Annual Summary of Vital Statistics—1998

Bernard Guyer, MD, MPH*; Donna L. Hoyert, PhD‡; Joyce A. Martin, MPH‡; Stephanie J. Ventura, MA‡;
Marian F. MacDorman, PhD‡; and Donna M. Strobino, PhD*

Note to the Reader: 1999 is the 50th anniversary of the publication of this annual article in Pediatrics. A series of monthly columns and special articles began in the very first volume of Pediatrics, in 1948, and included a feature called "Public Health, Nursing, and Medical Social Work" authored first by Dr Leona Baumgartner, Chief of the Bureau of Child Hygiene of the New York City Health Department, and later by Myron Wegman.[1] In the fourth volume of Pediatrics in 1949, Wegman devoted his first column to the discussion of the nation's vital statistics.[2] The regular publication of the "Annual Summary" article in the December issue of Pediatrics began in 1957.[3]

The column has changed and evolved over the years to take eventually the form that most of us associate with Dr Wegman's long stewardship. It continues to evolve. This year we include a special feature—the publication of state-by-state comparisons of infant mortality rates, low birth weight rates, and birth weight-specific mortality rates. These data will allow readers to make more informed inferences about state-by-state differences in infant mortality.

ABSTRACT. Most vital statistics indicators of the health of Americans were stable or showed modest improvements between 1997 and 1998. The preliminary birth rate in 1998 was 14.6 births per 1000 population, up slightly from the record low reported for 1997 (14.5). The fertility rate, births per 1000 women aged 15 to 44 years, increased 1% to 65.6 in 1998, compared with 65.0 in 1997. The 1998 increases, although modest, were the first since 1990, halting the steady decline in the number of births and birth and fertility rates in the 1990s.

Fertility rates for total white, non-Hispanic white, and Native American women each increased from 1% to 2% in 1998. The fertility rate for black women declined 19% from 1990 to 1996, but has changed little since 1996. The rate for Hispanic women, which dropped 2%, was lower than in any year for which national data have been available. Birth rates for women 30 years or older continued to increase. The proportion of births to unmarried women remained about the same at one third.

The birth rate for teen mothers declined again for the seventh consecutive year, and the use of timely prenatal care (82.8%) improved for the ninth consecutive year, especially for black (73.3%) and Hispanic (74.3%) mothers.

The number and rate of multiple births continued their dramatic rise; the number of triplet and higher-order multiple births jumped 16% between 1996 and 1997, accounting, in part, for the slight increase in the percentage of low birth weight (LBW) births. LBW continued to increase from 1997 to 1998 to 7.6%.

The infant mortality rate (IMR) was unchanged from 1997 to 1998 (7.2 per 1000 live births). The ratio of the IMR among black infants to that for white infants (2.4) remained the same in 1998 as in 1997. Racial differences in infant mortality remain a major public health concern. In 1997, 65% of all infant deaths occurred to the 7.5% of infants born LBW. Among all of the states, Maine, Massachusetts, and New Hampshire had the lowest IMRs. State-by-state differences in IMR reflect racial composition, the percentage LBW, and birth weight-specific neonatal mortality rate for each state. The United States continues to rank poorly in international comparisons of infant mortality.

Expectation of life at birth increased slightly to 76.7 years for all gender and race groups combined. Death rates in the United States continue to decline, including a drop in mortality from human immunodeficiency virus. The age-adjusted death rate for suicide declined 6% in 1998; homicide declined 14%. Death rates for children from all major causes declined again in 1998. A large proportion of childhood deaths, however, continue to occur as a result of preventable injuries. *Pediatrics* 1999; 104:1229–1246; *birth, birth weight-specific mortality, death, infant mortality, low birth weight, mortality, multiple births, regionalization, vital statistics.*

Most vital statistics indicators of the health of Americans were stable or showed modest improvements between 1997 and 1998. The birth rate for teen mothers declined again for the seventh consecutive year, and the use of timely prenatal care improved, especially for Black mothers. Life expectancy at birth increased slightly to 76.7 years. Death rates in the United States continue to decline, including drops in mortality from human immunodeficiency virus (HIV), suicide, homicide, and unintentional injury. However, the infant mortality rate (IMR) was unchanged from 1997 to 1998. The proportion of births to unmarried mothers remained about the same at one third. The number and rate of multiple births continue their dramatic rise, accounting, in part, for the increase in low birth weight (LBW) births.

METHODS

The data presented in this report were obtained from vital statistics records—birth certificates, fetal death reports, and death certificates—for residents of the United States. Data for 1997 and earlier years are final and include all records. Data for 1998 are preliminary, and are based on 99% of births and at least 85% of deaths reported to the National Center for Health Statistics. More complete descriptions of vital statistics data systems are available elsewhere.[4-6] The preliminary estimates may differ from the final data for 1998 that will include all records, but most differences are usually small.

Current vital statistics patterns and recent trends through 1998 are presented in this report by state of residence, age, race and Hispanic origin, as well as other birth and infant death characteristics. More detailed data are available in the final files for 1997 than in the preliminary files for 1998, so some of the detailed analyses of birth and death patterns focus on the 1997 data. Hispanic origin and race are collected as separate items in vital records. Persons of Hispanic origin may be of any race, although most births and infant deaths of Hispanic origin (97%) are to white women. Because there are often important differences in childbearing patterns between non-Hispanic white and Hispanic women, all tables that present data by race have been reformatted to include data separately for non-Hispanic white and Hispanic women.

The mother's marital status for birth data, underlying cause of

death for deaths, and birth weight for infant deaths have special considerations for which readers should be aware. Mother's marital status was reported directly on the birth certificates or through the electronic birth registration process in all but 3 states in 1997 and all but 2 states in 1998. Details about the reporting of marital status in those 3 states and methods of edits and imputations applied to other items on the birth certificate are presented in publications of the National Center for Health Statistics.[4,6]

Cause of death statistics in this report are based solely on the underlying cause of death. The underlying cause of death is defined as "(a) the disease or injury that initiated the train of events leading directly to death, or (b) the circumstances of the accident or violence that produced the fatal injury." From 1979 to the present, cause of death data in the United States have been classified according to the *International Classification of Diseases, 9th Revision.*[7]

Infant mortality statistics by birth weight in this report were obtained from the 1997 period linked birth-infant death dataset.[8] In this dataset, the death certificate is linked with the corresponding birth certificate for each infant who died in 1997 in the United States. The purpose of this linkage is to use additional variables available from the birth certificate, such as birth weight, to better interpret infant mortality patterns. Numbers of infant deaths were weighted to compensate for the 2.1% of infant deaths in 1997 for which the matching birth certificate could not be identified.[8] The weighting procedure results in the same overall IMR as that based on unlinked death or mortality data; however, small differences may exist because of geographic coverage differences, additional quality control, and weighting.[8]

Population denominators for the calculation of birth, death, and fertility rates are estimates of the US population as of July 1 of each year, produced by the US Bureau of the Census.[9,10] However, IMRs were computed by dividing the total number of infant deaths in each calendar year by the total number of live births in the same year.[5,8] Fetal and perinatal mortality rates were computed by dividing the number of fetal or perinatal deaths by the number of live births plus fetal deaths.

NATURAL INCREASE

According to preliminary data, 1 605 976 persons were added to the population in 1998 as a result of natural increase, the excess of births over deaths (Table 1).[6] The rate of natural increase has been the same for each year 1996–1998, at 5.9 persons per 1000 population.

BIRTHS

The preliminary number of births in the United States increased in 1998 to 3 944 046, up 2% compared with the final total for 1997 (Table 1). The preliminary birth rate in 1998 was 14.6 births per 1000 population, up slightly from the record low reported for 1997 (14.5). The fertility rate, defined as

TABLE 1. Vital Statistics of the United States, Final 1915–1997 (Selected Years) and Preliminary 1998

Item	Number			Rate*						
	1998	1997	1996	1998	1997	1996	1990	1980	1950	1915†
Live births	3 944 046	3 880 894	3 891 494	14.6	14.5	14.7	16.7	15.9	24.1	29.5
Fertility rate				65.6	65.0	65.3	70.9	68.4	106.2	125.0
Deaths	2 338 070	2 314 245	2 314 690	8.7	8.6	8.7	8.6	8.8	9.6	13.2
Age-adjusted rate				4.7	4.8	4.9	5.2	5.9	8.4	14.4
Natural increase	1 605 976	1 566 649	1 576 804	5.9	5.9	5.9	8.1	7.1	14.5	16.3
Infant mortality	28 486	28 045	28 487	7.2	7.2	7.3	9.2	12.6	29.2	99.9
Population base (in thousands)				270 299	267 636	265 284	248 710	226 542	150 697	100 546

* Rates per 1000 population except for fertility, which is per 1000 women aged 15 to 44 years of age and infant mortality, which is per 1000 live births.
† Birth rate adjusted to include states not in registration area (10 states and the District of Columbia when started in 1915). Death rate is for death registration area. Infant death rate is for birth registration area.
Note: Populations are as of July 1 for 1996, 1997, and 1998, and as of April 1 in 1950, 1980, and 1990. Population for 1915 is the midyear estimate based on the April 15, 1910 census.
Source: National Center for Health Statistics, National Vital Statistics System and the US Bureau of the Census.

the number of births per 1000 women aged 15 to 44 years, increased 1% to 65.6 in 1998, compared with 65.0 in 1997. The 1998 increases, although modest, were the first since 1990, halting the steady decline in the number of births and birth and fertility rates in the 1990s.

Geographic Variation

The numbers of births as well as birth and fertility rates increased in the majority of states according to 1998 preliminary data. The number of births increased in 43 states and declined in 7 states and the District of Columbia. Numbers rose 5% to 7% in Colorado, Nevada, and Utah. Birth rates per 1000 total population increased in 34 states, declined in 7 states, the District of Columbia, Puerto Rico, the Virgin Islands, and Guam, and were unchanged in 9 states. Fertility rates per 1000 women aged 15 to 44 years increased in 43 states, declined in 6 states, the District of Columbia, Puerto Rico, and the Virgin Islands, and were unchanged in New York and Guam (Table 2).

Births to Native American and Asian or Pacific Islander women and women of Hispanic origin tend to be highly concentrated geographically, as indicated in Table 2. Nearly half of births to Native American women were to residents of Alaska, Arizona, California, New Mexico, and Oklahoma. Residents of California, Hawaii, and New York accounted for half of births to Asian or Pacific Islander women. Three-fifths of births to women of Hispanic origin were to residents of California, New York, and Texas.

Racial and Ethnic Composition

Fertility rates for total white (64.7 per 1000), non-Hispanic white (57.8), and Native American women (70.5) each increased from 1% to 2% in 1998. The fertility rate for black women (71.0 in 1998) declined 19% from 1990 to 1996, but has changed little since 1996. The rate for Asian or Pacific Islander women (63.5) declined 4% between 1997 and 1998, reaching the lowest level since this rate was first calculated in 1980.[4] Similarly, the rate for Hispanic women (101.1), which dropped 2%, was lower than in any year for which national data have been available (1989).[4] Among populations of Hispanic origin for which fertility rates can be reliably computed, Mexican-American women continue to have the highest fertility, with a rate of 116.6 per 1000 in 1997 (Table 3), and the highest age-specific birth rates among women under age 30.

