Part I
Overview of Children's Health

Chapter 2

Children% Health Status: Current Trends

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Chapter 2

Children's Health Status: Current Trends

INTRODUCTION

In any study of children's health, an obvious first question is whether American children are as healthy as they can be and whether their health has been improving in recent years. This chapter addresses that question by examining recent trends in a number of indicators of children's health. The greatest emphasis of this chapter is on infant mortality, but other measures of children's health are examined as well.

The infant mortality rate[1] has long been a primary indicator of the overall health status of nations for two reasons: first, it tends to be closely associated with access to adequate food, shelter, education, sanitation, and health care ***(426);*** and second, it is relatively easy to monitor with basic vital statistics collected in most countries. Indeed, its wide availability as a quality-of-life indicator has given infant mortality a visibility in policy debates that it might not otherwise have. The much higher rate of infant mortality in the South than in other parts of the United States, for example, has propelled leaders in that region to come up with a plan to reduce the disparity ***(604).*** The infant mortality rate may even overshadow other important, but much less easily measured, dimensions of children's health status that take account of the full physical, cognitive, and emotional well-being of children in this country.

One of the problems in evaluating children's health is that good indicators of children's health status are hard to find. More research aimed at developing valid measures that take a broader view of children's health would certainly enhance our understanding of the health problems of children in this country. Lacking such measures at present, OTA has focused in this chapter on those measures for which recent data (into the 1980s) are available.

The first part of this chapter examines U.S. infant mortality rates and the reasons for the recent slowdown in improvement experienced in this country. The second part of the chapter examines several indicators of children's health status in the period beyond infancy.

[1] The infant mortality rate for any year is defined as the number of infant deaths under 1 year of age per 1,000 live births in the same year. The infant mortality rate is the sum of two components: the neonatal mortality rate (defined as the number of infant deaths under 28 days per 1,000 live births), and the postneonatal mortality rate (defined as the number of infant deaths between 28 days and 1 year per 1,000 live births). When linked birth and death certificates are available, the postneonatal mortality rate is usually defined as the number of infant deaths between 28 days and 1 year per 1,000 neonatal survivors. Unless otherwise indicated, the former definition will be used in this chapter.

THE PROBLEM OF INFANT MORTALITY

The current status of and trends in infant mortality rates in the United States are matters of widespread concern ***(426,666).*** After a period of rapid decline from the mid-1960s through the 1970s, the pace of the decline in the U.S. infant mortality rate may be significantly slowing. Recent final mortality data show an average annual decline in the U.S. infant mortality rate of 3.3 percent for the 3-year period from 1981 to 1984 (709). This is the lowest percentage reduction in the U.S. infant mortality rate in any 3-year period since ***1965.***

Hope that the trend from 1981 to 1984 is an aberration from an otherwise substantial and continuous decline in the U.S. infant mortality rate since the mid-1960s is not supported by the most recent provisional data on U.S. infant mortality.[2]

[2] Provisional mortality data and final mortality data are both based on birth and death certificates reported by State vital statistics offices. In this chapter, provisional data for a given year are for the preceding 12 months ending with June 30; final mortality data, however, are for the calendar year. Because of differences in reporting systems, provisional data are not always comparable to final data. Trends within each system are highly correlated, however, so provisional data on infant mortality rates may be used in lieu of final data to provide a reasonable estimate of the most recent trends (337).

These provisional data indicate that the average annual rate of decline in the U.S. infant mortality rate for 1985 and 1986 was only 1.4 percent—a smaller decline than the previous low for a 2-year period. At this rate of decrease in U.S. infant mortality rates, the U.S. Surgeon General's objective of reducing the U.S. infant mortality rate to 9.0 infant deaths per 1,000 live births by 1990 (715) will not be reached.

Not only has there been a decline in the rate of decrease in the overall U.S. infant mortality rate, but large racial disparities in infant mortality rates persist. Over the past 24 years, black infant mortality has been consistently higher than white infant mortality by almost two to one (see app. C). In 1985, the infant mortality rate was 18.2 infant deaths per 1,000 live births for blacks and 9.3 for whites.

Infant Mortality in the United States and Other Developed Countries

In comparison to the ranking of several other industrialized countries, the United States' ranking with respect to infant mortality is unfavorable (see table 2-l). In 1985, the United States had 10.6 infant deaths per 1,000 live births, and its infant mortality rank of 17th was unchanged from 1980. Even if the higher infant mortality rates of blacks and other minorities are excluded from the comparisons for 1985, the remaining (white) U.S. rate of 9.3 deaths per 1,000 live births would still yield a comparatively low rank of 10th. If the U.S. infant mortality rate in 1985 had been equal to that achieved by the country with the lowest rate (Japan, with a rate of ***5.5*** infant deaths per 1,000 live births), the United States would have had 19,350 fewer infant deaths that year—a sum greater than the number of deaths of all children between 1 and ***15*** years of age in 1985.

A country's infant mortality rate depends both on the incidence of low birthweight and on birthweight-specific infant mortality rates. The international ranking of the United States with respect to the incidence of low birthweight is rather poor. In 1980, the United States ranked 14th in the percentage of live births that were low birthweight (less than 2,500 grams) and 15th in the percentage of live births that were very low birthweight (less than 1,500 grams) (296).

Table 2-1 .—Comparison of Infant Mortality Rates[a] in the United States and Other Countries, 1985

Country	Infant mortality rate, 1985
1. Japan	5.5
2. Finland	6.3
3. Sweden	6.7
4. Switzerland	6.9
5. Denmark	7.9
6. Canada	7.9
7. Netherlands	8.0
8. France	8.1
9. Norway	8.3
10. Ireland	8.9
11. United Kingdom	9.4
12. Belgium	9.4
13. West Germany	9.5
14. East Germany	9.9
15. Australia	9.9
16. Spain	10.5[b]
17. United States	10.6
18. Italy	10.9
19. New Zealand	11.0
20. Austria	11.0
21. Israel	11.9
22, Brunei	12.0
23. Malta	13.6
24. Greece	14.0
25. Czechoslovakia	15.3[c]
26. Bulgaria	15.8
27. Cuba	16.5
28. Poland	18.5
29. Hungary	20.4
30. Romania	23.4'

[a]Th, infant mortalit, rate ıs defined as the number of infants who die in the first year of life per 1,000 live births.
[b]This is Spain's infant mortality rate in 1983
[c]These infant mortality rates are for 1984.

SOURCE: A Von Cube, Population Reference Bureau, Washington, DC, personal communication May and September 1987

U.S. birthweight-specific mortality rates are comparable or superior to birthweight-specific mortality rates in a number of countries that have the same or a lower overall infant mortality rate (158,236). In 1980, for example, the United States had an overall infant mortality rate of 12.6 infant deaths per 1,000 live births—higher than the rates in Sweden (with 6.9 infant deaths) and England/Wales (with 12.1 deaths) (501) (see table 2-2). In terms of birthweight-specific neonatal and infant mortality rates in 1980, the United States generally did slightly worse than Sweden at the normal birthweight intervals, but substantially better than Sweden at the low birthweight intervals (see table 2-2). Sweden had lower infant and neonatal mortality rates than the United States because Sweden had a more favorable birth distribution than the United States; in the United States, ***6.84*** percent of live births in 1980 were low

Table 2-2.—Comparison of Birthweight-Specific Mortality Rates and the Incidence of Low Birthweight Births in the United States, Sweden, and England/Wales, 1980

	United States[a]	Sweden[b]	England/Wales[b]
Birthweight-specific neonatal mortality rate[c]			
Low birth weight:			
1,000-1,499g	183.3	*217.2*	NA[d]
< 15oog	437.7	NA	359.8
1,500-1,999g	49.7	56,4	NA
2,000-2,499g	15.7	17.5	17.7
<2,500g	92.9	NA	NA
Normal birth weight:			
2,500-2,999g	*4.1*	*4.2*	*4.9*
3,000-3,499g	2.0	1.6	2.4
3,500-3,999g	1.4	1.0	1.8
4,000-4,499g	1.5	1.2	NA
>2,500g	2.2	NA	NA
>4,000g	1.9	NA	2.3
>4,500	3.7	1.2	
Birthweight-specific infant mortality rate[e]			
Low birthweight			
1,000-1,499g	212.8	235.0	NA
<1,500g	465.6	NA	NA
1,500-1,999g	65.3	67.0	NA
2,000-2,499g	24.6	21,7	NA
<2,500g	106.3	NA	NA
Normal birthweight:			
2,500-2,999g	*8.9*	*6,7*	NA
3,000-3,499g	4.9	3.1	NA
3,500-3,999g	3.5	2.2	NA
4,000-4,499g	3.4	2.1	NA
>2,500g	5.0	NA	NA
>4,000g	3.9	NA	NA
>4,500g	5.9	1.7	NA
Overall infant mortality rate	12.6	6.9	12.1
Incidence of low birthweight[f]			
Percentage of birthweights <1,500g	1.150/0	0.49%	0.770/0
Percentage of birthweights <2,500g	6.840/o	4.030/0	6.790/o

[a]U S Department of Health and Human Services Public Health Service.Centers for Disease Control, preliminary tables from the 1960 National Infant Mortality Surveillance Project (NIMS), May 1986 All birthweight-specific deaths of multiple birth Infants were assigned to the neonatal period
[b]U.S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Proceedings of the International Collaborative Effort on Perinatal and Infant Mortality*, VOI I (Hyattsville, MD: NCHS, August 1985)
[c]Th birthweight-specific neonatal mortality rate is defined as the number of infants in a given birthweight interval who die in the first 28 days Of life per 1,000 live births in that interval
[d]NA . not available
[e]Th birthweight-specific infant mortality rate is defined as the number of Infants in a given birthweight Interval who die In the first year Of life per 1,000 live births in that interval
[f]Institute of Medlcine *Preventing Low Birthweight* (Washington, DC National Academy Press, 1985) Swedish percentage IS for 1978

SOURCE Office of Technology Assessment, 1988

birthweight, while in Sweden, only about 4.03 percent of live births were low birthweight (see table 2-2). In terms of birthweight-specific mortality rates, the United States did worse than England/Wales at very low birthweight intervals, but better than England/Wales at moderately low and normal birthweight intervals where many more births are concentrated. In England/ Wales, 6.79 percent of live births in 1980 were low birthweight; only 0.77 percent of live births were very low birthweight.

