

Age-adjusted Death Rates: Trend Data Based on the Year 2000 Standard Population

by Donna L. Hoyert, Ph.D. and Robert N. Anderson, Ph.D., Division of Vital Statistics

Abstract

Age-adjusted death rates are routine mortality risk measures used to compare rates over time or between groups such as those living in different geographic areas. This type of measure eliminates differences that would be caused because one population is older than another. Beginning with mortality data for 1999, the standard population used by the Centers for Disease Control and Prevention's National Center for Health Statistics (NCHS) to calculate age-adjusted death rates based on the Year 2000 estimated population distribution replacing that of 1940 used previously. Comparisons of 1999 mortality data with that of 1998 and earlier years cannot be made unless age-adjusted death rates are based on the same standard population. Changing the standard population generally changes the magnitude of an age-adjusted death rate and may change the magnitude of the differential between two groups. Typically, the change in standard makes relatively little difference in the mortality trend but it can when age-specific rates have divergent patterns. This publication provides age-adjusted death rates by race and sex based on the year 2000 population standard and directs readers to the NCHS Web site for age-adjusted death rates by selected causes.

Introduction

This report provides trends in mortality using the year 2000 standard population to calculate age-adjusted death rates, replacing trends based on the previous 1940 standard million population.

Beginning with deaths for 1999, NCHS implemented a change in standard population used to calculate age-adjusted death rates for the following reasons: to establish the same standard population across Federal agencies, to use a population standard that more closely resembles the current age distribution of the United States, and to deal with a perception that the 1940 population is outdated.

NCHS convened two workshops to examine technical and policy issues related to the age adjustment of mortality statistics. The first workshop, held in 1991, examined technical issues and problems related to the calculation and interpretation of age-adjusted death rates

(1). The second workshop, held in 1997, recommended that the Secretary of the Department of Health and Human Services adopt a new standard based on the year 2000 population instead of the 1940 population (2). The Secretary approved this recommendation as policy in 1998 (3). Detailed information on the workshops and a summary report on the rationale, implications, and methodology are available in separate reports (1–3).

Methods

Data in this report are based on information from death certificates filed in the States and the District of Columbia. All States have provided these data since 1933. The number of States participating in the National Vital Statistics System increased from 10 and the District of Columbia in 1900 to 47 and the District of Columbia in 1932.

Age-adjusted death rates are summary mortality risk measures used to compare risk between groups and over time. This measure is the death rate that would occur if the observed age-specific death rates were present in a population with the age distribution of the standard population.

Age-adjusted death rates are calculated using the direct method of age-adjustment in this report. This involves weighting age-specific death rates by a standard set of weights ([table A](#)). The weights represent the proportion by age in a standard population.

Results

Age-adjusted death rates based on the year 2000 standard population for males and females, 1900–1999, are shown in [table 1](#). For the death-registration area in 1900 (i.e., 10 States and the District of Columbia), the rate was 2,518.0 per 100,000 standard population, 1,850.1 for the total United States in 1933, and 881.9 for the total United States in 1999. During this period, mortality decreased overall with periodic upturns often reflecting infectious disease outbreaks, often influenza, such as the pandemic of 1918.

Table A. United States standard year 2000 population: Numbers and proportions (weights)

Age	Number	Weight (w_i)
All ages	1,000,000	1.000000
Under 1 year	13,818	0.013818
1-4 years	55,317	0.055317
5-14 years	145,565	0.145565
15-24 years	138,646	0.138646
25-34 years	135,573	0.135573
35-44 years	162,613	0.162613
45-54 years	134,834	0.134834
55-64 years	87,247	0.087247
65-74 years	66,037	0.066037
75-84 years	44,842	0.044842
85 years and over	15,508	0.015508

For the black population, data are available only for 1960 forward; prior to 1968, data were routinely produced only for the white and non-white population. Age-adjusted death rates for other race groups such as the American Indian and Asian or Pacific Islander populations are not shown in this report. Rates will be shown for selected years in a forthcoming report.