Trends in Age-specific Birth Rates

Teen Childbearing

Since 1991, when it reached a 20-year high (62.1 per 1000 aged 15–19), the birth rate for teenagers has fallen 18%, to 51.1 in 1998 (Table 4). The 1998 rate, which is 2% lower than in 1997, is close to the 1986 record low of 50.2.[11] The slight increase in the number of births to teenagers in 1998 reflects entirely the 3% increase from 1997 to 1998 in the number of teenage females in the population.[10]

Birth rates for teenagers in all age groups declined from 1997 to 1998. The rate for the youngest group, aged 10 to 14 years, was 1.0 per 1000, the lowest level since 1969; the number of births in this age group in 1998 (9481) was 27% below its recent high in 1994. The birth rate for teenagers 15 to 17 years declined 5% to 30.4 in 1998, a record low. The 21% decline in this rate since 1991 essentially reverses the 27% rise in the rate between 1986 and 1991. The rate for older teenagers 18 to 19 was 82.0 in 1998, 2% lower than in 1997, and 13% lower than its 1992 high of 94.5.

Birth rates for teenagers differ considerably by race and Hispanic origin but all rates have declined in the 1990s (Table 4).[4,11,12] Between 1997 and 1998, rates per 1000 teenagers aged 15 to 19 fell 2% for all whites (45.4 in 1998) and non-Hispanic whites (35.2), by 3% for black women (85.3) and Asian or Pacific Islander teenagers (23.1), and by 4% for Hispanic teenagers (93.7). The rate for Native American teenagers was unchanged at 71.8. Since 1991, black teenagers have experienced the largest decline of any group. Their rate fell 26% from 115.5 in 1991 to 85.3 in 1998, lower than in any year since 1960 when data for black women first became available.[11] The birth rate for Hispanic teenagers has declined steadily since 1994, falling 13% to a lower level than in any year since national rates became available.

In examining the recent declines in teenage childbearing, it is useful to review trends separately for first births and for repeat births to teenagers. Rates of first births for teenagers declined in the 1990s but more slowly than overall rates, with nearly all of the total 10% reduction since 1991 occurring from 1995 (49.2) to 1997 (44.7). In contrast to this modest decline, repeat childbearing—that is, the rate of second births to teenagers who have already had 1 child—fell substantially in the 1990s, dropping 21% from 220.9 per 1000 in 1991 to 173.7 in 1997.[4,11] Although repeat births account for only 22% of all teen births, they are of particular concern; a teenager with 2 or more children is at greater risk for a host of difficulties.[13]

Childbearing for Women 20 Years of Age and Older

Birth rates for women in their twenties, the principal childbearing ages, increased 1% to 2% in 1998, to 111.2 per 1000 for ages 20 to 24 and 116.0 for ages 25 to 29 years. These rates generally declined from 1990 through 1995, but the year-to-year changes have been small.

Birth rates for women in their thirties continued to increase in 1998, rising to the highest levels in at least 30 years, to 87.5 per 1000 aged 30 to 34 and 37.4 per 1000 aged 35 to 39 years. Birth rates have also increased for women in their forties. The rate for women aged 40 to 44 years in 1998, 7.3 per 1000, has nearly doubled from its low point in 1981 (3.8). The steady upward trend in the rates for women in their thirties reflects in large part the ongoing tendency for many of these women to make up for previously postponed childbearing.[14] For example, the rate of *first* births per 1000 childless women aged 30 to 34 years in 1997, 92.1, is the highest ever recorded, 70%

TABLE 2. Live Births by Race and Hispanic Origin of Mother: United States, Each State, Puerto Rico, Virgin Islands, Guam, and American Samoa, Preliminary 1998, and Birth and Fertility Rates, Final 1997, and Preliminary 1998

Area	All Races	Number						Birth Rate		Fertility Rate	
		White, Total	White, Non-Hispanic	Black	Native American*	Asian or Pacific Islander	Hispanic	1998	1997	1998	1997
United States	3 944 046	3 122 391	2 364 907	610 203	40 167	171 284	735 019	14.6	14.5	65.6	65.0
Alabama	62 126	41 564	40 242	20 041	143	378	1317	14.3	14.1	63.3	62.1
Alaska	9935	6684	6180	405	2388	458	595	16.2	16.3	73.2	72.4
Arizona	78 296	68 428	38 729	2663	5437	1768	29 792	16.8	16.6	78.3	78.1
Arkansas	36 891	28 311	26 553	7990	219	371	1730	14.5	14.5	67.6	67.3
California	521 801	424 662	177 152	36 738	3380	57 020	247 668	16.0	16.3	70.7	72.3
Colorado	59 800	54 527	40 086	2880	654	1739	14 710	15.1	14.5	67.4	64.2
Connecticut	43 812	36 938	28 957	5375	110	1389	6183	13.4	13.2	61.3	60.3
Delaware	10 583	7703	6939	2623	34	222	748	14.2	14.0	61.2	60.3
District of Columbia	7694	2054	1321	5467	8	164	734	14.7	15.0	60.9	61.7
Florida	195 636	146 218	107 758	44 386	910	4121	39 541	13.1	13.1	65.1	64.9
Georgia	122 372	78 194	69 495	41 252	240	2687	8241	16.0	15.8	67.2	66.1
Hawaii	17 586	4175	3527	558	187	12 666	2239	14.7	14.7	69.7	69.0
Idaho	19 392	18 774	16 092	82	315	221	2428	15.8	15.4	72.3	70.3
Illinois	182 491	140 144	105 538	35 713	251	6383	34 749	15.2	15.2	68.2	68.4
Indiana	84 131	73 884	70 025	9035	110	1102	3690	14.3	14.2	63.5	62.9
Iowa	37 282	35 229	33 188	1093	195	764	1739	13.0	12.9	61.4	60.4
Kansas	38 412	34 288	30 013	2787	393	944	3962	14.6	14.4	67.1	65.7
Kentucky	54 301	48 815	48 064	4862	96	528	761	13.8	13.6	61.5	59.9
Louisiana	66 884	38 124	36 757	27 452	325	983	1326	15.3	15.2	66.7	65.7
Maine	13 748	13 382	12 688	91	104	171	131	11.0	11.0	49.8	49.5
Maryland	72 029	44 913	41 238	24 176	189	2751	3581	14.0	13.8	60.2	58.9
Massachusetts	81 548	69 578	62 148	7907	138	3925	8701	13.3	13.1	58.6	57.8
Michigan	133 681	105 603	92 978	24 277	726	3076	5942	13.6	13.7	60.4	60.0
Minnesota	65 202	57 290	51 089	3665	1174	3073	2967	13.8	13.8	61.8	61.4
Mississippi	42 931	22 953	22 487	19 359	236	382	401	15.6	15.2	68.3	66.3
Missouri	75 382	62 527	60 570	11 406	275	1174	1970	13.9	13.7	62.9	62.2
Montana	10 679	9389	8876	43	1141	106	335	12.1	12.3	58.4	59.1
Nebraska	23 537	21 445	18 755	1236	406	450	2192	14.2	14.1	65.2	64.6
Nevada	28 669	24 322	15 598	2253	449	1644	8699	16.4	16.0	77.8	75.4
New Hampshire	14 611	14 253	13 508	137	41	181	260	12.3	12.2	53.0	52.4
New Jersey	116 519	86 486	67 381	21 848	176	8009	20 866	14.4	14.1	65.4	64.1
New Mexico	27 801	23 409	9617	519	3480	393	13 956	16.0	15.5	73.4	70.4
New York	258 132	186 144	124 114	54 497	671	16 820	52 241	14.2	14.2	63.9	63.9
North Carolina	111 683	79 336	71 298	28 244	1732	2370	8101	14.8	14.4	66.6	64.3
North Dakota	7932	7035	6707	87	737	73	152	12.4	13.0	58.3	61.0
Ohio	152 900	127 376	123 885	22 813	293	2418	3472	13.6	13.6	61.2	60.7
Oklahoma	49 479	38 924	35 068	4804	4874	877	3613	14.8	14.6	69.0	67.8
Oregon	45 277	41 614	35 143	966	752	1945	6501	13.8	13.5	64.7	62.7
Pennsylvania	146 059	121 830	114 679	20 530	369	3330	6879	12.2	12.0	57.0	55.9
Rhode Island	12 600	11 030	7744	967	147	456	1865	12.7	12.6	57.6	56.6
South Carolina	53 888	34 209	32 938	18 839	147	694	1266	14.0	13.9	61.3	60.4
South Dakota	10 289	8392	8252	85	1720	92	153	13.9	13.8	65.1	63.6
Tennessee	77 386	59 299	57 336	16 883	126	1077	1996	14.2	13.9	63.1	61.2
Texas	342 280	291 831	140 005	40 202	771	9476	151 490	17.3	17.2	76.2	75.3
Utah	45 157	42 930	37 979	281	669	1277	4878	21.5	20.9	91.4	88.5
Vermont	6580	6494	6295	27	17	41	38	11.1	11.2	49.1	49.6
Virginia	94 512	68 728	63 013	22 190	216	3378	5820	13.9	13.6	59.2	58.0
Washington	79 659	69 018	57 203	3112	1830	5700	10 076	14.0	13.9	62.3	61.8
West Virginia	20 755	19 857	19 736	762	12	124	91	11.5	11.4	53.7	53.1
Wisconsin	67 454	58 187	54 639	6541	881	1844	3642	12.9	12.9	58.5	58.1
Wyoming	6260	5888	5324	54	271	47	587	13.0	13.3	61.0	61.8
Puerto Rico	59 015	54 530	—	4485	—	—	—	15.3	16.8	65.2	71.1
Virgin Islands	1784	351	102	1390	42	1	337	15.1	17.6	69.0	80.3
Guam	4313	348	306	46	4	3915	45	28.9	29.6	138.9	138.9
American Samoa	—	—	—	—	—	—	—	—	27.1	—	123.5

— Indicates data are not available.
* Includes births to Aleuts and Eskimos.
Excludes data for Puerto Rico, Virgin Islands, Guam, and American Samoa.
Note: Births are tabulated by race and Hispanic origin; persons of Hispanic origin may be of any race.

greater than the rate reported in 1975 (53.4) (tabular data not shown).

The total fertility rate (TFR) provides an estimate of the number of births that a hypothetical group of 1000 women would have if they experienced, throughout their childbearing years, the age-specific birth rates observed in a given year. TFR increased 1% to 2059.5 in 1998. This increase reflects the rise in birth rates for women aged 20 and older. TFR rose 1% for black women (2171.5) in 1998 and 2% each for non-Hispanic white (1839.5) and Native American women (2086.0). The rate declined 2% for Hispanic

TABLE 3. Live Births, Age-specific Birth Rates*, and Total Fertility Rates† by Race and Hispanic Origin of Mother: United States, Final, 1997

	Live Births	Age-specific Birth Rate by Age of Mother*								Total Fertility Rate†
		15–44‡	15–17	18–19	20–24	25–29	30–34	35–39	40–44	
Total	3 880 894	65.0	32.1	83.6	110.4	113.8	85.3	36.1	7.1	2032.5
White	3 072 640	63.9	27.1	75.9	106.7	116.6	87.8	36.4	6.9	2009.0
Black	599 913	70.7	60.8	130.1	139.0	99.5	64.3	29.7	6.5	2154.0
Native American§	38 572	69.1	45.3	117.6	134.9	100.8	64.2	29.3	6.4	2047.5
Asian/Pacific Islander	169 769	66.3	14.3	39.3	70.5	113.2	110.3	54.1	11.9	1925.5
All Hispanic	709 767	102.8	66.3	144.3	184.2	161.7	97.9	45.0	10.8	2999.5
Mexican	499 024	116.6	77.3	165.1	204.9	176.3	104.2	49.0	11.6	3307.5
Puerto Rican	55 450	71.7	48.9	120.0	154.0	109.3	59.1	27.0	6.2	2164.0
Cuban	12 887	57.4	25.3	53.4	82.7	123.5	75.7	35.1	6.3	1814.5
Central and South American and other	97 405	87.6	48.3	106.8	146.4	147.9	104.4	45.4	11.8	2653.5
Non-Hispanic White	2 333 363	57.0	19.4	61.9	89.8	107.2	85.2	34.9	6.4	1801.0

* Rates per 1000 women in age-specific group.
† Sum of age-specific births times 5 divided by 1000 (includes rates for ages 10–14 and 45–49 years, not shown separately).
‡ Relates the number of births to women of all ages to women aged 15 to 44 years.
§ Includes births to Aleuts and Eskimos.
Note: Births are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race.