In 1983, the United States had higher overall neonatal and infant mortality rates than West Germany (see table 2-3). According to calculations for the United States based on aggregated data from nine States, birthweight-specific mortality rates in the United States in 1983 were lower than those in West Germany, but West Germany had a more favorable birthweight distribution; about 6.7 percent of live births in the United States were low birthweight, as compared to 5.6 percent in West Germany (see table 2-3). Insure, the evi-

Table 2-3.—Comparison of Birthweight-Specific Mortality Rates and the Incidence of Low Birthweight Births in the United States (Selected States) and West Germany, 1983

	United States (selected States)[a]	West Germany[b]
Birthweight-specific neonatal modality rate'		
Low birth weight:		
<1,000g	***658.7***	***688.3***
1,000-1,999g	***63.6***	192.8
2,000-2,499g	***12.2***	***14,9***
Normal birthweight:		
>2,500	1.8	1.9
All birthweights	7.2	5.9
Birthweight-specific infant mortality rate[d]		
Low birth weight:		
<1,000g	701.7	824.4
1,000-1,999g	91.1	137.9
2,000-2,499g	22,1	27.9
Normal *birth weight.'*		
22,500g	4.6	5.1
All birthweights	11.1	10.3
Incidence of low birthweight		
Percentage of birth-weights < 1,500g	0.490/0	0.270/o
Percentage of birth-weights < 2,500g	6.7%[e]	5.6%

[a]The neonatal mortality rates for the United States were calculated from aggregated births and neonatal deaths in nine States" Georgia, Maine, Minnesota, Missouri, North Carolina, New Hampshire, New York (excludes New York City), Vermont, and Wisconsin Infant mortality rates were calculated for those nine States minus New York State All birthweight-specific deaths of multiple birth Infants were assigned to the neonatal period U.S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Proceedings of the International Collaborative Effort on Perinatal and Infant Mortality*. vol. I (Hyattsville, MD. NCHS, August 1985)

[b]Herausgeber Statist isches Bundesamt Wiesbaden, Verlag; W Kohlhammer GMBH Stuttgart und Mainz, Bevolkerung und Erwerbstatideit, Riehe 1, Geblet u nd Bevolkerun, 1983

[c]The birth weight-specific neonatal mortality rate is defined as the number of infantsin a given birthweight Interval who diein the first 28 days of life per 1,000 live births in that interval

[d]The birthweight-specific infant mortality rate is defined as the number of infantsin a given birthweight interval who diein the first year of life per 1,000 live births in that interval

[e]Th, percentage calculated on the basis of nine States is 66 Percent, the Percentage calculated on the basis of eight States is 67 percent

SOURCE Off Ice of Technology Assessment, 1988

dence that is available indicates that the relatively poor international ranking of the United States with respect to infant mortality is largely due to the country's unfavorable birthweight distribution.

U.S. Infant Mortality Trends

Over the first half of this century, the U.S. infant mortality rate declined by 100 percent, reaching about 50 infant deaths per 1,000 live births in 1950. The subsequent trends in the U.S. infant mortality rate can be divided into two time periods:

- 1950 to 1967, represented by little change in infant mortality rates for whites and even less change in the rates for blacks; and
- 1968 to 1984, represented by a rapid decline in infant mortality for both whites and blacks.

Because vital statistics data from the early 1960s may not be as accurate as data from the late 1960s and subsequent years, particularly for blacks,[3] the discussion that follows emphasizes the years after 1967.

U.S. infant, neonatal, and postneonatal mortality rates and annual percentage changes for the years 1968 to 1985 are presented in appendix C. From 1968 to 1985, the U.S. infant mortality rate declined by about 50 percent for both whites and blacks, reaching 9.3 infant deaths per 1,000 live births for whites and 18.2 infant deaths for blacks. The average annual compound rate of decline in overall U.S. infant mortality during this period was 4.1 percent.

Since 1981, there has been a substantial, unprecedented, and statistically significant slowdown in the rate of improvement in U.S. infant mortality rates. From 1981 to 1984, the U.S. infant mortality rate declined by an average annual compound rate of 3.3 percent (709). The 3.3-percent average annual decline in the U.S. infant mortality rate from 1981 to 1984 not only was down from a 4.1-percent decline from 1977 to 1981, but it was also lower than the 4.5-percent average annual decline for the entire period from 1968 to 1981 (709).

Provisional data on U.S. infant mortality rates for 1986 indicate that the situation is continuing to deteriorate. Provisional data for each year from 1982 through 1986 indicate a progressive decrease

[3]The reason vital statistics data from the early 1960s, particularly for blacks, may not be as accurate as data from the late 1960s and subsequent years is that in the 1960s there may have been a considerable number of out-of-hospital births to blacks. One investigator notes that from 1950 to 1967, nonwhite out-of-hospital births in the United States declined from 42 percent of nonwhite births to 7 percent. A State-level study of the 1950-67 period showed that the reported low birthweight rate was highly correlated with the percentage of nonwhite births occurring in the hospital. This suggests that as more nonwhite births occurred in hospitals and were reported, low birthweight and infant mortality increased (126).

in the average annual compound rate of decline in the U.S. infant mortality rate ***(709).***[4] The decline in the provisional U.S. infant mortality rate for 1987 is less than 1.1 percent—a negligible improvement over the previous year,

Although year-to-year fluctuations in reported infant mortality rates are expected, the recent slowdown in improvement of U.S. infant mortality rates cannot be dismissed as random variation around the trend. At OTA's request, the National Center for Health Statistics (NCHS) predicted U.S. infant mortality rates for the 3-year period from 1982 to 1984 on the basis of trends in final U.S. infant mortality rates from 1968 to 1981.[5] The U.S. infant mortality rate NCHS predicted for 1984, 10.4 deaths, was significantly lower than the actual 1984 rate of 10.8 deaths (p = 0.01). Had the U.S. infant mortality rate continued to decline after 1981 at the rate predicted by NCHS, the United States would have suffered 1,395 fewer infant deaths in 1984 than actually occurred (339). The disparity between the predicted rate and the actual U.S. infant mortality rate increased further in 1985—the most recent year for which final U.S. infant mortality data are available. The U.S. infant mortality rate in 1985 was 10.6 infant deaths per 1,000 live births, while the rate predicted on the basis of the NCHS regression analysis was 9.9 deaths.

Just how substantial *a* departure from the past the most recent U.S. infant mortality trends represent is illustrated in figure 2-1. The dashed line shows the U.S. infant mortality rate through July 1986 as predicted on the basis of provisional data for January 1970 to December 1982 (339). The solid line shows the U.S. infant mortality rate as determined from monthly provisional infant mortality data from January 1970 through July 1986. For the years 1983 through July 1986, the solid line substantially departs from the dashed line,

[4]The reduction in the U.S. infant mortality rate, according to provisional data, was 6.6 percent for 1982, 3.5 percent for 1983, 1.8 percent for 1984, 1.9 percent in 1985, 0.9 percent in 1986, and 1.1 percent in 1987 (709). From 1982 to 1986, the average annual reduction in provisional U. S, infant mortality rates was 3 percent (about 71 percent of the average rate of decrease in the provisional rates for 1977 to 1981).

[5]Rates were predicted by a linear regression of the logarithm of infant mortality as a function of time.

Why the Slowdown in Improvement in U.S. Infant Mortality Rates?

Why the slowdown in improvement *in* the U.S. infant mortality rate since the early 1980s? To address this question, it is necessary to understand the importance of birthweight as a risk factor for infant mortality. Low birthweight, defined as under 2,500 grams, is a major determinant of infant mortality (296). In 1980, low birthweight infants made up less than 7 percent of the population of newborns in the United States but accounted for 60 percent of all babies who died in infancy ***(687).***

Low birthweight affects infant mortality through its effect on both neonatal mortality and on postneonatal mortality, but the greatest effect is on neonatal mortality. In 1980, 75 percent of all neonatal deaths and 30 percent of all postneonatal deaths in the United States occurred in low birthweight infants ***(687).*** As shown in figure ***2-2,*** the risk of death increases as birthweight decreases. In 1980, very low birthweight infants (those weighing under 1,500 grams at birth) had only about 6 chances in 10 of surviving beyond the neonatal period.