Additional age-adjusted death rates based on the year 2000 standard population are available for selected causes of death on the NCHS Web site at <http://www.cdc.gov/nchs/datawh/statab/unpubd/mortabs/hist-tabs.htm>.

Discussion

Selection of an appropriate standard population is largely arbitrary. The 1940 standard has been widely used at Federal and State levels since 1943; however, it has not been used by everyone. The use of different standards confuses data users and burdens State and local agencies that have to produce multiple data series to be consistent with national data. Further, the 1940 standard is perceived to be outdated and incompatible with the current age structure of the population.

Beginning with 1999 data, the projected year 2000 population replaces the 1940 standard used for age-adjusting death rates. The intent of the change in the standard is to have all agencies of the U.S. Department of Health and Human Services use the same population standard, thereby reducing the burden on State and local agencies and solving the wider perceived problem with the 1940 standard.

Changing the standard population affects the magnitude of the rates and can affect mortality patterns and trends. The 1998 age-adjusted death rate nearly doubles when based on the 2000 standard rather than the 1940 standard, because the 2000 standard gives more weight to death rates at older ages when mortality is higher. However, this difference varies by cause of death because mortality risk differs by age (3). Changing the population standard makes less difference for conditions with greatest mortality risk at younger ages as opposed to those conditions with greatest risk at the oldest ages, because the relative change in the weights at younger ages is smaller than at the oldest ages (3). Similarly, differentials between age-adjusted death rates for the white and black populations will be reduced because greater weight will be placed on older ages when race differentials in mortality are smaller (3). Generally, the change in standard makes relatively little difference on the relative trend but can when age-specific rates follow divergent trends (3).

References

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Table 1. Age-adjusted death rates by race and sex using year 2000 standard population: Death-registration States, 1900–32 and United States, 1933–99

[Based on age-specific death rates per 100,000 population in specified group. Computed by the direct method, using as the standard population the age distribution of the total population of the United States as projected for 2000]

