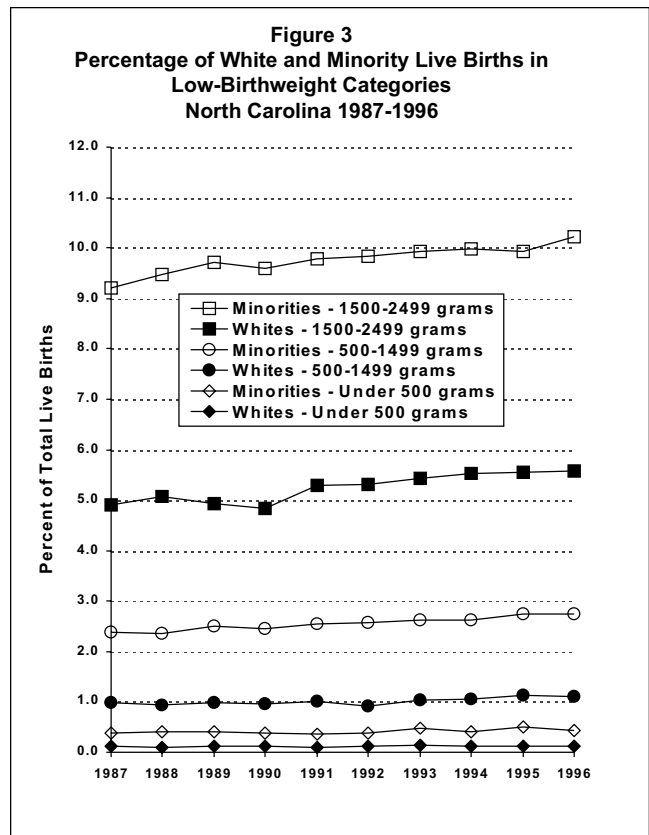
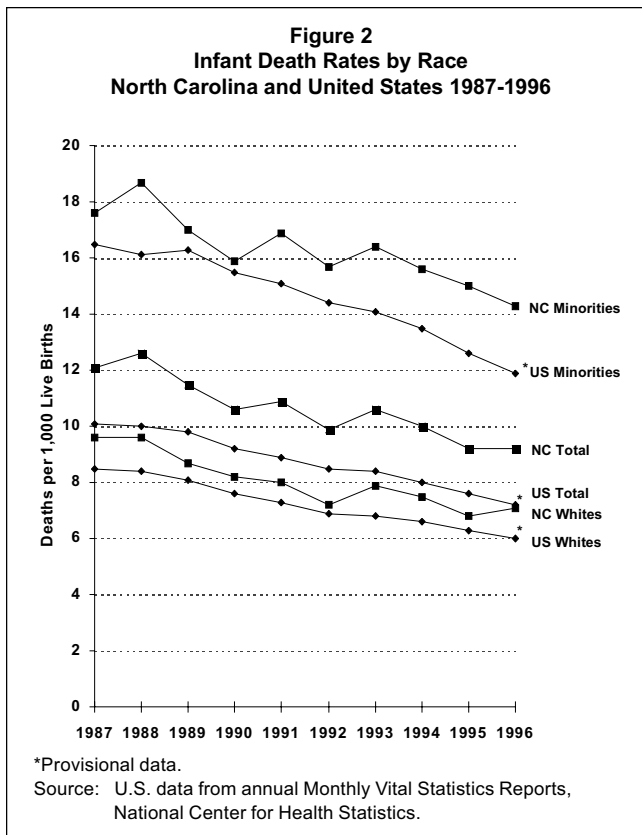


Table 1
Birthweight Distributions and Birthweight-Specific Infant Mortality by Race
North Carolina 1987-88 and 1995-96 Birth Cohorts