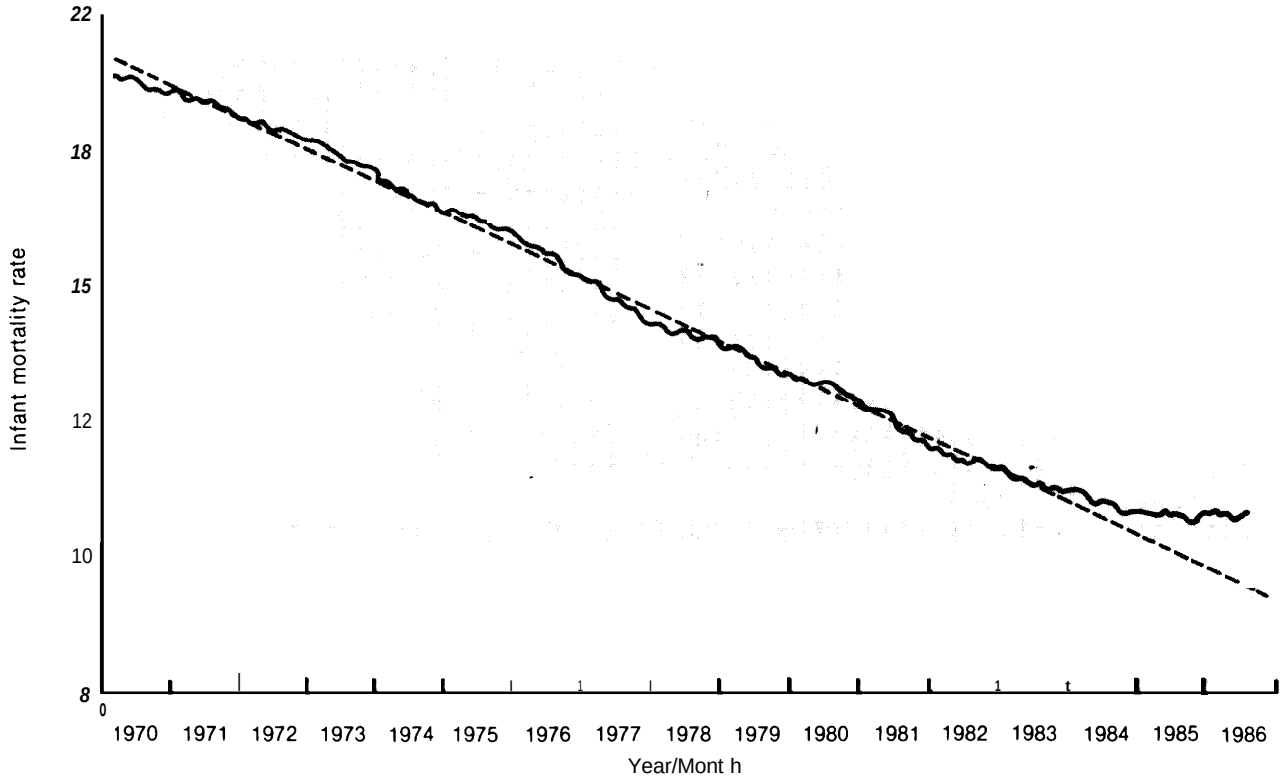
Progress in reducing U.S. infant mortality can come either through changes in the distribution of birthweights toward heavier babies or through changes in birthweight-specific infant mortality rates. Historically, most of the progress in the United States since 1960 has been in the realm of improved birthweight-specific mortality rates (8, 211,340,628,754). In fact, between 1960 and 1980, about 91 percent of the improvement in the U.S. infant mortality rate was due to changes in birthweight-specific mortality rates (80). The improvements in birthweight-specific mortality rates from 1960 to 1980 benefited black babies as well as white babies. For blacks, in fact, the percentage decreases in birthweight-specific infant mortality from ***1960*** to 1980 were higher than the decreases for whites (80).

Improvement in U.S. birthweight-specific mortality rates has continued beyond 1980 (see table 2-4). ' From 1980 to 1983, declines in birthweight-

[6]Estimates of 1983 birthweight-specific infant mortality rates for the United States were derived b, aggregating data from eight States: Georgia, Maine, Minnesota, Missouri, North Carolina, New Hampshire, Vermont, and Wisconsin (687, 706). Comparison of the overall

continued on next page

Figure 2-1.— Provisional U.S. Infant Mortality Rates, January 1970 to July 1986[a]
(12-month moving averages)



NOTE Dashed line fitted by log-linear regression analysis of provisional U.S. infant mortality rates for January 1970 to December 1982

SOURCE: J Kleinman, National Center for Health Statistics, Public Health Service, U S. Department of Health and Human Services, Hyattsville, MD, unpublished data from U S. vital statistics, 1986

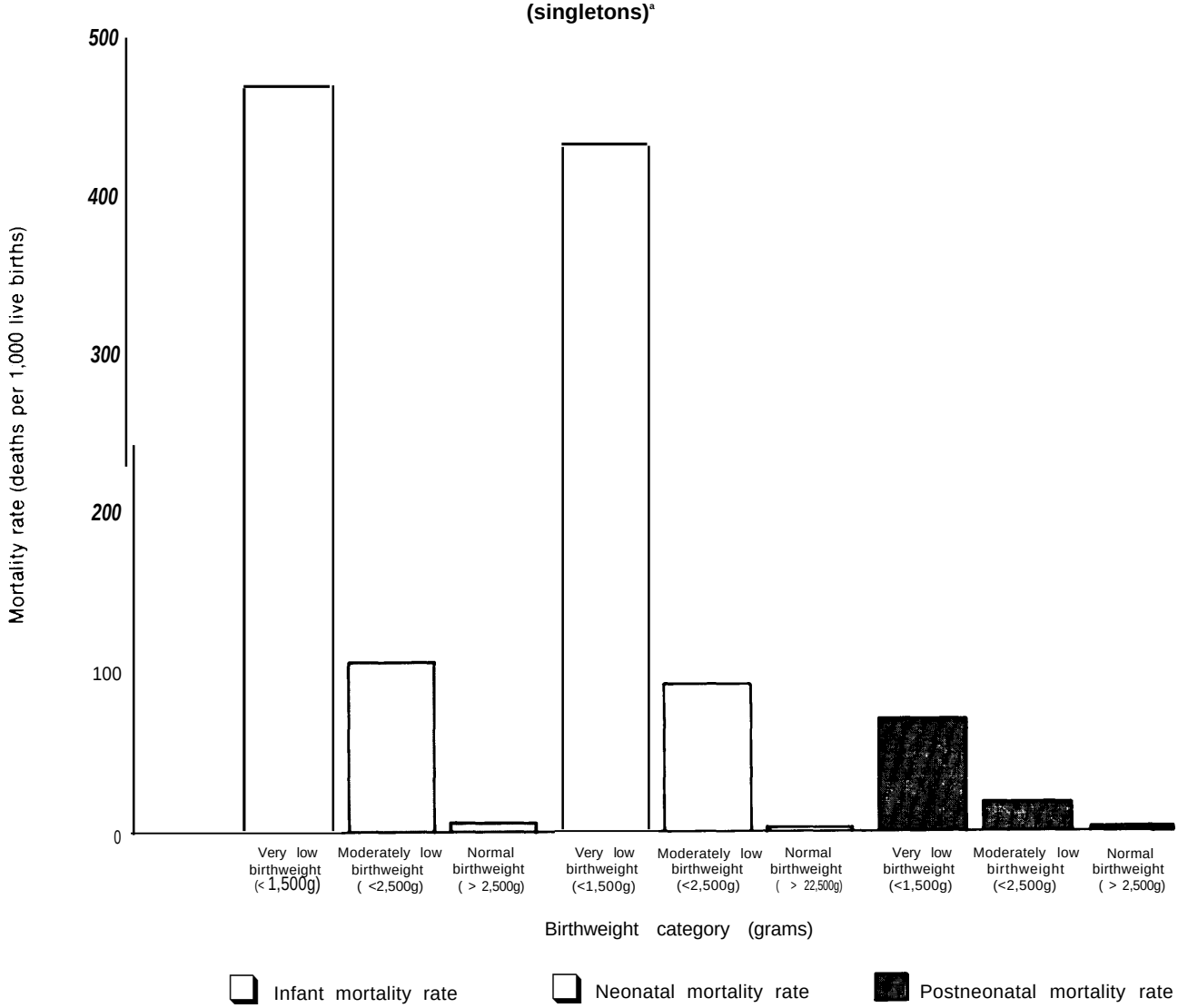
specific mortality rates were generally larger among infants born at low birthweights than among infants born at normal birthweights. An important exception was in the group of tiny infants weighing less than 1,000 grams at birth; the decline in birthweight-specific mortality among these infants was less than the decline for normal birthweight infants. The group of infants that experienced the largest decline in birthweight-specific mortality rates from 1980 to 1983 was the group in the birthweight interval from 1,000 to 1,499 grams.

While U.S. birthweight-specific mortality rates have been improving, the birthweight distribution in the United States has actually deteriorated since 1977. As shown in table 2-5, the percentage of live births at normal birthweights increased slightly from 1977 to 1984, but there was a shift in the distribution of low birthweight babies toward the lowest birthweight intervals (those under 1,000 grams). Had U.S. birthweight-specific mortality rates not improved from 1977 to 1984, the deteriorating birthweight distribution would have resulted in an increase in the overall U.S. infant mortality rate. The overall U.S. infant mortality rate would have increased at an average annual rate of 0.7 percent between 1977 and 1980 and 1.2 percent between 1981 and 1984 (339).[7]

aggregated neonatal and infant mortality rates of this sample of States with the U.S. final mortality statistics for 1983 supports the conclusion that these States were highly representative of the United States—there was almost no difference in the overall rates.