Year	All races			White			All other races					
							Total			Black		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1999	881.9	1,061.8	743.6	860.7	1,035.8	725.7	990.8	1,206.7	831.0	1,147.1	1,412.5	955.0
1998	875.8	1,064.6	732.7	854.7	1,038.5	715.1	984.3	1,209.9	818.4	1,135.7	1,410.6	938.2
1997	887.3	1,090.5	736.3	864.9	1,062.5	718.3	1,003.9	1,248.9	825.4	1,151.5	1,446.7	940.7
1996	902.4	1,117.5	742.8	877.6	1,086.1	723.3	1,034.9	1,300.6	840.8	1,188.7	1,513.9	956.3
1995	918.5	1,150.3	748.2	890.0	1,112.7	726.6	1,080.5	1,381.1	864.7	1,224.5	1,582.3	970.1
1994	920.2	1,160.9	745.0	891.6	1,123.4	723.5	1,081.3	1,388.3	860.5	1,224.6	1,589.8	965.0
1993	931.5	1,181.8	751.0	902.0	1,143.0	728.9	1,103.3	1,423.3	874.3	1,247.2	1,629.3	977.7
1992	910.9	1,161.2	731.2	882.9	1,125.6	709.5	1,074.5	1,383.1	852.6	1,216.9	1,591.4	954.4
1991	925.5	1,182.6	741.6	897.0	1,146.4	719.8	1,096.6	1,411.8	867.6	1,237.9	1,622.0	968.0
1990	938.7	1,202.8	750.9	909.8	1,165.9	728.8	1,116.3	1,443.4	881.5	1,250.3	1,644.5	975.1
1989	950.5	1,215.0	761.8	920.2	1,176.6	738.8	1,141.9	1,471.0	903.4	1,275.5	1,670.1	998.1
1988	975.7	1,250.7	781.0	947.6	1,215.9	759.1	1,152.1	1,483.8	912.8	1,284.3	1,677.6	1,006.8
1987	970.0	1,246.1	774.2	943.4	1,213.4	753.3	1,138.9	1,467.7	900.4	1,263.1	1,650.3	989.7
1986	978.6	1,261.7	778.7	952.8	1,230.5	758.1	1,146.1	1,475.4	906.9	1,266.7	1,650.1	994.4
1985	988.1	1,278.1	784.5	963.6	1,249.8	764.3	1,147.7	1,472.2	912.0	1,261.2	1,634.5	994.4
1984	982.5	1,271.4	779.8	959.7	1,245.9	760.7	1,129.9	1,447.3	898.4	1,236.7	1,600.8	976.9
1983	990.0	1,284.5	783.3	967.3	1,259.4	763.9	1,137.7	1,453.5	904.8	1,240.5	1,600.7	980.7
1982	985.0	1,279.9	776.6	963.6	1,255.9	758.7	1,124.1	1,442.6	886.5	1,221.3	1,580.4	960.1
1981	1,007.1	1,308.2	792.7	984.0	1,282.2	773.6	1,159.6	1,487.7	914.6	1,258.4	1,626.6	986.6
1980	1,039.1	1,348.1	817.9	1,012.7	1,317.6	796.1	1,222.6	1,569.4	963.6	1,314.8	1,697.8	1,033.3
1979	1,010.9	1,316.6	790.2	987.0	1,289.6	770.2	1,171.8	1,507.7	919.6	1,241.6	1,604.5	969.2
1978	1,043.7	1,358.1	816.4	1,020.1	1,332.5	796.6	1,202.4	1,539.6	946.0	1,267.7	1,626.9	995.1
1977	1,051.6	1,369.3	820.7	1,027.1	1,343.5	799.7	1,219.6	1,554.9	960.6	1,286.0	1,647.9	1,012.2
1976	1,084.1	1,404.3	849.4	1,060.0	1,379.5	828.9	1,245.1	1,582.0	982.3	1,311.2	1,676.0	1,031.2
1975	1,094.4	1,417.4	855.1	1,069.4	1,391.1	834.1	1,264.9	1,606.8	993.2	1,327.5	1,697.0	1,042.4
1974	1,151.8	1,478.5	907.5	1,125.2	1,450.8	884.2	1,334.0	1,677.9	1,061.7	1,397.7	1,769.5	1,109.7
1973	1,201.2	1,537.5	947.8	1,171.5	1,507.2	921.4	1,409.8	1,757.5	1,132.4	1,473.3	1,849.5	1,179.7
1972 ¹	1,214.8	1,551.1	958.7	1,185.3	1,520.2	932.9	1,421.1	1,777.3	1,134.5	1,486.3	1,871.8	1,181.2
1971	1,213.1	1,542.5	960.6	1,183.8	1,514.4	933.4	1,419.3	1,746.5	1,150.6	1,481.3	1,836.1	1,196.8
1970	1,222.6	1,542.1	971.4	1,193.3	1,513.7	944.0	1,434.6	1,754.5	1,166.5	1,518.1	1,873.9	1,228.7