TABLE 4. Birth Rates* for Teens, by Age, Race, and Hispanic Origin: United States, Final, Selected Years, 1990–1997, and Preliminary 1998

Age and Race and Hispanic Origin of Mother	1998	1997	1995	1991	1990	Percent Change 1991–1998
15–19 y						
All races†	51.1	52.3	56.8	62.1	59.9	−17.7
White, total	45.4	46.3	50.1	52.8	50.8	−14.0
White, non-Hispanic	35.2	36.0	39.3	43.4	42.5	−18.9
Black, total	85.3	88.2	96.1	115.5	112.8	−26.1
Hispanic	93.7	97.4	106.7	106.7	100.3	−12.2
15–17 y						
All races†	30.4	32.1	36.0	38.7	37.5	−21.4
White, total	25.9	27.1	30.0	30.7	29.5	−15.6
White, non-Hispanic	18.4	19.4	22.0	23.6	23.2	−22.0
Black, total	56.8	60.8	69.7	84.1	82.3	−32.5
Hispanic	62.3	66.3	72.9	70.6	65.9	−11.8
18–19 y						
All races†	82.0	83.6	89.1	94.4	88.6	−13.1
White, total	74.7	75.9	81.2	83.5	78.0	−10.5
White, non-Hispanic	60.6	61.9	66.1	70.5	66.6	−14.0
Black, total	126.8	130.1	137.1	158.6	152.9	−20.1
Hispanic	140.2	144.3	157.9	158.5	147.7	−11.5

* Rates per 1000 women in specified group.
† Includes races other than white and black.
Note: Births are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race.

women (2949.0), and 4% for women of Asian or Pacific Island descent (1852.5) (tabular data not shown for 1998).

Unmarried Mothers

The number, rate, and percent of births to unmarried women increased in 1998. The number of births increased 3% to 1 292 534. The preliminary birth rate for unmarried women rose to 44.3 births per 1000 unmarried women aged 15 to 44, about 1% higher than in 1997 (44.0), but still nearly 6% lower than its peak level, 46.9, in 1994. The number for 1998 is the highest ever reported in the United States; the increase is due mostly to continued increases in the number of unmarried women of childbearing age (up 6% since 1994).[15]

The proportion of all births that were to unmarried women increased from 32.4% in 1997 to 32.8% in 1998 (Table 5).[6] This proportion has been fairly stable since 1994. Nonmarital birth proportions rose for non-Hispanic white (21.9%) and Hispanic women (41.6%), and declined slightly for black women (69.0%).

The proportion of teen births that were to unmarried women continued to increase in 1998, rising to 78.8%. Birth *rates* for unmarried teenagers (ie, births per 1000 unmarried teenagers), available through 1997, describe the risk that an unmarried teenager will give birth. This rate declined by 9% overall between 1994 and 1997.

Smoking During Pregnancy

The rate of reported smoking during pregnancy continued to decline in 1997, a trend underway since this information first became available from the birth certificate in 1989.[16] In 1997, 13.2% of women reported smoking during pregnancy, down about one third since 1989 (19.5%) (Table 5). Tobacco use dur-

TABLE 5. Percent of Births with Selected Characteristics, by Race and Hispanic Origin of Mother: United States, Final 1990, 1997, Preliminary 1998

	All Races*			White, Total			Non-Hispanic White			Black, Total			Hispanic		
	1998	1997	1990	1998	1997	1990	1998	1997	1990†	1998	1997	1990	1998	1997	1990†
Mother															
<20 years of age	12.5	12.7	12.8	11.1	11.2	10.9	9.4	9.5	9.6	21.5	22.2	23.1	16.9	17.0	16.8
Unmarried	32.8	32.4	28.0	26.3	25.8	20.4	21.9	21.5	16.9	69.0	69.2	66.5	41.6	40.9	36.7
<12 completed years of school‡	—	16.0	17.6	—	16.0	17.1	—	8.2	15.2	—	17.1	19.6	—	45.3	53.9
16 or more completed years of school‡	—	26.1	20.1	—	27.7	21.7	—	32.8	22.5	—	13.5	9.4	—	8.1	5.1
Smoker§	—	13.2	18.4	—	14.3	19.4	—	16.5	20.9	—	9.8	15.9	—	4.1	6.7
Diabetes during pregnancy	—	2.6	2.1	—	2.6	2.2	—	2.6	2.3	—	2.5	1.8	—	2.5	2.4
Pregnancy-associated hypertention	—	3.7	2.7	—	3.7	2.8	—	4.0	3.1	—	4.0	2.7	—	2.7	2.3
Health care utilization															
First trimester prenatal care	82.8	82.5	75.8	84.8	84.7	79.2	87.9	87.9	83.3	73.3	72.3	60.6	74.3	73.7	60.2
Midwife-attended births	—	7.0	3.9	—	6.9	3.9	—	6.3	3.2	—	7.4	4.5	—	9.0	6.2
Cesarean delivery rate	21.2	20.8	22.7	21.0	20.7	23.0	21.2	20.9	23.4	22.4	21.8	22.1	20.6	20.2	21.2
Infant															
Birth weight															
VLBW¶	1.4	1.4	1.3	1.2	1.1	1.0	1.2	1.1	0.9	3.1	3.0	2.9	1.2	1.1	1.0
LBW¶	7.6	7.5	7.0	6.5	6.5	5.7	6.6	6.5	5.6	13.0	13.0	13.3	6.4	6.4	6.1
Multiple births per 1000															
Live births in twin deliveries (not percent)	—	26.8	22.6	—	26.7	22.1	—	28.8	22.9	—	30.0	26.5	—	19.5	18.0
Live births in higher-order multiple deliveries (not percent)	—	1.7	0.7	—	2.0	0.8	—	2.3	0.9	—	0.9	0.5	—	0.7	0.4

Includes races other than white and black.
† Excludes data for New Hampshire and Oklahoma, which did not report Hispanic origin.
‡ Includes mothers 20 years of age and older. For 1990, excludes data for New York (exclusive of New York City) and Washington, which did not report educational attainment of mother.
§ Excludes data for California, Indiana, New York (but includes New York City), and South Dakota, which did not report tobacco use.
¶ VLBW, birth weight of <1500 g (3 lb, 4 oz); LBW, birth weight of <2500 g (5 lb, 8 oz).
Note: Births are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race.

ing pregnancy is associated with a variety of adverse outcomes, including LBW, intrauterine growth retardation, and infant mortality, as well as negative consequences for child health.[17–19]

Maternal smoking declined or was unchanged in most racial/ethnic origin groups; rates are highest for non-Hispanic white, Native American, and Hawaiian women and lowest for Hispanic (except Puerto Rican) and Asian or Pacific Islander (except Hawaiian) women.[4] Smoking rates fell for women in most age groups, with the particular exception of pregnant teenagers, whose rates have now increased for 3 consecutive years, rising from 16.7% in 1994 to 17.6% in 1997, and are now higher than for any other age group. Although still relatively rare, smoking during pregnancy by black teenagers has risen from 5.0% to 6.6% since 1994.[4,16]

Prenatal Care

Timely prenatal care improved among US women for the 9th consecutive year, rising to 82.8% for 1998 (Table 5). The proportion of women beginning care in the first trimester of pregnancy changed little during the 1980s, but has increased 10% since 1989 (75.5%). For 1997–1998, the percent of women with first trimester care was unchanged for non-Hispanic white women (87.9%), but rose for black (73.3%) and Hispanic women (74.3%). Since 1989, first trimester care has risen 22% and 25%, respectively, among the latter 2 groups.

Although the relationship between prenatal care and pregnancy outcome is difficult to evaluate, timely prenatal care may promote better birth out-comes by providing early risk assessment to prevent or treat medical conditions, and by offering health behavior advice such as smoking cessation and nutrition counseling.[20]

The proportion of women beginning care late in pregnancy (during the third trimester), or with no care at all, was unchanged for 1997–1998 at 3.9%. Since 1989, this measure has declined from 6.4% for all births; among black women late or no care has dropped from 11.9% to 7.0%, and among Hispanic women from 13.0% to 6.3%.

Cesarean Delivery

The trend toward fewer cesarean deliveries may have ended, at least in the short-term. The cesarean delivery rate rose from 20.8 to 21.2 per 100 live births for 1997–1998 (Table 5). The primary cesarean rate (first cesareans per 100 live births to women who had no previous cesarean) increased for the first time since 1989 when these data became available from birth certificates, rising 2%, from 14.6% to 14.9%. The primary cesarean rate had fallen steadily between 1989 and 1996 (from 16.1 to 14.6%) and was unchanged for 1996–1997. Primary cesarean rates rose in 1998 among the 3 major racial/ethnic groups: non-Hispanic white (15.1%), black (16.0%), and Hispanic women (13.6%).

The rate of vaginal birth after previous cesarean delivery (VBAC; number of vaginal births per 100 births to women with a previous cesarean) was down 4%, dropping from 27.4 in 1997 to 26.3 in 1998. The VBAC rate rose 50% between 1989 and 1996, but has fallen 7% in the past 2 years. The recent decline

in the VBAC rate may reflect renewed controversy over the safety of VBAC compared with elective repeat cesarean.[21,22]

Overall cesarean section rates increase with maternal age; for 1997, mothers 40 years of age and older were more than twice as likely to have a cesarean delivery as teenaged mothers (32.4% and 14.3%, respectively).

Multiple Births

The number and rate of multiple births continues to climb. The number of births in twin deliveries rose 3% between 1996 and 1997, and has risen 52% since 1980 (from 68 339 to 104 137).[23] The number of triplet and other higher-order multiple births jumped 16% between 1996 and 1997, soaring 404% since 1980 (from 1337 to 6737 births).[23] Twins, triplets, and other higher-order multiples now account for nearly 3% of all births.

The twin birth rate (the number of twin births per 1000 live births) was up 3% to 26.8 per 1000 for 1997 (Table 5). On the heels of a 20% rise from 1995 to 1996, the higher-order multiple birth rate (the number of triplets, quadruplets, and other higher-order multiple births per 100 000 live births) rose 14% between 1996 and 1997 to 173.6 per 100 000. The higher-order multiple birth rate has doubled since 1991 (81.4) and quadrupled since 1980 (37.0).