[7]These calculations were based on the assumption that U.S. birthweight-specific mortality rates reported for 1980 held for the entire 1977-84 period.

Figure 2-2.—U.S. Infant, Neonatal, and Postneonatal Mortality Rates, by Birthweight, 1980 Birth Cohort (singletons)[a]



aThe mortality rates depicted in this figure are for all races combined For a breakdown of mortality rates by race, see table C-4 in aPP C of this report

SOURCE Office of Technology Assessment 1988, calculated from the preliminary tables from the 1980 National Infant Mortality Surveillance project U S Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, GA, May 1986

Furthermore, although U.S. birthweight-specific mortality rates have continued to decline throughout the 1980s, the improvements are coming more slowly now than they did in the late 1970s and the pattern of improvement across birthweights has changed. National birthweight-specific infant mortality rates are available only for 1960 and 1980; to consider recent changes in the pattern of mortality across birthweights, one must use more limited databases compiled in individual States.

Data on birthweight-specific neonatal mortality from California are shown in table 2-6.[8] These data show a substantial slowdown in improvement in the neonatal mortality rates for moderately low birthweight babies (those weighing between 1,500 and 2,499 grams) from the 1978-81

[8]Birthweight-specific neonatal mortalit y data from California are available only for newborns weighing more than 500 grams. Consequently, the birthweight-specific mortality rates reported in table 2-6 are lower than California's official neonatal mortality rates.

Table 2-4.—Changes in U.S. Birthweight-Specific Mortality Rates From 1980 to 1983

	Birth weight-specific neonatal mortality rate[a]			Birthweight-specific infant mortality rate[b]		
	1980[c]	1983[d]	Percent change 1980-83[e]	1980[c]	1983[f]	Percent change 1980-83[e]
Low birthweight:						
<1,000g	727.3[c]	658.7[d]	– 9,4 "/0	753.5[c]	701.7[f]	– 6.8 "/0
1,000-1,499g	183.3[c]	1 17.3d	–35.9	212.8[c]	154.9f	– 27.2
1,500-1,999g	49.7'	38.1[d]	– 23.3	65.3[c]	59.8[f]	– 8.4
2,000-2,499g	15.7[c]	12.2[d]	– 22.2	24.6[c]	22.1[f]	– 9.8
Normal birthweight:						
22,500g	***2.2***[c]	1.8d	–14.9"/0	5.0[c]	4.6[f]	– 8.1 0/0
All birthweights	**8.4**[c]	**7.2**[d]	-13.8%	12.0[c]	11.1[f]	– 7.60/o

[a]The birthweight-specific neonatal mortality rate is defined as the number of infants in a given birthweight Interval who die in the first 28 days Of life Per 1,000 live births in that Interval
[b]The birthweight-specific infant mortality rate is defined as the number of infants in a given birthweight Interval who die in the first year Of life per 1,000 live births
[c]Centers for Disease Control, Public Health Service, U.S Department Of Health and Human Services, preliminary table from the 1980 National Infant Mortality Surveillance Project, Atlanta, GA, May 1988 All birthweight-specific deaths of multiple birth infants were assigned to the neonatal period.
[d]U.S birthweight-specific neonatal mortality rates for 1983 were calculated from aggregated births and neonatal deaths in nine States Georgia, Maine, Minnesota, Missouri, North Carolina, New Hampshire, New York (excluding New York City), Vermont, and Wisconsin U S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Proceedings of the International Collaborative Effort on Perinatal and Infant Mortality*, VOI I (Hyatt sville, MD: NCHS, August 1985)
[e]p_{arcen} t_{age} change calculated on unrounded numbers
[f]U S birthweight-specific infant mortality rates for 1983 were calculated for the nine States noted above minus New York State

SOURCE Off Ice of Technology Assessment, 1988

Table 2-5.—U.S. Birthweight Distribution, Live Births, 1977, 1981, 1984

	1977		1981[b]		1984[c]		Average annual percentage increase in number of births	
	Number of births ***(000s)***	Percent of all births[d]	Number of births (000s)	Percent of all births[d]	Number of births (000s)	Percent of all births[d]	1977-81[e]	1981-84[e]
Low birthweight:								
<500g	30	0.1 0/0	3.5	0.1 0/0	4.4	0.1 0/0	3.560/0	8.1 70/0
500-999g	14.2	0 4	16.1	0.4	16,8	0.5	3.11	1.56
1,000-1,499g	20,4	0.6	22.2	0.6	22.3	0.6	2.06	0.19
1,500-1,999g	45.6	1,4	47.1	1.3	47.1	1.3	0.80	0.02
2,000-2,499g	152.1	4.6	158.1	4.4	155.8	4.3	0.98	– 0.04
Normal birthweight:								
22,500g	3,091.3	92.90/.	3,382.0	93.20/o	3,422.7	93.30/.	2,270/.	0.40%
All birthweights	3,326.6	100.0"/0	3,629.2	100.0 "/0	3,669.1	100.0"/0	2.200/0	*0.37%*

[a]U S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, "Advance Report of Final Natality Statistics, 1984, " Month/y *Vital Statistics Report*, VOI 35, No 4 (supplement), DHHS Pub No (PHS) 88-1120 (Hyattsville, MD: PHS, July 18, 19S8).
[b]U.S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, Vita/ *Statistics of the United States, 1981, Vol I Natality* DHHS Pub No (PHS) 85.1113 (Washington, DC: U S. Government Printing Office, 1985).
[c]US Department of Health and Human Services, Public Health Service, National Center for Health Statistics, Vita/ *Statistics Of the United States, 1977 Vol I Natality*, DHHS Pub No (PHS) 81-1113 (Washington, DC U.S Government Printing Office, 1981)
[d]The distribution of live births of unknown birthweight was assumed to be the same as the distribution of live births at known birthweights
epercentage calculated on unrounded numbers

SOURCE Office of Technology Assessment, 1988

period to the 1981-84 period and dramatic improvement in the rates for very low birthweight infants (those weighing between ***500*** and ***1,500*** grams), especially in the tiny newborns weighing 500 to 999 grams. The neonatal mortality rate for the very low birthweight infants in California declined more rapidly in the 1980s than it did in the late 1970s; however, very low birthweight infants make up a small proportion of all low birthweight births (see table 2-5), so the neonatal mortality rate for all low birthweight babies (i.e., those weighing more than 500 grams) declined slightly more slowly in the early 1980s than it did in the late 1970s.

Thus, available evidence suggests that the slowdown **in improvement in U.S. infant mortality in the early** 1980s compared to the late 1970s is the result of both **a more rapid deterioration in the U.S. birthweight distribution and, to a lesser extent, slowed improvement in U.S. birthweight-specific mortality rates.**

There are no sure answers to the question of why the U.S. infant mortality rate began to level

Table 2-6.—Changes in California's Birthweight-Specific Neonatal Mortality Rates, 1978, 1981, 1984

	Birthweight-specific neonatal mortality rate[a]			Percent change	Percent change
	1978	1981	1984	1978-81	1981-84
Low birth weight:					
500-999g	628.79	582.06	487.92	– 7.43%	***– 16.17%***
1,000-1,499g	181.55	139,15	103.99	– 23.35	- 25.27
1,500-1,999g	48.00	35.64	36,54	– 25.76	**+ 2.54**
2,000-2,499g	13.99	12,72	12,10	– 9.09	**– 4,86**
500-2,499g	73.24	64.04	56.28	– 12.56	-12.11
Normal birthweight: > 2,500g	1.91	1.67	1.47	– 12,87 0/0	– 11.95%
All birthweights >500g	**6.29**	**5.25**	**4,66**	-16.47%	– 11,27 0/0

[a]The birthweightspecific neonatal mortal ity rate is defi ned as the n u m ber of in fantsin a givenbirthweightinterval who diein the first 28 days of li fe per 1 000 l ive births in that nterval

SOURCE Off Ice of Technology Assessment 1988 calculated from unpublished data from the Maternal and Child Health database, provided by F Rust University of California Santa Barbara CA August 1986 April and August 1987

off in the early 1980s. Too little is known about how various factors—maternal, medical, and environmental—affect newborn babies' risks of dying in their first year to quantify the effects of changes in these factors on infant mortality. Yet we do know enough about the kinds of factors that matter to explore possible explanations for the slowdown. Several possible explanations are examined below.

Changes in Birth Reporting / Increased Resuscitation of the Tiniest Newborns

Some observers have suggested that the recent slowdown in improvement in the U.S. infant mortality rate is, at least in part, an artifact of increased reporting of live births that in the past would have been reported as fetal deaths or would have gone unreported altogether.