1969	1,271.8	1,601.4	1,013.4	1,240.2	1,570.4	984.2	1,502.7	1,838.3	1,222.1	1,570.4	1,934.4	1,274.9
1968	1,304.5	1,635.2	1,043.5	1,271.4	1,602.7	1,012.2	1,553.4	1,884.7	1,277.2	1,615.6	1,976.8	1,325.6
1967	1,274.0	1,591.8	1,020.5	1,246.4	1,566.9	992.9	1,466.9	1,767.2	1,209.7	1,520.6	1,843.5	1,252.1
1966	1,309.0	1,624.2	1,055.3	1,278.7	1,595.7	1,024.7	1,529.7	1,832.4	1,274.6	1,582.7	1,902.9	1,316.7
1965	1,306.5	1,614.3	1,056.1	1,278.3	1,589.9	1,026.7	1,508.9	1,791.0	1,266.0	1,556.2	1,859.4	1,303.2
1964	1,303.8	1,597.0	1,061.5	1,275.2	1,572.0	1,030.9	1,507.1	1,768.1	1,284.1	1,559.6	1,848.0	1,317.3
1963 ²	1,346.3	1,644.0	1,098.5	1,312.5	1,614.7	1,062.6	1,581.5	1,859.0	1,347.8	---	---	---
1962 ²	1,323.6	1,604.4	1,087.1	1,292.4	1,579.1	1,052.6	1,532.0	1,775.4	1,324.5	---	---	---
1961	1,298.8	1,567.6	1,068.5	1,272.2	1,547.3	1,038.8	1,492.2	1,713.3	1,295.9	1,524.4	1,759.6	1,321.1
1960	1,339.2	1,609.0	1,105.3	1,311.3	1,586.0	1,074.4	1,549.0	1,777.6	1,340.5	1,577.5	1,811.1	1,369.7
1959	1,317.3	1,573.4	1,093.5	1,291.9	1,552.1	1,065.3	1,504.4	1,724.7	1,305.0	---	---	---
1958	1,343.4	1,596.3	1,120.9	1,316.3	1,573.1	1,090.8	1,552.1	1,779.2	1,354.6	---	---	---
1957	1,356.7	1,606.7	1,134.5	1,328.7	1,581.7	1,104.1	1,571.7	1,797.0	1,374.6	---	---	---
1956	1,333.7	1,575.5	1,117.5	1,309.0	1,554.4	1,089.9	1,519.2	1,724.1	1,331.9	---	---	---
1955	1,332.3	1,565.2	1,121.9	1,308.3	1,544.7	1,095.4	1,510.2	1,707.5	1,326.7	---	---	---
1954	1,314.8	1,540.7	1,109.7	1,288.6	1,516.3	1,081.8	1,514.8	1,726.6	1,326.3	---	---	---
1953	1,385.6	1,619.0	1,172.6	1,354.6	1,589.0	1,141.0	1,641.2	1,863.1	1,434.3	---	---	---
1952	1,394.6	1,620.8	1,186.7	1,361.7	1,588.5	1,153.3	1,671.3	1,894.1	1,465.0	---	---	---
1951	1,423.5	1,651.7	1,213.4	1,391.0	1,621.7	1,179.1	1,698.2	1,903.4	1,508.3	---	---	---
1950	1,446.0	1,674.2	1,236.0	1,410.8	1,642.5	1,198.0	1,757.6	1,949.5	1,574.1	---	---	---
1949	1,457.3	1,676.7	1,252.6	1,424.3	1,647.8	1,217.3	1,739.9	1,915.4	1,572.2	---	---	---
1948	1,501.7	1,720.5	1,296.4	1,469.9	1,691.2	1,263.7	1,766.9	1,954.3	1,580.0	---	---	---
1947	1,532.0	1,743.0	1,332.5	1,503.5	1,718.6	1,301.6	1,749.7	1,922.8	1,586.1	---	---	---
1946	1,529.7	1,727.6	1,342.8	1,505.0	1,706.1	1,315.2	1,711.7	1,878.6	1,556.8	---	---	---
1945	1,575.4	1,791.6	1,376.8	1,544.3	1,761.6	1,344.7	1,808.8	2,002.7	1,634.8	---	---	---
1944	1,618.5	1,821.6	1,428.4	1,582.8	1,788.0	1,391.1	1,904.5	2,084.9	1,733.6	---	---	---
1943	1,702.4	1,907.7	1,507.8	1,665.8	1,872.9	1,469.1	2,006.9	2,189.9	1,837.6	---	---	---
1942	1,635.8	1,835.1	1,444.7	1,594.8	1,793.7	1,403.6	1,988.9	2,187.8	1,803.7	---	---	---
1941	1,694.6	1,894.3	1,502.4	1,645.0	1,844.1	1,453.2	2,142.8	2,351.1	1,945.9	---	---	---
1940	1,785.0	1,976.0	1,599.4	1,735.3	1,925.2	1,550.4	2,254.1	2,458.9	2,057.5	---	---	---
1939	1,766.9	1,937.2	1,599.8	1,724.0	1,894.4	1,556.8	2,157.0	2,328.1	1,992.4	---	---	---