The growth in twin and triplet birth rates in recent years among women 30 years of age and older is extraordinary. Between 1980–1982 and 1995–1997 (3 years of data are combined to generate stable rates), the twin birth rate rose 63% for women 40 to 44 years, and soared nearly 1000% for women 45 to 49 years. The higher-order multiple birth rate rose 400% for women in their thirties, and exploded by more than 1000% for women in their forties (Fig 1).[23]

The increase in multiple births, especially higher-order multiples, has been associated with two related trends—older age at childbearing and increased use of ovulation-inducing drugs and assisted reproductive technologies, such as in vitro fertilization.[24]

Multiple births, regardless of how conceived, tend to be high-risk births. About half of all twins and the great majority of triplets are born preterm or LBW. This higher risk, coupled with the escalating multiple
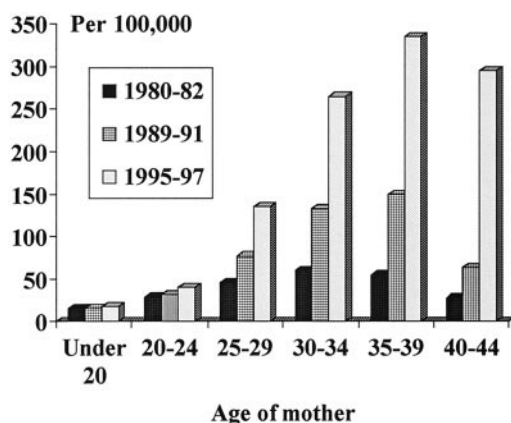

Fig 1. Triplet and other higher-order multiple birth rates: 1980–1982, 1989–1991, 1995–1997.

birth rate, has had a large influence on overall national and state measures of infant health.[25,26]

Birth Weight

The rate of LBW (<2500 g) was 7.6% in 1998, up from 7.5% in 1997. The percent LBW has been increasing fairly steadily from the low of 6.7% reported in 1984. The rate of very low birth weight (VLBW; births weighing <1500 g) also rose slightly to 1.45% for 1998, from 1.42% in 1997. VLBW has risen moderately during the 1980s and 1990s (from 1.15% in 1980).[4] When compared with heavier infants (2500 g or more), the risk of infant death in 1997 was 5 times higher for infants weighing 1500 to 2499 g, and 92 times higher for infants born at under 1500 g.[8]

Between 1997 and 1998, LBW increased among non-Hispanic white mothers (from 6.5% to 6.6%), but was essentially the same for black (13.0%) and Hispanic mothers (6.4%). LBW among black mothers has declined from a high of 13.6% reported for 1990, but remains higher than levels reported during the early and mid 1980s (12.6% to 12.8%).

The rise in the multiple birth rate has markedly influenced overall rates of LBW. Whereas LBW among all births rose 12% between 1984 and 1997, when only singleton births are examined, the rise in LBW is a comparatively modest, 5%. Multiple births also have an important impact on age-specific LBW rates, especially among older mothers. For example, among all births to women 45 to 54 years of age the LBW rate was 17.4%; when multiple births are excluded, however, the level drops to 9.2%, almost half the rate.

LBW risk varies broadly among Hispanic and Asian and Pacific Islander subgroups. For 1997, levels of LBW among mothers of Puerto Rican origin (9.4%) were 57% higher than those of their Mexican counterparts (6.0%). Among Asian and Pacific Islanders, LBW risk ranged from 5.1% for Chinese mothers (the lowest level reported among any of the racial/ethnic groups) to 8.3% for Filipino mothers.

INFANT MORTALITY

In 1998, an estimated 28 486 infant deaths were reported in the United States (Table 1). The preliminary IMR was 7.2 per 1000 live births, the same as the final 1997 rate of 7.2, and matches the lowest ever recorded in the United States[5,6] The neonatal mortality rate (NMR; infant deaths under 28 days) was 4.8 in 1997 and in 1998, while the postneonatal mortality rate (PNMR; 28 days through 11 months) declined from 2.5 to 2.4. Between 1997 and 1998, IMRs and NMRs declined for infants of black mothers; however, the decrease was not statistically significant. The respective rates for infants of white mothers remained the same. IMRs were higher for infants whose mothers were teenagers or 40 years of age or older, did not complete high school, were unmarried, began prenatal care after the first trimester of pregnancy, or smoked during pregnancy. IMRs were also higher for male infants, multiple births, and infants born preterm or LBW.[8]

Infant mortality in the United States has declined by >40% since 1980 (Table 6 and Fig 2). The NMR

TABLE 6. IMR, NMR, PNMR, Perinatal Mortality Rate and Fetal Mortality Rate by Race of Mother: Final 1980 and 1997, and Preliminary 1998

	1998	1997	1980	Percent Change 1980–1998
IMR*†	7.2	7.2	12.6	−42.9
White, total	6.0	6.0	10.9	−45.0
White Non-Hispanic	6.0	6.1	—	—
Black, total	14.1	14.2	21.4	−34.1
Hispanic	6.0	6.0	—	—
Black:white ratio	2.4	2.4	2.0	
NMR*†	4.8	4.8	8.5	−43.5
White, total	4.0	4.0	7.4	−45.9
White, Non-Hispanic	4.0	4.0	—	—
Black, total	9.3	9.4	14.1	−34.0
Hispanic	4.0	3.9	—	—
Black:white ratio	2.3	2.4	1.9	
PNMR*†	2.4	2.5	4.1	−41.5
White, total	2.0	2.0	3.5	−42.9
White, Non-Hispanic	2.1	2.1	—	—
Black, total	4.8	4.8	7.3	−34.2
Hispanic	1.9	2.0	—	—
Black:white ratio	2.4	2.4	2.1	
Perinatal mortality rate*‖	—	7.5	13.2	−43.2¶
White, total	—	6.4	11.8	−45.8¶
White, Non-Hispanic	—	6.0	—	—
Black, total	—	13.4	21.3	−37.1¶
Hispanic‡	—	6.5	—	—
Black:white ratio	—	2.1	1.8	
Fetal mortality rate*§	—	6.8	9.1	−25.3¶
White, total	—	5.8	8.1	−28.4¶
White, Non-Hispanic	—	5.2	—	—
Black, total	—	12.5	14.7	−15.0¶
Hispanic‡	—	5.9	—	—
Black:white ratio	—	2.2	1.8	

* Includes races other than white and black.
† Rate per 1000 live births.
‡ States not reporting Hispanic origin for 1997 for fetal deaths are Maryland, Massachusetts, and Oklahoma.
§ Number of fetal deaths at ≥20 weeks of gestation per 1000 live births plus fetal deaths.
¶ Percent change is from 1980–1997 because preliminary 1998 data not available.
‖ Number of fetal deaths at ≥28 weeks of gestation plus number of infant deaths at <7 days of age per 1000 live births plus fetal deaths.
— Indicates data are not available.
Note: Infant, fetal, and perinatal deaths are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race. IMRs, NMRs, and PNMRs by race from unlinked data may differ slightly from those based on the linked file (Tables 7 and 9).

declined more rapidly during the 1980s, whereas the PNMR has declined more rapidly during the 1990s. The decline in the perinatal mortality rate (number of fetal deaths at 28+ weeks of gestation plus number of infant deaths at <7 days of age per 1000 live births plus fetal deaths) has closely paralleled the decline in the NMR, while the fetal mortality rate (number of fetal deaths at 20+ weeks of gestation per 1000 live births plus fetal deaths) has declined more slowly.

Racial differences in the IMR remain a major national concern. Although all race groups have experienced declines in IMR, the relative difference in rates between black and white newborns, expressed as the ratio of black to white IMRs, increased from 2.0 in 1980 to 2.4 in 1990 (Table 6). The ratio remained unchanged at 2.4, from 1990–1998. The absolute difference in IMRs has actually decreased since 1990,

from 10.4 to 8.1 deaths per 1000 live births in 1998. The Hispanic IMR was the same as the non-Hispanic white IMR in 1998. While the recent decline is very encouraging, racial disparities in IMR present continued challenges for researchers and health care providers alike.[27,28] Some states are beginning to address the problem.[29]

Birth Weight-specific Infant Mortality

Birth weight is one of the most important predictors of infant mortality. The IMR for a given population can be partitioned into 2 key components: the birth weight distribution and birth weight-specific mortality rates (the mortality rate for infants at a given weight). The IMR can decrease when either the percentage of LBW births decreases or birth weight-specific mortality rates decrease. The percentage of LBW births plateaued during the early 1980s, but has generally increased since then (Fig 2). Thus, all of the decline in the IMR since 1980 has been attributable to declines in birth weight-specific IMRs, and not to the prevention of LBW. These declines have been attributed primarily to improvements in obstetric and neonatal care. The United States has been unsuccessful in reducing the number of preterm and LBW deliveries in recent years even though prevention efforts have the potential to save many more infant lives and reduce subsequent morbidity than do further improvements in neonatal care.

In 1997, 65% of all infant deaths occurred to the 7.5% of infants born LBW, and 51% of all infant deaths occurred to the 1.4% of infants born VLBW.[8] Almost 9 out of 10 infants with birth weights <500 g die within the first year of life—most within the first few days of life (Table 7). An infant's chances of survival increase rapidly thereafter with increasing birth weight. At birth weights of 1250 to 1499 g, >95 out of 100 infants now survive the first year of life. IMRs are lowest for infants weighing 4000 to 4499 g, with small increases among the heaviest infants.

IMRs are lower for infants of black mothers than for infants of non-Hispanic white mothers for individual birth weight categories under 2500 g, but are higher at birth weights of 2500 g or more. In contrast, IMRs are higher for infants of black mothers than for infants of non-Hispanic white mothers for the broad birth weight categories of <1500 g and <2500 g. The reason for this discrepancy is that the birth weight distribution for infants of black mothers includes a much higher proportion of births at extremely low birth weights, and, as a result, influences the IMRs for these broad birth weight groupings. The largest relative difference, nevertheless, in birth weight-specific IMRs between infants of non-Hispanic white and black mothers is for infants weighing 2500+ g (2.5 and 4.1, respectively). Thus, much of the excess mortality for black infants can be explained by 2 factors: 1) A birth weight distribution with a higher incidence of LBW, VLBW, and preterm births among infants of black mothers; and 2) higher IMRs for black infants weighing 2500+ g.

Birth weight-specific IMRs for infants of Hispanic mothers are quite similar to those for non-Hispanic white mothers, but with slightly higher IMRs for
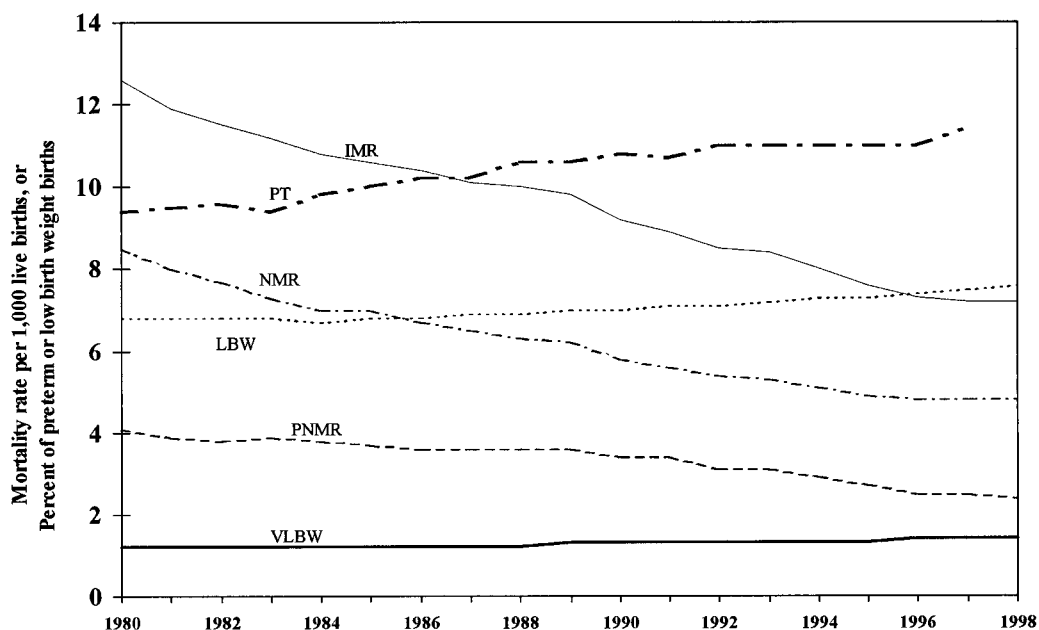
Fig 2. IMR, NMR, PNMR, LBW, VLBW, and preterm delivery, United States, 1980–1998. IMR indicates IMR per 1000 live births; LBW percent LBW (<2500 g); VLBW, percent VLBW (<1500 g); PR, percent preterm (<37 weeks of gestation).