Race and Weight Group	1987-88				1995-96				Percent Contribution to Total Decline
	Live Births	Percent of Live Births	Infant Deaths	Mortality Risk*	Live Births	Percent of Live Births	Infant Deaths	Mortality Risk*	
All Races									
Under 500 grams	367	0.19	355	967.3	475	0.23	440	926.3	- 8.9
500-749	608	0.32	443	728.6	701	0.34	354	505.0	19.5
750-999	618	0.32	191	309.1	788	0.38	134	170.1	11.3
1000-1499	1,452	0.76	178	122.6	1,792	0.87	115	64.2	12.1
1500-2499	12,149	6.37	325	26.8	14,213	6.90	247	17.4	16.3
2500+	175,619	92.04	797	4.5	187,942	91.27	543	2.9	49.8
Whites									
Under 500 grams	133	0.10	129	969.9	192	0.13	176	916.7	- 9.9
500-749	264	0.20	196	742.4	317	0.22	175	552.1	12.8
750-999	298	0.23	103	345.6	350	0.24	75	214.3	11.8
1000-1499	692	0.53	99	143.1	952	0.66	64	67.2	13.8
1500-2499	6,531	5.00	190	29.1	8,075	5.57	153	18.9	17.4
2500+	122,793	93.94	473	3.9	135,143	93.18	345	2.6	54.1
Minorities									
Under 500 grams	234	0.39	226	965.8	283	0.46	264	932.9	- 13.1
500-749	344	0.57	247	718.0	384	0.63	179	466.1	26.5
750-999	320	0.53	88	275.0	438	0.72	59	134.7	11.2
1000-1499	760	1.26	79	103.9	840	1.38	51	60.7	10.8
1500-2499	5,618	9.35	135	24.0	6,138	10.08	94	15.3	15.9
2500+	52,826	87.89	324	6.1	52,799	86.72	198	3.8	48.5

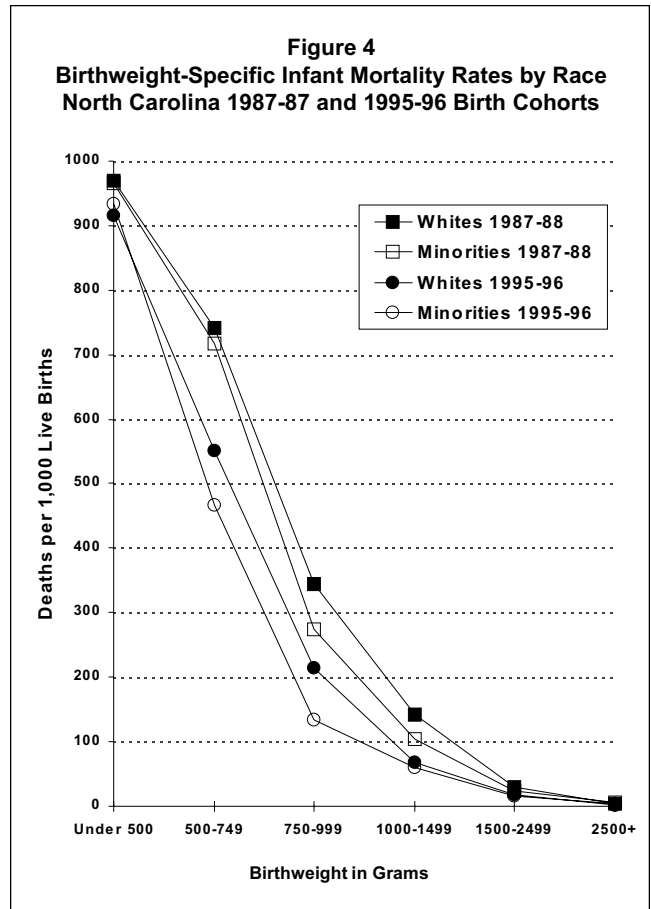
*Infant deaths per 1,000 live births.

Changes in Birthweight-Specific Infant Mortality

Between 1987-88 and 1995-96, the state's infant mortality risk declined 27 percent, from 12.3 to 9.0 deaths per 1,000 live births. The infant mortality risk declined 25 percent for whites and 26 percent for minorities to rates of 6.9 and 14.0 respectively. The two-fold disparity between minorities and whites persists.