See footnotes at end of table.

Table 1. Age-adjusted death rates by race and sex using year 2000 standard population: Death-registration States, 1900–32 and United States, 1933–99—Con.

[Based on age-specific death rates per 100,000 population in specified group. Computed by the direct method, using as the standard population the age distribution of the total population of the United States as projected for 2000]

Year	All races						All other races					
	All races			White			Total			Black		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
1938	1,764.3	1,932.4	1,599.1	1,714.8	1,882.7	1,549.4	2,217.2	2,384.3	2,057.1	---	---	---
1937	1,882.6	2,072.8	1,695.1	1,829.1	2,016.5	1,644.3	2,374.0	2,596.1	2,158.5	---	---	---
1936	1,963.7	2,148.5	1,780.6	1,906.6	2,087.0	1,727.4	2,496.6	2,722.4	2,278.7	---	---	---
1935	1,860.1	2,031.2	1,690.6	1,809.9	1,979.3	1,642.0	2,316.0	2,502.9	2,136.5	---	---	---
1934	1,888.2	2,056.7	1,720.7	1,834.0	2,000.7	1,668.1	2,386.5	2,567.5	2,213.4	---	---	---
1933	1,850.1	2,002.0	1,699.1	1,800.5	1,952.2	1,649.4	2,307.9	2,452.1	2,174.1	---	---	---
1932	1,897.1	2,036.4	1,758.4	1,845.1	1,982.9	1,707.3	2,397.3	2,550.0	2,256.1	---	---	---
1931	1,895.1	2,047.4	1,743.6	1,832.5	1,983.6	1,681.8	2,516.0	2,680.3	2,362.8	---	---	---
1930	1,943.8	2,088.8	1,798.3	1,870.7	2,013.8	1,726.6	2,682.9	2,845.5	2,530.1	---	---	---
1929	2,081.2	2,219.7	1,940.9	2,006.8	2,141.2	1,869.9	2,832.6	3,012.6	2,664.8	---	---	---
1928	2,124.6	2,256.3	1,990.5	2,053.0	2,182.8	1,920.2	2,835.5	2,980.3	2,703.1	---	---	---
1927	1,989.5	2,113.8	1,863.8	1,925.6	2,048.6	1,800.4	2,676.2	2,801.1	2,565.5	---	---	---
1926	2,146.2	2,262.2	2,028.0	2,078.8	2,190.6	1,963.8	2,906.0	3,054.7	2,778.0	---	---	---
1925	2,068.7	2,178.0	1,957.1	1,999.1	2,104.4	1,890.5	2,858.7	3,000.7	2,741.9	---	---	---
1924	2,038.0	2,146.9	1,927.2	1,968.7	2,073.7	1,860.6	2,806.5	2,947.0	2,693.2	---	---	---
1923	2,141.4	2,229.5	2,050.5	2,087.0	2,174.2	1,995.9	2,717.8	2,803.9	2,657.8	---	---	---
1922	2,049.5	2,131.8	1,965.1	2,004.4	2,088.2	1,917.7	2,507.8	2,560.4	2,476.1	---	---	---
1921	1,958.2	2,025.0	1,890.4	1,914.9	1,986.2	1,842.3	2,459.8	2,461.2	2,475.0	---	---	---
1920	2,147.1	2,213.2	2,081.3	2,096.3	2,166.6	2,025.9	2,743.3	2,748.4	2,756.2	---	---	---
1919	2,057.2	2,141.5	1,973.1	2,005.6	2,096.0	1,915.1	2,648.5	2,650.0	2,663.2	---	---	---
1918	2,541.6	2,740.5	2,342.8	2,477.7	2,680.7	2,274.9	3,411.9	3,532.5	3,304.3	---	---	---
1917	2,275.9	2,427.8	2,119.9	2,221.5	2,375.9	2,063.3	3,069.6	3,172.8	2,970.6	---	---	---
1916	2,266.6	2,406.2	2,123.3	2,223.9	2,365.6	2,078.3	2,940.3	3,035.1	2,853.6	---	---	---
1915	2,174.8	2,302.6	2,044.3	2,139.4	2,267.8	2,008.4	3,021.8	3,104.1	2,948.8	---	---	---
1914	2,149.3	2,286.1	2,009.0	2,116.8	2,254.1	1,976.1	2,914.6	3,017.4	2,810.1	---	---	---
1913	2,206.5	2,351.2	2,058.1	2,176.7	2,322.1	2,027.6	2,906.6	3,011.9	2,802.7	---	---	---
1912	2,211.7	2,352.8	2,067.2	2,187.9	2,327.5	2,045.1	2,959.2	3,114.2	2,807.7	---	---	---
1911	2,245.4	2,374.5	2,112.1	2,221.3	2,350.3	2,088.3	3,000.6	3,094.2	2,899.8	---	---	---
1910	2,317.2	2,459.9	2,171.3	2,299.4	2,441.9	2,154.0	2,983.5	3,087.5	2,875.3	---	---	---
1909	2,249.2	2,385.7	2,111.5	2,228.5	2,363.8	2,092.1	3,006.9	3,149.0	2,875.6	---	---	---
1908	2,298.9	2,433.4	2,162.3	2,278.1	2,412.3	2,141.8	3,048.2	3,140.0	2,963.6	---	---	---
1907	2,494.4	2,660.3	2,327.3	2,470.8	2,637.0	2,303.8	3,295.1	3,408.1	3,179.3	---	---	---
1906	2,399.0	2,553.6	2,244.6	2,374.8	2,529.3	2,220.8	3,223.4	3,341.0	3,115.4	---	---	---
1905	2,423.7	2,565.5	2,287.7	2,404.1	2,544.7	2,269.0	3,440.1	3,654.7	3,247.5	---	---	---
1904	2,502.5	2,652.9	2,358.8	2,481.9	2,630.5	2,339.7	3,586.2	3,845.7	3,362.4	---	---	---
1903	2,379.0	2,513.5	2,250.6	2,359.8	2,494.2	2,231.5	3,373.7	3,546.5	3,210.9	---	---	---
1902	2,301.3	2,447.9	2,162.8	2,284.3	2,430.1	2,146.4	3,190.4	3,399.8	3,003.4	---	---	---
1901	2,473.1	2,600.5	2,350.5	2,456.2	2,582.3	2,334.7	3,338.4	3,524.8	3,167.2	---	---	---
1900	2,518.0	2,630.8	2,410.4	2,501.2	2,613.2	2,394.0	3,423.3	3,576.5	3,308.0	---	---	---