TABLE 7. IMR and NMR by Birth Weight and Race of Mother, United States, 1997 Linked File

Birth Weight (g)	IMR				NMR			
	All Races*	Non-Hispanic White	Black	Hispanic	All Races*	Non-Hispanic White	Black	Hispanic
Total	7.2	6.0	13.7	6.0	4.8	3.9	9.2	4.0
<2500	61.7	56.0	75.8	58.4	50.3	46.0	61.3	47.6
<1500	252.8	240.7	270.1	250.1	223.8	215.7	236.1	218.3
<500	883.9	899.7	875.2	864.1	869.2	886.0	861.1	838.9
500–749	492.7	510.7	456.9	506.3	437.5	461.0	396.2	446.5
750–999	161.3	172.5	140.4	174.6	122.4	136.6	96.8	137.4
1000–1249	75.9	75.8	72.3	84.9	53.7	58.4	42.5	61.7
1250–1499	48.6	51.7	38.9	56.0	34.3	39.3	22.6	38.2
1500–1999	30.2	31.1	26.6	33.4	18.8	20.2	14.0	22.2
2000–2499	12.4	12.5	12.3	12.0	6.5	7.0	5.2	7.1
≥2500	2.7	2.5	4.1	2.3	1.0	1.0	1.1	0.9
2500–2999	4.9	5.0	5.8	4.3	2.0	2.1	1.8	2.0
3000–3499	2.6	2.5	3.7	2.1	0.9	0.9	0.9	0.8
3500–3999	1.9	1.8	2.9	1.6	0.6	0.6	0.7	0.5
4000–4499	1.7	1.5	3.0	1.6	0.7	0.6	1.0	0.7
≥4500	2.2	1.9	5.1	2.1	1.0	0.8	†	†

* Includes races other than white and black.
† Figure does not meet standards of reliability or precision.
Note: IMRs and NMRs by race from the linked file differ slightly from those based on unlinked data because the linked file uses the self-reported race of mother from the birth certificate, whereas the unlinked data uses the race of child as reported by the funeral director on the death certificate. Births are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race.
Source: National Center for Health Statistics, 1997 Period Linked Birth/Infant Death Data Set.

infants born weighing 750 to 1999 g, and slightly lower IMRs for infants born weighing 2000 to 3999 g.

From 1990 to 1997, IMRs declined rapidly (by 34%–39%) for infants weighing 750 to 1499 g at birth, moderately (by 24%–31%) for infants weighing 500 to 749, and 1500 to 3999 g, and more slowly (by 19%–22%) for infants weighing >4000 g. In contrast, mortality rates for infants born at <500 g declined very little (4%) from 1990–1997, reflecting the limited success of intensive efforts made to save these very small infants. The few infants who do survive at these VLBWs may suffer lifetime disabilities such as blindness, mental retardation, and neurologic disor-

ders, necessitating increased levels of medical and parental care.[30,31]

Geographic Variation

Tables 8 and 9 present information on state variations in LBW, IMR, and birth weight-specific NMR. The percent LBW relates mostly to prenatal factors such as the proportion of multiple births, preexisting maternal risk factors (eg, smoking, maternal medical conditions), and the quality and content of prenatal care. The NMR for 500 to 1499-g births more closely reflects the quality and availability of neonatal intensive care. Infant mortality can be viewed as a com-

TABLE 8. Percent LBW and IMR by Race of Mother, United States and Each State, 1997

State of Residence	Percent LBW*					IMR‡				
	All Races†	White, Total	Non-Hispanic, White	Black	Hispanic	All Races	White, Total	Non-Hispanic, White	Black	Hispanic
United States	7.5	6.5	6.5	13.0	6.4	7.2	6.0	6.1	14.2	6.0
Alabama	9.2	7.4	7.4	13.1	7.3	9.5	7.5	7.5	13.9	§
Alaska	5.9	5.5	5.3	12.3	7.1	7.5	6.8	6.9	§	§
Arizona	6.9	6.6	6.7	13.6	6.6	7.1	6.8	6.0	14.4	8.1
Arkansas	8.4	7.2	7.2	12.7	6.5	8.7	7.4	7.5	13.8	§
California	6.2	5.6	5.5	12.0	5.6	5.9	5.6	5.6	13.1	5.6
Colorado	8.8	8.5	8.3	15.1	9.1	7.0	6.7	6.7	16.3	7.0
Connecticut	7.3	6.5	6.2	12.3	8.3	7.2	6.3	6.2	14.3	8.2
Delaware	8.7	6.9	6.8	14.1	8.0	7.8	5.7	5.7	14.5	§
District of Columbia	13.4	5.9	5.7	16.1	6.2	13.2	§	§	16.7	§
Florida	8.0	6.8	6.8	12.3	6.7	7.1	5.7	5.9	12.3	4.4
Georgia	8.8	6.6	6.7	13.0	5.4	8.6	6.1	6.4	13.8	4.2
Hawaii	7.2	5.1	5.1	10.2	7.4	6.6	§	3.5	§	§
Idaho	6.3	6.3	6.1	§	7.4	6.8	6.9	6.9	§	§
Illinois	7.9	6.4	6.4	13.9	6.2	8.4	6.4	6.0	17.1	7.1
Indiana	7.7	7.0	7.0	13.6	7.0	8.2	7.3	7.3	15.8	7.3
Iowa	6.4	6.2	6.1	10.4	6.6	6.2	5.9	5.8	18.2	§
Kansas	6.9	6.4	6.4	12.9	5.9	7.4	6.6	6.0	17.1	8.4
Kentucky	7.8	7.4	7.4	12.0	7.2	7.3	7.0	6.9	11.0	§
Louisiana	10.2	7.0	7.1	14.6	5.5	9.5	6.6	6.7	13.8	§
Maine	5.9	5.9	6.0	§	§	5.1	5.3	5.3	§	§
Maryland	8.8	6.4	6.4	13.6	6.6	8.8	5.1	5.4	16.2	§
Massachusetts	7.0	6.6	6.4	10.6	8.3	5.2	5.0	4.6	8.8	6.7
Michigan	7.7	6.5	6.4	13.2	6.7	8.2	6.1	6.4	17.5	8.4
Minnesota	5.9	5.5	5.6	11.1	6.8	5.9	5.1	5.3	16.5	8.8
Mississippi	10.1	7.4	7.4	13.4	6.1	10.6	7.1	7.1	14.9	§
Missouri	7.7	6.7	6.7	13.5	6.1	7.6	6.1	6.1	16.3	§
Montana	6.3	6.1	6.0	§	7.6	6.9	6.0	6.4	§	§
Nebraska	7.0	6.7	6.8	11.7	5.2	7.4	6.8	6.7	19.2	§
Nevada	7.6	7.0	7.4	13.7	6.3	6.5	6.2	6.7	13.6	4.5
New Hampshire	5.8	5.9	5.8	§	8.8	4.3	4.3	4.3	§	§
New Jersey	7.9	6.5	6.2	13.7	7.4	6.3	4.9	4.3	13.4	6.9
New Mexico	7.8	7.8	7.7	15.4	7.9	6.1	5.6	4.7	§	6.6
New York	7.8	6.7	6.2	11.8	7.6	6.7	5.7	6.2	10.9	4.6
North Carolina	8.8	7.1	7.2	13.6	6.1	9.2	6.9	7.1	15.7	4.8
North Dakota	6.2	6.2	6.2	§	§	6.2	5.9	5.8	§	§
Ohio	7.7	6.7	6.7	13.6	7.5	7.8	6.5	6.5	15.6	6.7
Oklahoma	7.3	6.8	6.9	12.3	5.7	7.5	6.7	6.8	15.0	§
Oregon	5.5	5.3	5.3	11.0	5.4	5.8	5.7	5.5	§	6.7
Pennsylvania	7.6	6.5	6.4	13.9	9.2	7.6	6.0	5.8	17.6	10.0
Rhode Island	7.4	6.9	6.4	11.9	7.8	7.0	7.0	5.9	§	§
South Carolina	9.2	6.8	6.8	13.5	5.9	9.6	6.4	6.4	15.4	§
South Dakota	5.5	5.6	5.6	§	§	7.7	5.3	5.3	§	§
Tennessee	8.8	7.4	7.4	13.7	6.3	8.6	6.5	6.4	16.3	§
Texas	7.3	6.5	6.5	12.4	6.6	6.4	5.9	5.8	10.9	6.1
Utah	6.6	6.5	6.4	13.8	7.4	5.8	5.8	5.6	§	6.5
Vermont	6.3	6.3	6.1	§	§	6.1	6.1	6.3	§	§
Virginia	7.7	6.2	6.2	12.6	6.3	7.8	6.0	5.9	14.2	7.3
Washington	5.6	5.3	5.3	10.2	5.4	5.6	5.3	5.3	15.4	6.1
West Virginia	8.3	8.1	8.1	12.8	§	9.6	9.1	9.1	§	§
Wisconsin	6.4	5.6	5.6	13.3	6.7	6.5	5.7	5.7	13.9	§
Wyoming	9.0	9.0	9.0	§	8.0	5.8	5.6	5.1	§	§
Puerto Rico	10.7	10.7	—	9.8	—	11.3	11.9	—	§	—
Virgin Islands	8.1	§	§	9.3	5.9	12.9	§	§	13.8	§
Guam	7.1	5.0	§	§	§	8.1	§	§	§	§
American Samoa	3.2	—	—	—	—	§	—	—	—	—

* Percent of births <2500 g (5 lb, 8 oz).
† Includes races other than white and black.
‡ Infant deaths under one year of age per 1000 live births.
§ Figure does not meet standards of reliability or precision.
— Indicates data are not available.
Note: Births and infant deaths are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race.

posite measure, reflecting the influences of these, and other factors (for example, postneonatal mortality attributable to sudden infant death syndrome [SIDS] or injuries).