Table 1 shows birthweight-specific mortality risks by race for infants born in 1987-88 and 1995-96. The rightmost column of the table gives the percentage of the total decline in infant mortality attributable to improved survival among infants in a particular birthweight category.

For both whites and minorities, the death rate for infants weighing under 500 grams declined slightly, but the improvement was negated by the increased numbers of births in that high-risk category, where the chances of survival remain low. For all other birthweight categories, declines in mortality risk contributed to the overall improvement in infant mortality.



**Table 2
Neonatal and Postneonatal Mortality by Race
North Carolina 1987-88 and 1995-96 Birth Cohorts**

	Number of Deaths		Mortality Risk*		Percent Change
	1987-88	1995-96	1987-88	1995-96	
All Races					
Infant	2,342	1,851	12.3	9.0	- 26.8
Neonatal	1,558	1,285	8.2	6.2	- 24.4
Postneonatal	784	566	4.1	2.8	- 31.7
Whites					
Infant	1,210	1,001	9.2	6.9	- 25.0
Neonatal	792	687	6.1	4.7	- 23.0
Postneonatal	418	314	3.2	2.2	- 31.3
Minorities					
Infant	1,132	850	18.5	14.0	- 24.3
Neonatal	766	598	12.5	9.8	- 21.6
Postneonatal	366	252	6.1	4.2	- 31.1

*Infant: Deaths under one year of age per 1,000 live births.
 Neonatal: Deaths under 28 days of age per 1,000 live births.
 Postneonatal: Deaths 28 days to one year of age per 1,000 neonatal survivors.

Because it accounts for most of the births, the normal birthweight category (2,500+ grams) accounted for most of the decline in infant mortality – 54 percent of the white decline and 48.5 percent of the minority decline. Mortality risk among those normal-weight newborns actually declined one-third for whites and 38 percent for minorities.

Also of interest in Table 1 is the survival advantage of minorities at low birthweights. In 1995-96, mortality risk was lower for minorities than for whites at birthweights between 500 and 2,500 grams (see also Figure 4).

Changes in Neonatal and Postneonatal Mortality

Table 2 shows the numbers and rates of neonatal and postneonatal deaths among infants born in 1987-88 and 1995-96. As shown by the percent changes, whites and minorities experienced similar declines in the two components of infant mortality with greater reductions in postneonatal than in neonatal mortality risk.

Changes in Cause-Specific Infant Mortality

Table 3 shows the cause-specific infant mortality rates by race for 1987-88 and 1995-96. Among whites, reductions in four categories – respiratory distress, SIDS, birth defects, and other respiratory conditions – accounted for 73 percent of the overall decline. Among minority infants, reduced mortality from those causes as well as “other perinatal conditions” accounted for 93 percent of the overall decline in infant mortality.

The substantial reductions in death from respiratory distress syndrome and other respiratory conditions among both white and minority infants is commonly attributed to the availability and now widespread use of surfactant.

For infants of both race groups, the death rate for prematurity/low birthweight increased by 18 percent for whites and 12 percent for minorities. As already described, the percentages of live births in low-birthweight categories have increased (Table 1 and Figure 3). The percentage of live births that were less than 500 grams increased from 0.19 to 0.23 from 1987-88 to 1995-96, or an increase of 21 percent (Table 1). About 93 percent of babies in this weight group die. Over the time period of this study, the percentage of all infant deaths accounted for by births less than 500 grams increased from 15 to 24. A recent study of perinatal mortality in Alabama noted a large increase in live

born infants weighing less than 500 grams at birth, and attributed this to changes in reporting.³

Discussion

The infant mortality rate in North Carolina declined by 27 percent from 1987-88 to 1995-96. There were large reductions in the death rate for all birthweight categories except the very lowest. Reduced mortality of low birthweight infants was an important factor in the overall decline in infant mortality, but about half of the reduction was due to reduced mortality among normal birthweight infants.

While birthweight-specific mortality has been decreasing, the percentage of births that are low birthweight has increased. Clearly these are opposing trends. Low-birthweight babies are 25 times as likely to die in the infant period as babies of normal birthweight. As long as the reduction in infant mortality is achieved only by improved birthweight-specific survival, with no improvement in low birthweight, future reductions in infant mortality will be more difficult. Reasons for the lack of improvement in low birthweight are not well understood.