--- Data not available.

¹Based upon a 50-percent sample.²Figures by race exclude data for residents of New Jersey.

NOTE: See Technical notes to see when each State was admitted to the death-registration area.

SOURCE: CDC/National Center for Health Statistics, National Vital Statistics System, Mortality.

Technical notes

Nature and sources of data

Data shown in this report are based on information from all death certificates filed in the death-registration area, which after 1932 comprised all the States and the District of Columbia (table I). The State death certificates conform closely to the U.S. Standard Certificate of Death, which is developed and revised periodically in a cooperative effort between NCHS and the States (4). Mortality statistics are based on information coded by the States and provided to NCHS through the Vital Statistics Cooperative Program and from copies of the original certificates received by NCHS from State registration offices (4,5). A history of the data system is available in a separate publication (6).

Race

A number of studies have been conducted on the reliability of race reported on the death certificate by comparing race on the death certificate with that reported on another data collection instrument, such as the census or a survey. Differences may arise because of differences in who provides race information on the compared records. Race information on the death certificate is reported by the funeral director as provided by an informant or in the absence of an informant, on the basis of observation. In contrast, race on the census or on the Current Population Survey is obtained while the individual is alive and is self-reported or reported by another member of the household familiar with the individual and, therefore, may be considered more valid. A high level of agreement between the death certificate and the census or survey report is essential to assure unbiased death rates by race.