Percent LBW and IMR by state are presented in Table 8 for 1997. Oregon, South Dakota, and Wash- ington State had the lowest percent of LBW births (5.5–5.6), while Mississippi (10.1), Louisiana (10.2), and the District of Columbia (13.4) had the highest. When examining IMRs, Maine, Massachusetts, and New Hampshire had the lowest rates in 1997, and the District of Columbia, Mississippi, West Virginia,

TABLE 9. NMR for Infants for 500-g to 1499-g Births by Race of Mother: United States and Each State, 1995–1997 Linked Files

State of Residence	All Races* Rate†	All Races* 95% CI‡		Non-Hispanic, White Rate†	Non-Hispanic, White 95% CI‡		Black Rate†	Black 95% CI‡		Hispanic Rate†	Hispanic 95% CI‡	
United States	153.2	151.0	155.4	154.9	151.7	158.0	146.3	142.6	150.0	159.3	153.5	165.1
Alabama	159.5	144.1	174.8	162.5	139.3	185.7	154.9	134.2	175.5	—	—	—
Alaska	152.8	104.2	201.3	161.9	93.0	230.9	—	—	—	—	—	—
Arizona	179.0	160.1	197.9	169.6	143.5	195.6	—	—	—	215.0	180.0	250.1
Arkansas	146.5	125.9	167.1	164.2	135.7	192.6	117.1	87.2	147.1	—	—	—
California	154.5	148.0	161.1	159.8	147.6	172.1	141.1	125.9	156.4	156.7	146.6	166.8
Colorado	152.9	134.2	171.5	150.6	127.7	173.4	148.8	89.8	207.7	150.6	110.1	191.0
Connecticut	142.6	123.5	161.7	144.1	117.1	171.0	132.1	96.6	167.6	174.7	120.1	229.4
Delaware	126.1	92.6	159.6	118.8	73.3	164.3	142.5	87.1	197.9	—	—	—
District of Columbia	162.1	131.6	192.6	—	—	—	161.9	129.8	194.0	—	—	—
Florida	138.1	129.2	147.0	145.1	131.1	159.0	130.4	116.9	143.9	132.9	110.5	155.4
Georgia	164.4	152.6	176.2	168.9	149.5	188.3	160.4	145.0	175.8	190.9	115.1	266.7
Hawaii	149.7	113.7	185.7	—	—	—	—	—	—	—	—	—
Idaho	187.4	143.7	231.1	187.6	138.2	237.1	—	—	—	—	—	—
Illinois	169.6	159.5	179.7	165.0	150.2	179.8	168.0	151.9	184.1	184.5	155.1	213.8
Indiana	180.6	164.0	197.2	182.8	163.4	202.2	171.2	136.3	206.0	—	—	—
Iowa	163.2	138.3	188.1	167.7	140.2	195.1	—	—	—	—	—	—
Kansas	150.5	127.2	173.9	147.4	120.2	174.6	157.8	100.9	214.5	—	—	—
Kentucky	127.9	111.0	144.8	130.6	111.4	149.7	101.1	66.3	136.0	—	—	—
Louisiana	141.6	128.1	155.2	162.4	136.9	187.9	132.3	116.2	148.4	—	—	—
Maine	140.9	102.0	179.9	141.9	101.6	182.2	—	—	—	—	—	—
Maryland	149.3	135.6	163.0	142.7	120.6	164.8	151.1	133.0	169.2	—	—	—
Massachusetts	131.3	116.6	146.0	129.5	111.4	147.6	120.8	89.7	152.0	121.3	80.5	162.1
Michigan	161.5	149.8	173.2	156.7	141.2	172.2	156.4	137.5	175.4	183.1	111.6	254.5
Minnesota	116.8	100.3	133.3	119.1	100.0	138.2	—	—	—	—	—	—
Mississippi	159.4	141.0	177.8	169.6	135.9	203.2	154.4	132.2	176.5	—	—	—
Missouri	166.2	149.3	183.1	164.9	144.1	185.7	165.7	135.4	196.1	—	—	—
Montana	147.2	101.6	192.7	150.3	97.7	202.9	—	—	—	—	—	—
Nebraska	207.8	172.0	243.6	205.9	166.3	245.6	—	—	—	—	—	—
Nevada	144.5	117.3	171.6	158.2	119.3	197.1	—	—	—	148.1	88.9	207.4
New Hampshire	123.5	85.3	161.7	110.0	72.2	147.8	—	—	—	—	—	—
New Jersey	136.0	124.9	147.2	142.8	125.2	160.3	115.5	99.1	131.8	156.5	125.6	187.4
New Mexico	159.0	128.9	189.0	163.8	113.5	214.2	—	—	—	158.9	115.8	201.9
New York	160.2	152.1	168.4	143.5	129.6	157.5	165.0	152.0	178.0	176.4	157.1	195.8
North Carolina	152.4	140.8	163.9	159.0	141.8	176.2	141.7	125.5	158.0	193.3	116.7	269.8
North Dakota	134.8	84.3	185.4	138.3	81.6	195.0	—	—	—	—	—	—
Ohio	158.1	147.1	169.1	162.2	148.5	175.9	148.8	129.5	168.0	—	—	—
Oklahoma	175.5	152.8	198.2	185.1	156.1	214.1	166.7	120.2	213.3	—	—	—
Oregon	142.9	118.6	167.3	139.0	111.7	166.3	—	—	—	214.5	127.1	301.9
Pennsylvania	158.4	147.1	169.8	166.2	151.5	180.9	143.0	123.7	162.2	172.2	120.2	224.2
Rhode Island	138.8	99.5	178.2	125.3	74.5	176.1	—	—	—	—	—	—
South Carolina	168.0	150.8	185.2	156.1	130.3	182.0	177.3	153.9	200.8	—	—	—
South Dakota	164.5	113.2	215.7	134.1	81.2	187.0	—	—	—	—	—	—
Tennessee	140.2	126.6	153.8	137.6	119.6	155.5	142.3	121.1	163.6	—	—	—
Texas	143.0	135.6	150.4	156.4	143.4	169.5	118.9	105.5	132.3	147.6	135.4	159.9
Utah	124.8	103.0	146.6	125.9	101.5	150.3	—	—	—	—	—	—
Vermont	184.5	111.6	257.4	177.1	102.0	252.2	—	—	—	—	—	—
Virginia	151.8	138.4	165.2	153.2	134.0	172.5	146.4	126.4	166.4	189.6	117.6	261.6
Washington	152.1	133.9	170.3	145.0	123.7	166.3	166.3	103.5	229.1	146.9	91.9	201.9
West Virginia	169.9	138.5	201.3	166.6	134.4	198.9	—	—	—	—	—	—
Wisconsin	136.8	119.9	153.8	147.9	126.4	169.4	106.9	76.4	137.5	—	—	—
Wyoming	128.4	75.1	181.7	—	—	—	—	—	—	—	—	—

— Indicates figure does not meet standards of reliability or precision.
* Includes races other than white and black.
† Rates are per 1000 live births weighing 500 to 1499 g.
‡ 95% confidence interval.
Note: Data are tabulated separately by race and Hispanic origin; persons of Hispanic origin may be of any race.
Source: National Center for Health Statistics, 1997 Period Linked Birth/Infant Death Data Set.

South Carolina, Louisiana, and Alabama had the highest. Although the highest rates of both LBW and IMR were for the District of Columbia, it is more appropriate to compare these rates to those for other large US cities because of the high concentrations of high-risk women in these areas. Differences in LBW and IMR by state reflect, in part, differences in the racial, ethnic, and socioeconomic composition of their populations.

NMRs for infants with birth weights of 500 to 1499 g are presented in Table 9. Because of small annual numbers of neonatal deaths at 500 to 1499 g in some states, data are presented for a 3-year time period (1995–1997), and confidence intervals are provided to aid in the interpretation of differences. States with rates that were significantly lower than the national average were Minnesota, Utah, Kentucky, Massachusetts, New Jersey, Texas, and Florida. Those with rates that were significantly higher than the national average were Nebraska, Arizona, Indiana, and Illinois.

It is possible to compare the statistics presented here for a given state to get an idea of how well the state is doing in overall infant mortality, and then to gain further insight into areas of strength or weakness in regard to maternal risk factors and prenatal care (%LBW), neonatal intensive care (NMRs for 500- to 1499-g births), or other factors. For example, the high IMR for the District of Columbia relates primarily to the high percent of LBW births to black mothers, who constitute the majority of mothers in the District of Columbia. In contrast, the NMR for 500- to 1499-g births is not significantly different from the national average. The comparatively low IMR for New Hampshire (4.3) primarily reflects a lower percentage of LBW births; although the NMR for 500- to 1499-g births is also lower than the US average, the difference is not statistically significant. Finally, although Nebraska has the highest NMR for 500- to 1499-g births, the IMR is not significantly different from the US average, attributable to Nebraska's relatively low percentage of LBW births.

Leading Causes of Infant Death

The 10 leading causes of infant death for 1998 are shown in Table 10. About half of all infant deaths were attributable to the 4 leading causes of infant death: congenital anomalies, disorders relating to short gestation and unspecified LBW, SIDS, and respiratory distress syndrome (RDS) and newborns affected by maternal complications of pregnancy. IMRs from congenital anomalies declined by 38% from 1979 to 1998, less than the decline for overall infant mortality. IMRs for RDS declined by 63% since 1989 when new medical treatments for this condition became widely available.[32–34] Of concern, however, is the lack of any significant decline since 1979 for disorders related to short gestation and unspecified LBW, the second leading cause of infant death. Following slow declines during the 1980s, SIDS rates fell >40% after 1992 when the American Academy of Pediatrics issued a recommendation to reduce the risk of SIDS by placing infants on their backs or sides to sleep.[35–37]

INTERNATIONAL COMPARISONS

Table 11 shows the IMR for countries with a population of at least 2.5 million and for which the IMR was lower than the US rate in 1995, 1996, or 1997. These data were obtained primarily from the United Nations' *1997 Demographic Yearbook*[38] and confirmed by United Nations personnel (M. Otero, personal communication, September 1999). Hong Kong has been retained in the table for purposes of consistency with previous years despite its change in status. The order of some of the countries has shifted in the table from last year, but generally the countries in the top half, with the lowest IMRs, have remained the same.

As in previous years, the United States is in the unenviable position of having one of the highest IMRs among developed countries, along with the highest birth rate. Some caution should be taken in interpreting these comparisons as the high IMR in the United States compared with other countries may be attributable in part to variations in reporting requirements for infant deaths and for live birth registration.[39–41] Nevertheless, the unfavorable birth weight distribution in the United States continues to be one reason for its unenviable IMR, and as noted earlier, the proportion of the smallest and most vulnerable infants has been increasing over the 1990s.

TABLE 10. Infant Deaths and IMRs for the 10 Leading Causes of Infant Death in 1998: United States, Final 1979 and 1997, and Preliminary 1998

Cause of Death and *International Classification of Diseases, 9th Revision* Codes	Rank*	1998			1997			1979			Percent Change 1979–1998
		Number	Percent	Rate†	Number	Percent	Rate†	Number	Percent	Rate†	
All causes	—	28 488	100.0	722.3	28 045	100.0	22.6	45 665	100.0	1306.8	−44.7
Congenital anomalies (740–759)	1	6266	22.0	158.9	6178	22.0	59.2	8923	19.5	255.4	−37.8
Disorders relating to short gestation and unspecified low birth weight (765)	2	4011	14.1	101.7	3925	14.0	101.1	3495	7.7	100.0	1.7
Sudden infant death syndrome (798.0)	3	2529	8.9	64.1	2991	10.7	77.1	5279	11.6	151.1	−57.6
Respiratory distress syndrome (769)	4	1328	4.7	33.7	1301	4.6	33.5	5458	12.0	156.2	−78.4
Newborn affected by maternal complications of pregnancy (761)	4	1328	4.7	33.7	1244	4.4	32.1	1621	3.5	46.4	−27.4
Newborn affected by complications of placenta, cord, and membranes (762)	6	932	3.3	23.6	960	3.4	24.7	970	2.1	27.8	−15.1
Infections specific to the perinatal period (771)	7	815	2.9	20.7	777	2.8	20.0	981	2.1	28.1	−26.3
Accidents and adverse effects (E800–E949)	8	726	2.5	18.4	765	2.7	19.7	1080	2.4	30.9	−40.5
Intrauterine hypoxia and birth asphyxia (768)	9	459	1.6	11.6	452	1.6	11.6	1393	3.1	39.9	−70.9
Pneumonia and influenza (480–487)	10	400	1.4	10.1	421	1.5	10.8	1129	2.5	32.3	−68.7

* Rank based on number of deaths.
† Rate per 100 000 live births.