Increases in multiple births have contributed to the increasing percentage of live births in North Carolina that are low birthweight, a pattern also shown by a recent study in Canada.⁴ About 60 percent of multiple births weigh less than 2,500 grams. The percentage of live births that were multiple births (twins, triplets, etc.) increased from 2.3 in 1987 to 2.7 in 1996. Over this same period the percentage of all low-birthweight births (less than 2,500 grams) that were multiple births increased from 16.3 to 18.2.

The increasing percentage of live-born infants delivered at extremely low birthweights could also be a result of the adoption of more aggressive intrapartum medical management strategies for extremely premature pregnancies. If obstetricians are more likely to use c-section to “rescue” small fetuses of borderline viability, then they are likely to be delivering some live births that in the past would have been stillbirths. Because a high percentage of these infants subsequently die, these interventions will tend to increase the infant mortality rate. There is some evidence to support this suggestion. From 1988-89 to 1996-97 in North Carolina, the percentage of live born infants weighing less than 500 grams that were delivered by c-section increased from 3.9 to 11.8. For infants weighing 500-749 grams, the

Table 3
Cause-Specific Infant Mortality by Race, North Carolina
1987-88 and 1995-96 Birth Cohorts

All Races	Number of Deaths		Mortality Risk*		Percent Change	Percent Contribution to Total Decline
	1987-88	1995-96	1987-88	1995-96		
Birth Defects	409	343	2.1	1.7	- 22.2	14.5
Prematurity/Low Birthweight	297	358	1.6	1.7	11.8	- 5.6
Respiratory Distress/BPD**	221	102	1.2	0.5	- 57.2	20.2
Sudden Infant Death Syndrome	301	195	1.6	0.9	- 39.9	19.2
Labor/Delivery Complications	62	44	0.3	0.2	- 34.2	3.4
Injuries	82	65	0.4	0.3	- 26.5	3.5
Infection	168	132	0.9	0.6	- 27.1	7.3
Maternal Complications	194	193	1.0	0.9	- 7.7	2.4
Other Respiratory Conditions	204	109	1.1	0.5	- 50.4	16.5
Other Perinatal Conditions	203	121	1.1	0.6	- 44.7	14.5
Other Known Cause	181	147	0.9	0.7	- 24.7	7.1
Unknown	20	42	0.1	0.2	94.8	- 3.0
All Causes	2,342	1,851	12.3	9.0	- 26.7	100.0
Whites						
Birth Defects	271	240	2.1	1.7	- 20.1	17.8
Prematurity/Low Birthweight	121	158	0.9	1.1	17.8	- 7.0
Respiratory Distress/BPD**	115	48	0.9	0.3	- 62.4	23.3
Sudden Infant Death Syndrome	155	110	1.2	0.8	- 36.0	18.2
Labor/Delivery Complications	33	21	0.3	0.1	- 42.6	4.6
Injuries	43	39	0.3	0.3	- 18.2	2.5
Infection	83	68	0.6	0.5	- 26.1	7.1
Maternal Complications	103	91	0.8	0.6	- 20.3	6.8
Other Respiratory Conditions	92	56	0.7	0.4	- 45.1	13.5
Other Perinatal Conditions	80	58	0.6	0.4	- 34.6	9.0
Other Known Cause	107	88	0.8	0.6	- 25.8	9.0
Unknown	7	24	0.1	0.2	209.2	- 4.8
All Causes	1,210	1,001	9.2	6.9	- 25.4	100.0
Minorities						
Birth Defects	138	103	2.3	1.7	- 26.2	12.4
Prematurity/Low Birthweight	176	200	2.9	3.3	12.3	- 7.4
Respiratory Distress/BPD**	106	54	1.8	0.9	- 49.6	18.0
Sudden Infant Death Syndrome	146	85	2.4	1.4	- 42.4	21.2
Labor/Delivery Complications	29	23	0.5	0.4	- 21.6	2.1
Injuries	39	26	0.6	0.4	- 34.1	4.6
Infection	85	64	1.4	1.1	- 25.6	7.4
Maternal Complications	91	102	1.5	1.7	10.8	- 3.4
Other Respiratory Conditions	112	53	1.9	0.9	- 53.2	20.4
Other Perinatal Conditions	123	63	2.0	1.0	- 49.4	20.8
Other Known Cause	74	59	1.2	1.0	- 21.2	5.4
Unknown	13	18	0.2	0.3	36.9	- 1.6
All Causes	1,132	850	18.8	14.0	- 25.8	100.0