Studies (7,8) show that a person self-reported as American Indian or Asian on census or survey records was sometimes reported as white on the death certificate. The net effect of misclassification is an underestimation of deaths and death rates for races other than white and black. In addition, undercoverage of minority groups in the census and resultant population estimates, introduces biases into death rates by race (4,9,10). Estimates of the approximate effect of the combined bias due to race misclassification on death certificates and underenumeration on the 1990 census are as follows: white, -1.0 percent; black, -5.0; American Indian, +20.6; Asian or Pacific Islander, +10.7 (9).

Population bases for computing rates

The population used for computing death rates shown in this report (furnished by the U.S. Bureau of the Census) represents the population residing in the specified area. Death rates for 1999 are based on population estimates as of July 1, 1999 (11). The estimates are based on the 1990 census level counts. Decennial year populations use the enumerated population as of April 1 while populations are estimates as of July 1 for noncensus years. The populations are available on the NCHS Web site at <http://www.cdc.gov/nchs>.

Computation of age-adjusted death rates

The age-adjusted death rates in this report were computed by the direct method, that is, by applying the age-specific death rates to the U.S. standard population (relative age distribution of the 2000

population of the United States). See separate report for details on methodology (3). The formula for an age-adjusted death rate is as follows:

$$AADR = \sum_i w_{si} \cdot R_i$$

where

w_{si} = standard weights representing the relative age distribution of the standard population

R_i = age-specific death rate usually expressed per 1,000 or 100,000 population

Random variation

Although the mortality data in this report (except data for 1972) are not subject to sampling error, they may be affected by random variation in the number of deaths involved. When the number of events is small (perhaps less than 100) and the probability of such an event is small, considerable caution must be observed in interpreting the data. Such infrequent events may be assumed to follow a Poisson probability distribution. For this distribution, a simple approximation may be used to estimate the confidence interval (4). Additional information on random variation may be found in the Technical Appendix of *Vital Statistics of the United States*, Volume II (4).

Rates, proportions, and ratios

An asterisk is shown in place of a rate based on fewer than 20 deaths. These rates have a relative standard error of 23 percent or more and are, therefore, considered statistically unreliable. For age-adjusted death rates, this criterion is applied to the sum of the age-specific deaths.

Table I. Year in which each State was admitted to the death-registration area

Year	State	Year	State	Year	State
1880	Massachusetts	1908	Washington	1919	Florida
	New Jersey		Wisconsin		Mississippi
	District of Columbia ¹	1909	Ohio	1920	Nebraska
1890	Connecticut	1910	Minnesota	1922	Georgia ⁴
	Delaware ²		Montana		Idaho
	New Hampshire		Utah		Wyoming
	New York	1911	Kentucky	1923	Iowa
	Rhode Island		Missouri	1924	North Dakota
	Vermont	1913	Virginia	1925	Alabama
1900	Maine	1914	Kansas		West Virginia
	Michigan	1916	South Carolina	1926	Arizona
	Indiana		North Carolina	1927	Arkansas
1906	California	1917	Tennessee	1928	Oklahoma
	Colorado	1918	Illinois	1929	Nevada
	Maryland		Louisiana		New Mexico
	Pennsylvania		Oregon	1933	Texas
	South Dakota ³				

¹Included in States.

²Dropped from the registration area in 1900; re-admitted in 1919.

³Dropped from the registration area in 1910; re-admitted in 1930.

⁴Dropped from the registration area in 1925; re-admitted in 1928.

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National Center for Health Statistics

Director, Edward J. Sondik, Ph.D.
Deputy Director, Jack R. Anderson

Division of Vital Statistics

Director, Mary Anne Freedman

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**DEPARTMENT OF
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Centers for Disease Control and Prevention
National Center for Health Statistics
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