The basis for most States' reporting requirements is the World Health Organization's definition of a live birth. That definition classifies as a live birth "the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy, which, after such separation, breathes or shows any other evidence of life such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles" ***(700).*** If the product of the delivery does not show any such signs of life, it is classified as a fetal death. In 43 States, fetal deaths have to be reported only if the gestational age is at least 20 weeks or if a minimum weight has been reached (755). If extremely premature births (e.g., those with birthweights under 500 grams) are more frequently resuscitated today than they were in the late ***1970s,*** they might be newly counted as live births instead of as fetal deaths, though their infant death rate would approach 100 percent. Counting these under-500-gram resuscitated infants as live births rather than as fetal deaths would push up neonatal and infant mortality rates because the vast majority of these tiny infants die.

Even without more aggressive resuscitation of the tiniest newborns, hospitals today may be more careful to report as live births what might have been reported as fetal deaths in the past. The reasons include increased pressure by State health authorities for complete reporting (210) as well as legal and economic considerations (755). More careful reporting of live births by hospitals also would have the effect of artificially raising U.S. neonatal and infant mortality rates. "

Since changes in birth reporting practices are difficult to assess without detailed review of hospital and vital statistics records, more indirect tests of the importance of the reporting phenomenon are necessary. National data on the distribution of live births in the United States show that from ***1981*** to ***1984,*** the reported number of live births under 500 grams increased much more rapidly than the number of live births at higher birth-

[a]There appeartobelargedifferencesin reporting oflivebirths among the States an observation which suggests that there issubstantialroomfor changes in reporting practices throughout the country (755)

weights (see table 2-5). This observation suggests that reporting changes may indeed be taking place in the under-500-gram birthweight class.

The increase in reported live births at the lowest birthweights in the United States is matched by a rapid decrease in fetal death rates at the lowest weights. '" The U.S. fetal death rate for weights under 1,000 grams declined much more rapidly from 1981 to 1984 (2 percent annually) than it declined from 1977 to 1981 ('/2 percent annually). If deliveries that in previous years would have been labeled fetal deaths are increasingly being labeled as live births, this labeling could account for the rapid rise in the number of very low birthweight live births.

To test how much of a difference such reporting changes could make to the U.S. infant mortality rate, OTA recalculated U.S. infant mortality rates for 1981 and 1984, making two assumptions:

- that in the two periods 1977-81 and 1981-84, the rate of change in the number of births under 500 grams was the same as the rate of change in number of births in all other low birthweight categories combined (500 to 2,500 grams); and
- that all of the "excess births" in the under-500-gram category (i. e., the difference between the number of births actually reported in the under-500-gram category and the number that would have been reported had the rate of change held constant) died in infancy.

OTA calculated that without these excess births in the under-500-gram category, the U.S. infant mortality rate in 1981 would have been 11.81 deaths per 1,000 live births in 1981 (instead of 11.9 deaths) and 10.41 deaths per 1,000 in 1984 (instead of 10.8 deaths). These recalculated infant mortality rates correspond to a compound annual rate of decrease in the U.S. infant mortality rate of 4.4 percent from 1977 to 1981 and 4,1 percent from 1981 to 1984.

Thus, much of the recent slowdown in improvement in the U.S. infant mortality rate could be accounted for by increased reporting of deliveries as live births. How much of the slowdown can be attributed to this reporting phenomenon depends on our willingness to believe that other factors—medical or environmental—are at work to differentially increase the frequency of live births in the very lowest weight category. If, for example, sexually transmitted diseases were found to be important correlates of very premature delivery, an increase in the 1980s in the incidence of such disease among women of childbearing age could have differentially increased the number of births under ***500*** grams in this period—but this is simply conjecture. Currently, all that can be said is that we cannot rule out the possibility that a large part of the leveling off of improvement in the U.S. infant mortality rate in the early 1980s was an artifact of changes in birth reporting.

Loss of **Technological Opportunities**

One possibility is that technological opportunities for improving either the U.S. birthweight distribution or birthweight-specific mortality rates that were available in the 1970s have run their course and have not been replaced by new opportunities of equal importance. Because 65 percent of all infant deaths occur in the neonatal period and 7.5 percent of neonatal deaths occur in low birthweight babies, it is useful to consider whether opportunities to improve the outcomes of low birthweight babies in the neonatal period have declined.

The 1970s saw rapid advances in technologies for treating low birthweight babies, particularly babies with respiratory distress syndrome (RDS), the most common cause of neonatal death.[11] Beginning in 1974, new respiratory therapy techniques and improvements in mechanical ventilation had a major impact on deaths from RDS (488,634). These respiratory technologies were first successfully applied in more mature infants with RDS. For less mature infants with RDS, it is relatively difficult for respiratory technology to compensate for undeveloped lungs, and weaning such infants from a mechanical ventilator takes longer (77,237,285). Nevertheless, recent years have seen respiratory therapy technologies increasingly applied, and with greater success, to very low birthweight newborns (665).

[10] The fetal death rate is defined as the ratio of fetal deaths to fetal deaths plus live births.

[11] Advances in technologies for treating low birthweight babies are discussed in OTA's 1987 case study on neonatal intensive care (665),

Given the history of development of neonatal respiratory therapy, it is reasonable to assume that the technology diffused in the late 1970s to moderately low birthweight babies and only later to smaller newborns. The vast majority (82 percent) of low birthweight infants are of moderately low birthweight (between 1,500 and 2,500 grams), so it is possible that the improvements in neonatal intensive care that are continuing to yield dramatic improvements in very low birthweight babies' chances of survival are statistically imperceptible because of the relatively small number of very low birthweight births. Data presented above from California support this hypothesis (see table ***2-6).*** In California, the decline in neonatal mortality among very low birthweight babies was much higher in the 1981-84 period than it was in the 1978-81 period. But for moderately low birthweight babies, the high rate of decline in the 1978-81 period virtually evaporated in the 1981-84 period. Across all low birthweight classes, these changes translated into a modest decrease in the rate of decline in infant mortality (from ***12.6*** percent in the 1978-81 period to 11.9 percent in the 1981-84 period, when the birthweight distribution is held constant at the 1978 level).

Thus, it appears that in recent years the ability of new neonatal intensive care technologies to bring about dramatic improvements in U.S. infant mortality rates has declined slightly. The decline would be greater with each succeeding year as existing neonatal technology becomes ever more widely applied even among the lowest birthweight babies. This explanation for the slowdown in improvement in U.S. infant mortality rates, therefore, should become more important as time goes by. But new technologies currently under development—e.g., the use of exogenous natural or synthetic lung surfactant ***(207,251,304,349,422,*** 602,751)—may have a dramatic impact on RDS and, hence, infant mortality, in the future.

Another influence on U.S. infant mortality in the mid-1970s may have been the availability of legal abortions. Recent analyses suggest that the availability of abortions precipitated by the 1973 U.S. Supreme Court decision Roe v. Wade may have had an influence on the rapid decreases in U.S. neonatal and infant mortality rates in the mid-1970s (118,119,229,311). The mechanism for this influence is probably the differential reduction of births to women at high risk for infant mortality, such as very young teenagers and unmarried women (610).

The rapid increase in the U.S. abortion ratio[12] beginning in 1973 would be expected to stabilize at a point when the availability of abortion providers was high enough to meet the demand for their services. At that time, the impact that abortion would have on the U.S. infant mortality rate would have already occurred, and sustaining the reduction in infant mortality in subsequent years would require new factors that may not have materialized.

Recent data suggest that the U.S. abortion ratio has indeed stabilized since 1981. Among adolescents, the percentage of pregnancies ended by abortion remained virtually unchanged between 1980 and 1982 (703). These data would suggest that the decreases in U.S. infant mortality brought about by the sudden availability of legal abortion in ***1973*** were largely complete by 1981.

Increased Poverty

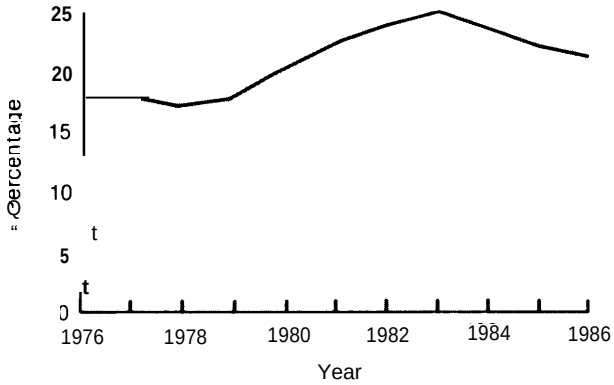
The inverse relationship between infant mortality and income has been well documented (118, 176,218,229,619,757). But the ways in which poverty affects infant mortality is not well understood. Poor people may have lower rates of use of health care, higher stress, less hospitable home environments, higher rates of risky behaviors (e.g., smoking during pregnancy), fewer social supports, and more nutritional deficiencies than nonpoor people and also may exhibit racial and ethnic differences that contribute to the disparity in infant mortality between poor and nonpoor people (456,583,757). Because the causal pathways between poverty and infant mortality are not well understood, information on trends in poverty in the recent past can only be suggestive.

Since the late 1970s, the family incomes of infants in the United States deteriorated markedly. Figure 2-3 shows the percentage of infants in the United States from families with household incomes below the poverty level throughout the 1976-86 period. Whereas the average percentage

[12]The abortion ratio is defined as the number of abortions per 1,000 live births.