*Infant deaths per 1,000 live births.

**Bronchopulmonary dysplasia.

Note: Percent change may not match that calculated from the table due to rounding.

percentage delivered by c-section increased from 24.0 to 41.8. This was during a time when the percentage of all live births delivered by c-section decreased from 24 to 21 percent.

Low birthweight is a multi-faceted problem and more than medical interventions are needed to improve it. In 1996, there were 9,128 low birthweight babies born to North Carolina women. For 78 percent of those babies, the mother began prenatal care in the first trimester. The percentage of all mothers beginning prenatal care in the first trimester increased from 75 percent in 1988 to 83 percent in 1996, a period during which the percentage of low-weight births was increasing. Improving prenatal care participation is very important, but it is not the only answer to reducing low birthweight. Of the 9,128 low birthweight babies born in 1996, 81 percent were born to mothers age 20 and older. Teenage pregnancy is thus a comparatively small cause of low birthweight in North Carolina. Health interventions are only part of the solution to this serious and difficult problem. A recent North Carolina study⁵ showed that maternal smoking and minority race were strong, independent predictors of low birthweight. Policies and programs designed to address aspects of the social and economic environment of families may help to reduce low birthweight. Additional research is needed to determine how environmental factors interact with biological characteristics to influence the risk for low birthweight.

In 1988, North Carolina ranked next to last in the nation in infant mortality. As improvements were seen in the early 1990s, North Carolina's rank improved to about forty-third. However, in 1995, 1996, and 1997, the infant mortality rate for North Carolina remained at 9.2, while the rate for the nation continued to decline. As a result, preliminary national data for 1997 indicate that North Carolina again had the second highest infant mortality rate in the nation. North Carolina's high rate of low birthweight is not the only factor that accounts for our poor standing in infant mortality. Our state's rates of death from birth defects and SIDS – two major contributors to infant death – are higher than those of the U.S. as well.^{6,7}

Significant reductions in infant mortality from 1987-88 to 1995-96 occurred for respiratory conditions, birth defects, and SIDS. It is important that we build on the successes in these areas as a means of continuing the downward trend in infant mortality. There has been much less success in preventing preterm delivery, which is a major cause of low birthweight. Innovative strategies to reduce preterm delivery are needed if substantial progress is to be made in reducing low birthweight.

References

1. Zahniser C et al. Using linked birth and infant death files for program planning and evaluation: NIMS workshop lessons. *Pub. Health Rep.* 102:211-216, 1987.
2. Kitagawa EM. Components of a difference between two rates. *J. Am. Stat. Assoc.* 50:1168-1194, 1955.
3. Phelan ST et al. Perinatal mortality and its relationship to the reporting of low-birthweight infants. *Am. J. Public Health* 88:1236-1239, 1988.
4. Joseph KS et al. Determinants of preterm birth rates in Canada from 1981 through 1983 and from 1992 through 1994. *N. Engl. J. Med.* 339:1434-1439, 1998.
5. Wood C. The association of marital status with low birthweight: North Carolina, 1994-1995. *SCHS Studies*, 104, April 1997.
6. Petrini J et al. Trends in infant mortality attributable to birth defects – United States, 1980-1995. *MMWR*, vol. 47, no. 37, 773-778, 1998.
7. National Center for Health Statistics. Deaths: final data for 1996. *National Vital Statistics Report*, vol. 47, no. 9, 1998.

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