TABLE 11. Live Births and Birth Rates for 1997 and IMR for 1995, 1996, and 1997 for Countries of >2 500 000 Population and With IMR Equal to or Less than the United States Rate for 1995, 1996, or 1997

	Number of Births in 1997	Birth Rate 1996	IMR 1997	IMR 1996	IMR 1995
Sweden	89 171	10.1	3.6	4.0	3.7
Japan	1 190 000*	9.5*	3.7*	3.8	4.2
Singapore	47 371	12.7	3.8	3.8	4.0
Hong Kong	60 379	9.3	4.0	4.0	4.6
Norway	59 715	13.6	4.1	4.0	4.0
Finland	59 300*	11.5*	4.2*†	4.0	3.9
Switzerland	79 485	11.2	4.5	4.7	5.0
Austria	83 297	10.3	4.7	5.1	5.1
Denmark	67 677	12.8	4.7†	5.7	5.1
Spain	364 739*†	9.3*†	—	4.7*	5.0
Germany	791 025	9.6	4.9	5.0	5.3
Netherlands	192 443	12.3	5.0	5.7	5.5
France	725 460*	12.4*	5.1*	4.9	4.9
Australia	253 955*	13.7*	5.3	5.8	5.7
Italy	528 901	9.2	5.5	6.0	6.1
Canada	361 785	12.1	—	5.6	6.1
Czech Republic	90 657	8.8	5.9	6.0	7.7
United Kingdom	725 800*	12.3*	5.9*	6.1	6.2
Belgium	116 244	11.4	6.1	5.6	6.1
Ireland	52 311	14.3	6.2	5.5	6.4
New Zealand	57 736	15.3	6.6	—	6.7
Greece	101 995*	9.7*	6.9*	8.1*	7.9
United States	3 880 894	14.7	7.2	7.3	7.6
Portugal	111 382	11.4	8.4*†	6.9	7.5

* Preliminary data.
† 1998 data.
— Indicates data are not available.
Sources: United Nations *1997 Demographic Yearbook,* United Nations Personnel (M. Otero, 1999), and country profiles.

DEATHS

There were an estimated 2 338 070 deaths in the United States in 1998 (Table 1), 23 825 more than the 2 314 245 deaths reported in 1997. The preliminary death rate for 1998 was 865.0 deaths per 100 000 population, essentially the same as the final 1996 rate of 864.7. The preliminary age-adjusted death rate for 1998 was 470.8 deaths per 100 000 US standard population.[6] This rate was almost 2% lower than the final 1997 age-adjusted death rate of 479.1 and was a record low for the United States.[5,6] Age-adjusted death rates are better indicators of the risk of mortality over time than crude death rates because they control for variations in the age composition of the population; the aging of the US population results in higher crude death rates, despite lower age-specific rates.

Expectation of Life

The estimated expectation of life at birth for a given year represents the average number of years that a group of infants would be expected to live if, throughout their lifetime, they were to experience the age-specific death rates prevailing during the year of their birth. Based on preliminary data for 1998, the expectation of life at birth reached a new record high of 76.7 years, an increase of 0.2 year from the previous year. Life expectancy increased from the previous year by 0.6 years for black males, 0.3 years for black females, 0.3 years for white males, and was the same for white females, setting record highs for the 3 former groups, and matching the record high set in 1997 for white females. In 1998, life expectancy at birth was 79.9 years for white females, 75.0 years for black females, 74.6 years for white males, and 67.8 years for black males.

Causes of Death

Based on preliminary data, the 10 leading causes of death in 1998 accounted for approximately 80% of all US deaths (Table 12). Between 1997 and 1998, age-adjusted death rates declined for a number of causes of death including: HIV infection by 21%, homicide by 14%, suicide by 6%, accidents and adverse effects (unintentional injuries) by 5%, chronic liver disease and cirrhosis (cirrhosis) by 4%, cerebrovascular diseases by 4%, diseases of heart by 3%, and malignant neoplasms (cancer) by 2%. Among the 10 leading causes of death in 1998, age-adjusted death rates increased for pneumonia and influenza by 5%, nephritis, nephrotic syndrome, and nephrosis (kidney disease) by 2%, and chronic obstructive pulmonary disease by 2%.

HIV and Other Infectious Diseases

Deaths attributable to infectious diseases increased noticeably between 1979 and 1994, but the age-adjusted death rate from infectious diseases overall declined by 45% between 1995 and 1998; they account for a relatively small percentage of all deaths (2.2% in 1998). In 1987, a special cause of death category was created in the United States to uniquely classify deaths attributable to HIV infection.[42] Between 1987 and 1994, the age-adjusted death rate for HIV infection rose an average of 16% annually, before leveling off in 1995. After 1995, mortality attributable to HIV infection fell by 71%, and HIV infection dropped out of the 15 leading causes of death in 1998. This downturn has been attributed to improvements in the treatment of the disease.[43,44] HIV, however, remains a leading cause for specific age, race, and sex groups. Other infectious diseases, however, have continued to increase. Although septicemia increased from 1979 to 1998, in most cases physicians should have provided additional information on why septicemia developed. The age-adjusted rate for viral hepatitis more than quadrupled during the same period. In 1998, septicemia accounted for 46% of deaths attributable to infectious and parasitic diseases, while HIV infection accounted for 26% and viral hepatitis, for 9%.

Homicide and Suicide

The age-adjusted death rate for homicide and legal intervention (homicide) declined by 14%, from 8.0 per 100 000 in 1997 to 6.9 in 1998. Since 1979, the age-adjusted homicide rate has fluctuated; however, the 1998 rate is 37% less than the peak of 10.7 in 1991; 1998 is the fifth consecutive year in which homicide rates have decreased. The age-adjusted death rate for suicide continued to decline with a 6% decline from 1997 to 1998, and is 16% less than the peak of 11.9 in 1986.

TABLE 12. Mortality from Selected Causes of Death: United States, Final 1979 and 1997, and Preliminary 1998

Causes of Death and *International Classification of Diseases, 9th Revision* Codes	Rank*	1998			1997			1979			Percent Change in Age-adjusted Rate, 1979–1998
		Number	Percent	Rate†	Number	Percent	Rate†	Number	Percent	Rate†	
All causes		2 338 075‡	100.0	470.7	2 314 245	100.0	479.1	1 913 841	100.0	577.0	−18.4
Major cardiovascular diseases (390–448)		939 610	40.2	160.4	944 148	40.8	166.1	958 282	50.1	254.2	−36.9
Diseases of heart (309–398, 402, 404–429)	1	724 269	31.0	126.0	726 974	31.4	130.5	733 235	38.3	199.5	−36.8
Cerebrovascular diseases (430–438)	3	158 060	6.8	25.0	159 791	6.9	25.9	169 488	8.9	41.6	−39.9
Malignant neoplasms (140–208)	2	538 947	23.1	122.9	539 577	23.3	125.6	403 395	21.1	130.8	−6.0
Digestive system (150–159)		127 685	5.5	27.9	127 054	5.5	28.2	109 125	5.7	33.1	−15.7
Respiratory system (160–165)		159 207	6.8	38.2	158 465	6.8	38.7	103 178	5.4	35.2	8.5
Breast (174–175)		41 862	1.8	10.2	42 297	1.8	10.5	34 622	1.8	12.2	−16.4
Genital organs (179–187)		58 097	2.5	11.6	59 010	2.5	12.0	45 402	2.4	13.6	−14.7
Urinary organs (188–189)		23 722	1.0	5.0	23 395	1.0	5.0	17 443	0.9	5.2	−3.8
Chronic obstructive pulmonary diseases (490–496)	4	114 381	4.9	21.6	109 029	4.7	21.1	49 933	2.6	14.6	47.9
Pneumonia and influenza (480–487)	5	94 828	4.1	13.5	86 449	3.7	12.9	45 030	2.4	11.2	20.5
Diabetes mellitus (250)	7	64 574	2.8	13.6	62 636	2.7	13.5	33 192	1.7	9.8	38.8
Chronic liver disease and cirrhosis (571)	10	24 936	1.1	7.1	25 175	1.1	7.4	29 720	1.6	12.0	−40.8
Nephritis, nephrotic syndrome, and nephrosis (580–589)	9	26 295	1.1	4.5	25 331	1.1	4.4	15 729	0.8	4.3	4.7
Infectious and parasitic diseases (001–139)		50 880	2.2	12.7	52 371	2.3	13.7	15 360	0.8	5.0§	154.0
Tuberculosis (010–018)		1110	0.0	0.2	1166	0.1	0.3	2007	0.1	0.7	−71.4
Septicemia (038)		23 643	1.0	4.4	22 396	1.0	4.2	8024	0.4	2.3	91.3
HIV infection (*042–*044)		13 210	0.6	4.6	16 516	0.7	5.8	—	—	—	—
Viral hepatitis (070)		4729	0.2	1.4	4057	0.2	1.2	753	0.0	0.3	366.7
Accidents and adverse effects (E800–E949)	6	93 207	4.0	28.5	95 644	4.1	30.1	105 312	5.5	42.9	−33.6
Motor vehicle accidents (E810–E825)		41 826	1.8	15.0	43 458	1.9	15.9	53 524	2.8	23.2	−35.3
All other accidents (E800–E807, E826–E949)		51 382	2.2	13.5	52 186	2.3	14.2	51 788	2.7	19.6	−31.1
Suicide (E950–E959)	8	29 264	1.3	10.0	30 535	1.3	10.6	27 206	1.4	11.7	−14.5
Homicide and legal intervention (E960–E978)		17 350	0.7	6.9	19 846	0.9	8.0	22 550	1.2	10.2	−32.4
Certain perinatal conditions (760–779)		13 133	0.6	333.0	12 935	0.6	333.3	23 322	1.2	667.4¶	−50.1

* Rank based on 1998 data. Ranking is shown for ten leading causes only. For an explanation of ranking procedures, see Technical Appendix in *Vital Statistics of the United States, Vol. II, Mortality Part A* (published annually).
† Age-adjusted death rate per 100 000 US standard population.
‡ Two separate sets of weights were applied to mortality records—one for demographic, and one for cause of death data, resulting in slight inconsistencies in the number of deaths between Tables 1 and 12.
§ Excludes HIV infection.
¶ Because deaths from this cause occur primarily among infants, infant deaths, and mortality rates per 100 000 live births attributable to this cause are shown.
— Indicates comparable data are not available for this time period.
Source: National Center for Health Statistics, National Vital Statistics System, 1979–1998.

Deaths Among Children

Based on preliminary data, an estimated 26 522 children and adolescents between the ages of 1 and 19 years died in the United States in 1998 (Table 13). The death rate for children 1 to 4 years old in 1998 was 34.2 per 100 000 population, 4% lower than the rate of 35.8 in 1997. From 1997 to 1998, the respective death rates for children and teenagers aged 5 to 9, 10 to 14, and 15 to 19 declined by 5%, 6%, and 7%. Since 1979, death rates have declined by 47% for children 1 to 4 years old, by 43% for children 5 to 9 years old, by 31% for children 10 to 14 years old, and by 30% for teenagers 15 to 19 years old.