72- 676 0 - 88- 2

Figure 2-3.— Percentage of U.S. Infants Under 1 Year of Age in Poverty, 1976-86



SOURCE J McNeil Bureau of the Census U S Department of Commerce. Washington, DC, personal communication, June 1987

of U.S. infants in poverty between ***1976*** and 1979 was 17 to 18 percent, it rose to 23.9 percent between 1981 and 1983 (419).[13] Since 1983, the percentage of U.S. infants in poverty has moderated, but at 21.3 percent in 1986, it was still almost 4 percentage points higher than it was in the late 1970s,

There is no way of knowing exactly how much effect the dramatic increase in the percentage of infants living in poverty in recent years has had on the U.S. infant mortality rate. Probably, however, only a modest part of the leveling off of improvement in the U.S. infant mortality rate in the early 1980s is attributable to the deterioration in living standards of infants and their mothers. One study of low birthweight in the State of Washington found that the percentage of women receiving late or no prenatal care in low-income census tracts in the State increased 34 percent and that the low birthweight rate in these census tracts increased by 18 percent between 1980 and 1982, years in which Washington State experienced an economic recession (176). The dramatic increase in the low birthweight rate in the low-income census tracts would cause a comparatively small rise in total infant mortality rates in the region, because poor women constitute a minority of the population.

Changes in Pregnant Women and Children's Access to Health Services

Other chapters of this assessment summarize the evidence on the effect of health care services on the health of U.S. infants and children. The weight of the evidence supports the contention that early and appropriate use of prenatal care, combined with access to specialized perinatal services for high-risk mothers and newborns, improves birth outcomes both by raising birthweights and by improving birthweight-specific mortality rates. '4 In addition, delay in seeking or receiving care for infants with life-threatening conditions that respond strongly to appropriately timed medical care (e.g., infectious and respiratory diseases) may affect infant mortality rates (610).

Because poverty and unemployment reduce financial access to health care services, the inverse relationship between poverty and infant mortality may in part reflect differences in the use of appropriate services by pregnant women and children. But the impact that increases in U.S. poverty have on access to health care can be mediated by the provision of publicly funded or subsidized health services. Conversely, cutbacks in the availability of public subsidies can exacerbate the impact of poverty and unemployment on access to services.

In recent years, while the poverty rate among infants and children in this country rose, Federal spending for health care services for the poor declined. Three barometers of spending trends are the following:

1. changes in expenditures by Medicaid on behalf of poor children,
2. changes in Federal spending on maternal and child health (MCH) services, and
3. changes in Federal spending for community health centers and migrant health centers—direct Federal grant programs that provide primary health care to poor populations.[15]

[13] The percentage of children in poverty in the United States could actually be slightly higher than these data suggest. The reason is that these data categorize mothers with infants who live with parents or guardians as being within the entire household income even if they do not receive any benefit of income earned by other individuals in the household.

[14] Prenatal care is discussed at greater length in ch. 4. Specialized perinatal services for high-risk newborns are discussed in OTA'S 1987 case study on neonatal intensive care (665).

[15] See ch. 3 for more detail on these programs.

Throughout the period from 1980 to 1984, the proportion of poor children eligible for Medicaid remained fairly stable. During that period, however, Federal and State Medicaid spending per child recipient of Aid to Families With Dependent Children (AFDC) in constant dollars declined, reflecting cutbacks in covered services, lower payment rates to hospitals and doctors, and increased control over the use of services (278). From 1981 to 1984, total Medicaid expenditures per AFDC child declined in constant dollars by an average of 3.1 percent annually—almost twice as fast as the decline in the 1978-81 period (see table 2-7). Total Medicaid spending on behalf of children from 1981 to 1984 declined by 5.1 percent in constant dollars for physician care and by 4.4 percent in constant dollars for prescription drugs (278).

Funding by the Federal Government for MCH programs also decreased dramatically in real terms in the early 1980s, in contrast to more gradual declines in previous years. Whereas real Federal funding for MCH services declined at an average annual rate of 6 percent between 1978 and 1981, it declined at an average annual rate of 12 percent between 1981 and 1984 (see table 2-8). Similar declines in funding for the federally supported community health and migrant health centers occurred in the period from 1981 to 1984 (see table 2-8). Trends in Federal and State funding for MCH services from 1978 to 1984 are shown in figure 2-4. Although the States' funding for MCH services remained at approximately the same level, combined Federal and State funding for MCH services declined in constant dollars by 23..5 percent between 1981 and 1984.

Table 2.7.—Medicaid Expenditures Per Child Recipient of Aid to Families With Dependent Children, 1978-84

	Expenditures per recipient	
Year	Nominal expenditures	Constant 1978 dollar expenditures
1978	$322	$322
1979	$346	$316
1980	$384	$316
1981	$416	$306
1982	$416	$278
1983	$456	$283
1984	$477	$279
Average annual percentage change:		
1978-81	+8.90/o	– 1.6%
1981-84	+4.7%	–3. 1'Yo

SOURCE :J. F Holahan and J.W. Cohen, *Medicaid The Tradeoff Between Cost Containment and Access to Care* (Washington DC Urban Institute Press, 1986)

The impact of reductions in publicly financed health services for pregnant women and poor children in the early 1980s when the U.S. poverty rate was rising is unknown. For both whites and blacks in the United States, the percentage of mothers who did not obtain any prenatal care or obtained late prenatal care decreased in the 1977-81 period, but the percentage increased in the 1981-84 period (see table 2-9), This observation suggests that the decline in Federal spending on health care for poor children and pregnant women in the early 1980s, coupled with a rise in poverty during that period, may have had some impact on these individuals' access to effective health care. How such changes in access may have translated into impacts on the total U.S. infant mortality rate cannot be assessed with information currently available, Their contribution is likely to have been small overall, however, because the Federal funding cutbacks affected a relatively small proportion of all pregnant women and infants.

Since 1984, the cutbacks in publicly financed health services for pregnant women and infants may have begun to moderate. The 1984 Deficit Reduction Act (Public Law 98-369) expanded Medicaid eligibility for pregnant women and children who meet the income requirements of the States, regardless of their family structure, and the Consolidated Omnibus Reconciliation Act (Public Law 99-272) gave States the option of covering all women in poverty under Medicaid.[16] Furthermore, several States have developed their own initiatives for delivering care to pregnant women and children in need (491). To the extent that the cutbacks in Federal programs contributed to the recent slowdown in improvement in the U.S. infant mortality rate, these new initiatives may moderate similar effects in the future.

Changes in the Demographic Composition of Women Having Babies

OTA examined whether changes in the demographic composition of the population of women

[16] "Recent developments pertaining to the expansion of Medicaid eligibility are discussed further in ch. 3.

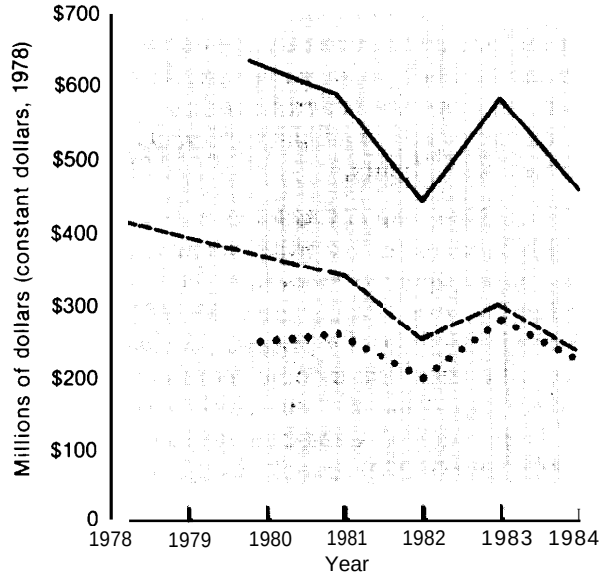
Table 2-8.—Federal Appropriations for Direct Public Health Programs, Selected Fiscal Years 1978.87

Program	Fiscal year 1978	Fiscal year 1980	Fiscal year 198'1	Fiscal year 1982	Fiscal year 1983	Fiscal year 1984	Fiscal year 1985	Fiscal year 1966	Fiscal year 1987
Maternal and child health services:									
Current dollars[a]	$410.3[b]	$454.7[b]	$454.7[b]	$372.0	$478.0[c]	$399.0	$478.0	$457.4	$496.75*
Constant 1978 dollars[e]	$410.3	$375.2	$338.7	$248.3	$293.5	$230.7	$260.2	$231.5	NA
Community health centers:									
Current dollars[g]	$225.0	**$320.0**	**$323.7**	**281.2**	**$360.0**	**$351.35**	**$360.0**	**$396.0**	**$400.0**
Constant 1978 dollars[e]	$225.0	$264.0	$241.2	$187.7	$221.1	$203.1	$195,9	$200.4	NA
Migrant health centers:									
Current dollars[g]	$ 34.5	$39.7	$43.2	$38.2	$38.1	$42.0	$44.3	$45.4	$45.4
Constant 1978 dollars[e]	$ 34.5	$32.8	$32.2	$ 25.5	$23.4	$24.3	$24.1	$23.0	NA

[a] E Magee, Deputy Associate Bureau Director, Division of Maternal and Child Health, Health Services and Resources Administration, U.S. Department of Health and Human Services, personal communication Rockville, MD, September 1987; and S. Bailey, '(The Maternal and Child Health Services Block Grant, Title V of the Social Security Act," report no. S3-93 EPW, Congressional Research Service, Washington, DC, May 5, 1983.
[b] Includes budgets for all programs that beginning in fiscal *year* 1982 *were* consolidated under the MCH block grant.
[c] Includes $105 million from a supplemental appropriation.
[d] Includes $1875 million from a supplemental appropriation.
[e] The medical care component of the Consumer Price Index was used to calculate 1978 constant dollars.
'NA = not available
9p. Conway, Budget office, Bureau of Health Care Delivery and Assistance, Health Services and Resources Administration, U.S. Department Health and Human Services, Rockville, MD, personal communication, September 1987

SOURCE" Office of Technology Assessment, 1988

Figure 2-4.— Estimated State and Federal Funding for Maternal and Child Health Services, 1978-84[a b]



— Total (State and Federal)

–-–– Federal

. • . •• State

[a] State funding data comparable to Federal funding data for the years 1978 and 1979 are not available.
[b] Estimates unavailable for 1979 Value for 1979 is based on linear interpretation between 1978 and 1980

SOURCE Office of Technology Assessment, 1988, based on actual Federal funding and reported data by State health agencies to the Public Health Foundation, Washington, DC

having babies could be contributing to the slowdown in improvement in U.S. infant mortality rates. The higher rates of low birthweight and infant mortality among unmarried, black, and adolescent women raises the question of whether changes in these high-risk groups account for any part of the slowdown.