For children 1 to 4 years of age, unintentional injury was the leading cause of death with congenital anomalies and homicide as the second and third causes, respectively. Unintentional injuries ac-counted for 36% of all deaths in this age group. Death rates for unintentional injuries and congenital anomalies have decreased 53% and 57%, respectively, since 1979. An estimated 355 children 1 to 4 years old died from cancer, making cancer the fourth leading cause of death in this age group. Since 1979, death rates for cancer for this age group have declined by 50%.

For children 5 to 9 years old, unintentional injury, cancer, congenital anomalies, and homicide were the leading causes of death. Unintentional injury accounted for nearly 43% of all deaths in 1998 while the second leading cause, cancer, accounted for 14% of all deaths in this age group. Since 1979, death rates attributable to each of the these leading causes of death have declined by at least 20%.

For children 10 to 14 years of age, unintentional

TABLE 13. Deaths and Death Rates for the Five Leading Causes of Childhood Death in Specified Age Groups in 1998: United States, Final 1979 and 1997, and Preliminary 1998

Cause of Death and Age	Rank*	1998			1997			1979			Percent Change 1979–1998
		Number	Percent	Rate†	Number	Percent	Rate†	Number	Percent	Rate†	
Total: 1–19 y											
All causes	—	26 522	100.0	35.9	27 834	100.0	38.0	40 339	100.0	58.1	−38.2
Accidents and adverse effects (E800–E949)	1	11 322	42.7	15.3	11 979	43.0	16.4	21 727	53.9	31.3	−51.1
Homicide and legal intervention (E960–E978)	2	3007	11.3	4.1	3450	12.4	4.7	2899	7.2	4.2	−2.4
Malignant neoplasms (140–208)	3	2081	7.8	2.8	2170	7.8	3.0	3271	8.1	4.7	−40.4
Suicide (E950–E959)	4	2020	7.6	2.7	2109	7.6	2.9	1940	4.8	2.8	−3.6
Congenital anomalies (740–759)	5	1001	3.8	1.4	1253	4.5	1.7	1899	4.7	2.7	−48.1
1–4 y											
All causes	—	5195	100.0	34.2	5501	100.0	35.8	8108	100.0	64.2	−46.7
Accidents and adverse effects (E800–E949)	1	1881	36.2	12.4	2005	36.4	13.1	3349	41.3	26.5	−53.2
Congenital anomalies (740–759)	2	531	10.2	3.5	589	10.7	3.8	1021	12.6	8.1	−56.8
Homicide and legal intervention (E960–E978)	3	368	7.1	2.4	375‡	6.8	2.4	314	3.9	2.5	−4.0
Malignant neoplasms (140–208)	4	355	6.8	2.3	438‡	8.0	2.9	578	7.1	4.6	−50.0
Diseases of heart (390–398, 402, 404–429)	5	198	3.8	1.3	212	3.9	1.4	265	3.3	2.1	−38.1
5–9 y											
All causes	—	3498	100.0	17.6	3645	100.0	18.5	5278	100.0	31.1	−43.4
Accidents and adverse effects (E800–E949)	1	1487	42.5	7.5	1534	42.1	7.8	2707	51.3	16.0	−53.1
Malignant neoplasms (140–208)	2	486	13.9	2.4	547	15.0	2.8	791	15.0	4.7	−48.9
Congenital anomalies (740–759)	3	199	5.7	1.0	223	6.1	1.1	289	5.5	1.7	−41.2
Homicide and legal intervention (E960–E978)	4	153	4.4	0.8	174	4.8	0.9	165	3.1	1.0	−20.0
Diseases of heart (390–398, 402, 404–429)	5	144	4.1	0.7	128	3.5	0.6	119	2.3	0.7	0.0
10–14 y											
All causes	—	4202	100.0	21.8	4416	100.0	23.2	5868	100.0	31.8	−31.4
Accidents and adverse effects (E800–E949)	1	1627	38.7	8.5	1837	41.6	9.6	2982	50.8	16.2	−47.5
Malignant neoplasms (140–208)	2	539	12.8	2.8	483	10.9	2.5	761	13.0	4.1	−31.7
Suicide (E950–E959)	3	311	7.4	1.6	303	6.9	1.6	151§	2.6	0.8	100.0
Homicide and legal intervention (E960–E978)	4	270	6.4	1.4	283	6.4	1.5	229§	3.9	1.2	−16.7
Diseases of heart (390–398, 402, 404–429)	5	160	3.8	0.8	185‡	4.2	1	170§	2.9	0.9	−11.1
15–19 y											
All causes	—	13 627	100.0	69.7	14 272	100.0	74.8	21 085	100.0	98.8	−29.5
Accidents and adverse effects (E800–E949)	1	6327	46.4	32.4	6603	46.3	34.6	12 689	60.2	59.4	−45.5
Homicide and legal intervention (E960–E978)	2	2216	16.3	11.3	2618	18.3	13.7	2191	10.4	10.3	9.7
Suicide (E950–E959)	3	1702	12.5	8.7	1802	12.6	9.5	1788	8.5	8.4	3.6
Malignant neoplasms (140–208)	4	701	5.1	3.6	702	4.9	3.7	1141	5.4	5.3	−32.1
Diseases of heart (390–398, 402, 404–429)	5	379	2.8	1.9	417	2.9	2.2	395	1.9	1.9	0.0

* Rank based on number of deaths for 1998.
† Rate per 100 000 population in specified group.
‡ In 1997, malignant neoplasms was the third and homicide was the fourth leading cause of death for children 1 to 4 years old, and congenital anomalies was the fifth leading cause for children 10 to 14 years old.
§ In 1979, congenital anomalies was the third leading cause of death for children 10 to 14 years old with a total of 289 deaths and a death rate of 1.6; homicide was ranked the fourth, suicide sixth, and diseases of heart fifth.

injury was the leading cause of death and accounted for 39% of all deaths in this age group. The second leading cause was cancer, followed by suicide and homicide. The death rate attributable to unintentional injuries and cancer for this age group has declined by 48% and 32%, respectively, since 1979. The death rate for suicide more than doubled from 1979 to 1993 but decreased by 6% from 1993 to 1998. The homicide death rate doubled from 1979 to 1993 but declined 44% between 1993 and 1997.

For teenagers aged 15 to 19 years, the leading cause of death, unintentional injuries, accounted for 46% of all deaths in 1998. The death rate for unintentional injuries has dropped by 46% since 1979. An estimated 2216 teenagers were victims of homicide, the second leading cause, in 1998, accounting for 16% of all deaths. The teen homicide rate peaked in 1993 and decreased 45% between 1993 and 1998. Suicide was the third leading cause of death for this age group, accounting for 13% of all deaths. From 1979 to 1988, suicide rates increased by 32% for this age group and remained fairly stable from 1988 to 1994, but declined by 22% between 1994 and 1998.

Summary of Childhood Deaths

In conclusion, death rates for children and teenagers dropped by 38% between 1979 and 1998. Despite declines, the leading cause of death in 1998 among children and teenagers continued to be unintentional injury. These declines have been attributed, in part, to injury prevention measures such as mandatory car seat requirements, smoke alarms, and sprinkler systems in homes and schools.[45] Congenital anomalies was the second leading cause of death at ages 1 to 4 years but dropped in importance for successively older age groups as cancer, homicide, and suicide became more prominent. Cancer accounts for 5% to 14% of deaths for each of the age groups under 19 years of age. Decreases in recent years for homicide and suicide, hopefully, signal the beginning of a long-term reversal in mortality from these causes among children. Yet, a large proportion of childhood deaths continue to occur as a result of preventable injuries.[46] American pediatricians must further strengthen their efforts to prevent many of these deaths.

USE OF VITAL STATISTICS: EXAMPLES OF EVALUATION OF REGIONALIZATION OF PERINATAL CARE IN 4 STATES

As noted earlier, the rate of infant mortality in a population is a function of both the distribution of birth weight and birth weight-specific mortality rates in that population. In the past few years, we have expanded the data on birth weight for the United States by presenting estimates of birth weight-specific mortality from linked birth and infant death data files. This year, we go one step further by presenting IMRs by state for the most vulnerable live births, those weighing between 500 and 1499 g. These rates along with the percentage of VLBW infants in the population have a profound effect on overall IMRs. As we close this year's article, we present an example of how the data available from linked certificates have been used to assess the organization of perinatal services in 4 states.

A major systems approach to organizing clinical care for pregnant women and newborns in the past 3 decades has been regionalization of perinatal care. Regionalization evolved as an important concept in the early 1970s because of the limited availability of both neonatologists and perinatologists at the time, coupled with a climate of regional planning and the need to make efficient use of scarce and expensive resources to care for high-risk mothers and newborns. The early stimulus for regionalization was to improve access to intensive care for high-risk mothers and newborns through the development of a system that linked hospitals and providers at different levels of care. These levels were initially designated as primary, secondary, and tertiary (today also called basic, specialty, and subspecialty, respectively) and were differentiated based on the complexity of the patient needs and the capabilities of provider or hospital to meet these needs.[47]

There is considerable evidence pointing to the success of regionalized systems in the 1970s in concentrating births of high-risk infants at tertiary centers, in reducing death rates of LBW infants in these centers, and in improving the survival of these infants at community hospitals, presumably through infant transport or provider education.[48] Reductions in neonatal mortality in states and other geographic areas were also reported after regionalization, particularly for LBW infants, although a cause-and-effect relationship of regionalization to reduced mortality has not been empirically documented.[49] Despite considerable progress in the 1970s and 1980s, recent changes have occurred in the organization of perinatal services in a number of states that threaten to erode existing systems. These changes have been documented empirically using vital statistics data and information about the level of perinatal care provided in hospitals throughout several states.

One measure of the extent to which states have been successful in assuring access of high-risk mothers and newborns to risk appropriate care is the proportion of VLBW infants born in subspecialty hospitals. In 2 states, California[50] and Washington,[51] there has been a rise, albeit not large, in the proportion of VLBW infants born in level II (specialty) hospitals. Although this rise may not appear alarming on the face of it, in the above 2 states as well as in South Carolina[52] and Missouri,[53] NMRs for VLBW infants born in specialty hospitals are similar to those for infants born in community hospitals and higher than the rates for subspecialty hospitals. Moreover, Phibbs et al[50] noted both a volume and level of care effect in California; the lowest NMRs were found in large subspecialty hospitals, with all other hospitals, including smaller subspecialty hospitals having similar and consistently higher rates.

The rise in level II, and to a lesser extent self-designated level III hospitals, is thought to be a result of competition for perinatal patients. Development of a full-service hospital is seen as a marketing advantage because the availability of neonatal intensive care unit care is attractive to pregnant women, and women tend to continue to use the same facility for family care after birth. Moreover, the number of neonatologists has increased considerably in recent years, yielding more specialists to staff the newly designated level II and III facilities.[50]

These analyses point to difficult policy decisions for states regarding the voluntary designation of hospitals and the shifting health care market. States must use such analyses of data from their vital statistics systems to monitor the impact of changing

health care policies on populations, highlighting again the importance of these data and the need to ensure their accuracy.

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WAITING FOR THE NEXT DISASTER

Seventy babies were admitted to neonatal intensive care from February to May 1998. They were given 455 drug treatments between them. Ninety percent of them were either prescribed unlicensed drugs—modified, specially formulated, or used for many years but never subject to clinical trials—or off label drugs—prescribed for different age groups, diseases, doses and in different ways to those which have been tested.

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