Data on the percentage of all births to women in various high-risk categories do not show any substantial differences between the pre-1981 and the post-1981 period (see table 2-IO). Although the proportion of births to unmarried mothers in the United States increased over the entire 1977-84 period, the rate of increase slowed substantially beginning in 1981.

The decline in the birth rate among teenagers actually accelerated in the 1981-84 period. Data not presented in table 2-10 show that the birth rate for black unmarried women has generally declined since 1975, while the rate for white unmarried women has increased steadily. Moreover, the increases in the number of births to unmarried women in the United States since 1980 have been entirely due to increases in births to unmarried *post-teenaged* women (710).

Thus, it appears that if changes in the demographic composition of women having babies have had any effect, the effect would have been to accelerate the rate of progress in reducing U.S. infant mortality. Demographic changes in the composition of women having babies have not played a role in the slowdown.

Table 2-9.— Percentage of Mothers Who Obtain Early, Late, or No Prenatal Care, by Race, 1977, 1981, 1984

	Percentage of mothers			Annual compound rate of change	
	1 977[a]	1981 [b]	1984'	1977-87-	1981-84
Whites:					
Early prenatal care[d]	77.3 %	79.4 0/0	79.90/0	+ 0.7 0/0	+ 0.20'0
Late or no prenatal care[e] . .	4,7	4.3	4.6	–0.2	+ 2.3
No prenatal care[f]	1.1	1.1	1.3	0.0	+ 5.7
Blacks:					
Early prenatal care[d]	59.00/0	62.4 0/0	61.3 0/0	+ 1 ,4 "/0	–0.6%
Late or no prenatal care[e] . .	9.6	9.1	10.0	– 1.3	+ 3.2
No prenatal care[f]	2.8	2.8	3.4	0.0	+ 6.7

[a]U S Department of Health and Human Services, Public H ealth Service, National Center for Health Statist ics Vita/ *Statistics of the United States 1977 Vol I Natality* DHHS Pub No (PHS) 81 1113 (Washington DC U S Government Printing Office, 1981)
[b]US Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Vital Statistics of the United States. 1981 Vol I Natality* DHHS Pub No (PHS) 85-1113 (Washington, DC U S Government Printing Off Ice. 1985)
[c]US Department of Health and Human Services. Public Health Service, National Center fOr Health Statistics "Advance Report of Final Natality Statistics 1984 *Monthly Vital Statistics Report*, vol 35, No 4, Supp DHHS Pub No (PHS) 861120, Hyattsville, MD July 18, 1986
[d]Early prenatal care is prenatal care beginning within first 3 months of pregnancy
[e]Late prenatal care is prenatal care beginning after 6 months of pregnanc y
[f]This group (mothers receiving no prenatal care) is a subset of the previous group (mothers receiving late or no prenatal care)

SOURCE Off Ice of Technology Assessment, 1988

Table 2-10.— Percentage of All Births in the United States to Mothers With Selected Demographic Risk Factors, 1977, 1981, 1984

	Percentage of all births			Average annual compound rate of change	
Demographic risk factor	1977	1981	1984	1977-81	1981-84
Unmarried ., ...	15.5"/0	18.90/o	21.0 "/0	+5. 1 0/0	+ 3.6%
Black	16,4	16.2	16.2	–0,3	0.0
Teen (<20 years)	17.2	14.8	13,1	–3.7	--40
Unmarried teen ., ...	7.5	7.4	7,4	–0.3	0.0
Low education (<12 years) . .	26.2	22.9	20.9	– 3.3	**– 3.0**

[a]U S Department of Health and H u man Serv ces Public Health Service, National Center for Health Statistics, *Vital Statistics of the United States 1977 Vol I Natality* DHHS Pub No (PHS) 81.1113 (Washington, DC U S Government Printing Office, 1981)
[b]U S Department of Health and Human Services Public Health Service National Center for Health Stat istics, Vita/ *Statistics of the United States 1981 Vol I Natality* DHHS Pub No (PHS) 851113 (Washington, DC U S Government Printing Off Ice, 1985)
[c]U S Department of Health and Human Services, Public Health Service Nat ional Center for Health Stat istics u n publi shed data in preparation for *Vital S tatistics of the United States 1984 Vol I Natality* (Hyattsville, MD, 1986)

SOURCE Office of Technology Assessment 1988

Conclusions

Taken together, the evidence suggests that the leveling off of the U.S infant mortality rate in the early 1980s is the result of a combination of factors, each contributing to the trend in different amounts. An increase in reported live births at the birthweight interval under 500 grams clearly plays an important—and probably dominant—role in the slowdown, although the magnitude of its effect cannot be estimated with precision. Increasing resuscitation of the tiniest infants in the early 1980s, perhaps resulting from the recognition by obstetricians and neonatologists that a few of these deliveries might be salvaged and from ethical concerns arising from the "Baby Doe" controversy, [17] may have been responsible for greater rates of resuscitation. Furthermore, better birth reporting and a higher rate of resuscitate ion may have resulted from the increasing concentration of low birthweight births in regional perinatal centers.

Other factors may also have contributed to the recent slowdown in improvement in the U.S. infant mortality rate, although available evidence suggests that their impact would be modest. These include the natural maturation of technologies for neonatal intensive care that diffused widely in the mid-1970s and that are now improving outcomes of the smallest birthweight babies; the completion of the process of diffusion of abortion services in

"Following the birth of Baby Jane Doe (an infant born with multiple birth defects), Federal regulations were written to require that hospitals treat severely w'~erel>r handicapped infants over the objections of their parents Those regulations were later declared unconstitutional by the Supreme Court

the late 1970s; and the deterioration in economic conditions and in the availability of subsidized health care services for pregnant women and children.

The key to the slowdown puzzle appears to lie in the deteriorating U.S. birthweight distribution, most especially increasing numbers of the tiniest newborns. At present, OTA is unable to identify the reasons for the rapid increase in the frequency of reported births in the lowest birthweight categories, but the most likely explanation is the phenomenon of better birth reporting and increased resuscitation of the tiniest newborns. If the recent slowdown in improvement in the U.S. infant mortality rate is, indeed, largely a reporting/resuscitation phenomenon, the implications for public policy may not be very different from those that would exist if the slowdown were found to be the result of environmental or medical factors at work in the prenatal period. If very low birthweight births in the United States are just being counted more accurately, then the country has even more of a problem of infant mortality than we thought. And if extremely tiny newborns in the United States are to be increasingly resuscitated, with high costs and low probability of success, then we need to find effective methods of preventing extremely low weight births in the first place. Thus, the slowdown question may be moot; the real question is what interventions make a difference to low birthweight and, hence, infant mortality.

CHILDREN'S HEALTH BEYOND INFANCY

The importance of infant mortality as a general indicator of children's health, coupled with the poor showing of the United States compared to other developed nations, tends to divert attention from other important dimensions of children's health, particularly in the postinfancy period. About 44 percent of deaths among children under 15 years of age in 1984 occurred in those over 1 year of age. But mortality is only one indicator of health status, and other aspects of health become increasingly important as children develop.

Unfortunately, good indicators of children's health status beyond infancy that allow monitoring of trends over time or differences among groups of children are hard to find (354,612,756). Data collected regularly through national health surveys on measures such as the prevalence of chronic conditions or self-reported health status are not easily interpreted. An increase in the prevalence of chronic conditions, for example, can be due in part to better diagnosis, increased medical access, or even medical advances that keep children alive, though chronically ill, who would otherwise have died. Changes in self-reported health status may in part reflect changes in such things as individuals' expectations about what constitutes good health (756). Even a seemingly objective indicator of children's health status (e.g., the number of bed-disability days per child) may be affected by changing attitudes about how childhood illnesses should be treated. '8

Several key indicators of young children's health status have recently been suggested by the University of North Carolina's Child Health Outcomes Project:

- immunization status,
- prevalence of growth stunting in high-risk populations,
- elevated levels of lead in the blood, and
- non-motor-vehicle accident fatalities.

These indicators were selected by the leaders of the project because they meet a number of important conditions: 1) they are widely accepted by experts in the field as reflecting important health policy concerns, 2) they are understandable, 3) data for their assessment and monitoring are easily obtainable, 4) the indicators relate to a condition that can be prevented or greatly reduced through known and available interventions, and 5) dissemination of information about

[18] Furthermore, in the case of the annual National Health Interview Survey, changes in questionnaire design also make intertemporal comparisons suspect. From *1981* to *1983,* the percentage of the child population reported by the survey to have activity limitations increased by *32* percent, but this increase is largely attributable to changes in questionnaire design (711).

these indicators will be likely to promote improvement in major social and health policies.

Beginning with the list of four indicators of children's health suggested by the Child Health Outcomes Project, OTA deleted one indicator (elevated blood lead levels[19]) and added the following two:

- total age-adjusted mortality rates, and
- mortality rates from "external" causes, including motor vehicle accidents, other accidents, and inflicted injuries.

Total age-adjusted mortality rates give a good picture of how one dimension of children's outcomes differs among groups in the population and over time. The mortality rate from "external" causes is a general index of "injury-related deaths" and reflects the difficulty that professionals have in distinguishing between injuries that are accidental and those that result from abuse or neglect .20

Children's Mortality Rates

U.S. children's mortality rates by age of death from age 1 up to age 19 and by race are presented in table 2-II. For any given age of death from 1 to 19, children's mortality rates declined steadily from 1968 to 1984. In any given year and for both whites and blacks, children's mortality rates decline with age until ages 15 to 19, at which point they increase greatly. Among white children, mortality rates for 1.5- to 19-year-olds are considerably greater than the mortality rates for the other age groups. With the exception of mortality rates for 15- to 19-year-olds (which show the differential impact of automobile accidents and suicide), mortality rates are much greater among black children than among whites.

For white children, the rate of decline in mortality rates in the 1981-84 period exceeded the rate of decline during the 1977-81 period (or the 1968-81 period for that matter) for all age groups with the exception of ages 10 to 14. For blacks, the rate of improvement in the 1981-84 period was superior to the past only for ages 1 to 4.

An examination of the causes of children's deaths in 1984 provides some understanding of the overall patterns discussed above. Leading causes of death and associated mortality rates for children up to 19 years of age are shown in table 2-12. External causes (e. g., accidents, suicide, homicide) are responsible for just 2.9 percent of all infant deaths, but this percentage increases to 43.5 percent, 51.0 percent, 57.4 percent, and 77.2 percent for ages 1 to 4, ages 5 to 9, ages 10 to 14, and ages 15 to 19, respectively.

In summary, for both white and black children in the United States, mortality rates have continued to decline for all age groups. Furthermore, with the exception of ages 10 to 14, the rates of decline for whites have generally been greater during the 1981-84 period than in the past; for blacks, with the exception of ages 1 to 4, the rates of decline have been less than the past. In 1984, black children aged 1 to 15 had a mortality rate 30- to 70-percent greater than that of whites. An examination of the causes of death indicates that external causes in general and motor vehicle acci-

[19]The prevalence of elevated blood levels in children is not included here because the quality of monitoring of these levels has seriously eroded since 1981 when the Federal MCH block grant enabled States to set their own public health priorities.

[20]See discussion of accidental injuries in ch. 7 and child maltreatment in ch. 8.

Table 2-11.—U.S. Children's Mortality Rates by Age and Race, Selected Years 1968-84

	Mortality rate[a]							
	Whites				Blacks			
Year	1-4	5-9	10-14	15-19	1-4	5-9	10-14	15-19
1968	78,3	41.7	38.9	102.0	151.7	61.9	58.9	149,4
1973	70,9	38.6	38.3	107.2	126.2	56.4	53.3	134,2
1977	61.1	31.4	33.4	99,6	103.2	44.4	41.9	100.1
1981	54.3	27.5	28,5	91.8	93.6	38.8	36.6	85.7
1984	46.9	23.3	27.3	81.9	78.8	36.1	34.4	77.9

[a]The mortality rate is defined here as the number of children in a specified age group who die Per 100.000 population in that age group

SOURCE U S Department of Health and Human Services Public Health Service National Center for Health Statistics, unpublished data from the U S vital statistics Hyattsville MD 1982 1986

Table 2-12.— Leading "Causes" of Death Among U.S. Infants and Children, 1984

Cause of death[b]	Mortality rate by age[a]				
	<1	1-4	5-9	10-14	15-19
All causes	1,086.6	51.9	25.1	28.2	81.9
Malignant neoplasms (140-208)	3.1	4.0	3.6	3.5	4,8
Major cardiovascular disease (390-448)	29.7	2.9	1.4	1.4	2.7
Pneumonia (480-486)	18.7	1.4	0.5	0.4	0.5
Congenital anomalies (740-759)	234.4	6.7	1,5	1.4	1.3
Certain conditions originating in the perinatal period (760-779)	512.4	1.0	0.1	0.0	0.0
Symptoms, signs, and ill-defined conditions (780-799)	161.1	1.8	0.3	0.3	1.3
All other diseases (residual)	49.3	6.6	3.1	3.2	4.6
Motor vehicle accidents (E810-E825)	4,4	6.9	6.2	7.1	34.6
All other accidents and adverse effects (E800-E807/E826-E949)	18.6	12.9	5.5	5.9	10.5
Suicide (E950-E959)	—	—	0.0	1.3	***9.0***
Homicide and legal intervention (E960-E978)	6.5	2.4	0.9	1.6	8.3
All other external causes (E980-E999)	1.6	0.4	0,2	0.3	0.8

[a]The mortality rate is defined here as the number of deaths per 100,000 population in each specified group
[b]International Classification of Diseases code number is in parentheses

SOURCE Office of Technology Assessment, 1988, calculated from unpublished data from the U.S vital statistics, provided by the National Center for Health Statistics, Public Health Service US Department of Health and Human Services. Hyattsville, MD, 1986

dents in particular represent a large proportion of total deaths for both whites and blacks and for all ages beyond infancy. The continued improvement in postinfancy death rates is probably due in large part to reductions in accidental death rates during the period. Nevertheless, accidental and other injuries continue to be responsible for the majority of deaths in school-aged children.

Children's Immunization Status

A detailed review of the most recent evidence on the immunization status of children in the United States is presented in chapter 6. In brief, the percentage of 5- and 6-year-olds who are immunized has been between 91 and 94 percent throughout the 1980s (693), very close to the national target for 1990 set by the Public Health Service (679). This high level of immunization is primarily due to the fact that all States have laws requiring proof of immunization prior to school entry (49). Reported immunization levels in licensed day care centers are also nearing the target level of ***95*** percent. In the school year 1985-86, according to the Licensed Day Care Center Facilities Immunization Survey, 93 percent or more of the children attending licensed day centers had had their basic immunizations (590).

In contrast, the percentage of 2-year-olds who have been immunized in the United States is well below the 1990 target objective of 90 percent and has shown little progress since 1980. From 1979 to 1985, the percentage of children under 2 years of age who have been immunized against mumps (the lowest percentage to begin with) increased; the percentage immunized against rubella (German measles) actually declined slightly. The percentage of children under age 2 who have received polio vaccine, measles vaccine, or the combined diphtheria, tetanus, and pertussis vaccine (DTP) hardly changed (692).

The United States has significantly lower immunization rates for infants than several other industrialized countries. The percentage of fully immunized infants (O to 1 year of age) in the United States against DTP (37.4 percent) is less than one-half the percentage in the United Kingdom (84 percent), Canada (80 percent), Sweden (94 percent, DT only), France (95 percent), Spain (97 percent), Italy (99 percent, DT only), and Israel (95 percent) (723,765).

Although it is apparent that the United States enjoys high levels of immunization overall, though not as high as they should be for very young children, considerable differences persist with respect to race and geographic location. National survey data indicate that differences exist between white and nonwhite as well as urban poverty areas and

suburban and rural areas. For example, the percentages of children immunized in central cities are substantially lower than percentages in non-central-city regions for both preschool-age and school-entry-age children. In 1985, 31 percent of preschoolers living in U.S. central cities were not adequately immunized against polio; 30 percent were not adequately immunized against mumps. Almost one-fifth of 5- to 6-year-old children living in U.S. central cities had not received three or more doses of polio vaccine, the minimally acceptable level for immunity. Nearly two-fifths of that group had not received the optimal four or more doses of polio vaccine. Many illegal aliens living in U.S. central cities have not been immunized (287).

Growth Stunting

A high prevalence of growth stunting—the failure of a group of children to achieve a distribution of heights that conforms to standards established for a well-nourished healthy population of children —is an indicator of widespread poor nutrition or chronic infection in that population (426). The Centers for Disease Control monitors the height of a group of low-income children in the United States. In these children, the prevalence of growth stunting (as measured by the number of children who failed to meet the fifth percentile of age-appropriate height) declined slowly, from 9.5 percent in 1976 to about 8.4 percent in 1983 (646,683).

Conclusions

OTA's examination of young children's health status in the United States suggests that improvements have continued throughout the 1980s. Indicators of children's health, though obviously limited, show improvement throughout the 1980s for both poor and nonpoor children. Yet when data are available to compare experience in the early 1980s with that of the late 1970s, it is clear that the pace of improvement for poor children has declined. Moreover, inequalities between poor and nonpoor children and racial inequalities in children's health status have persisted throughout the period and, on some *measures* of children's health, have even worsened.