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Achievements in Public Health, 1900-1999: Decline in Deaths from Heart Disease and Stroke -- United States, 1900-1999

Heart disease has been the leading cause of death in the United States since 1921, and stroke has been the third leading cause since 1938 (1); together they account for approximately 40% of all deaths. Since 1950, age-adjusted death rates from cardiovascular disease (CVD) have declined 60%, representing one of the most important public health achievements of the 20th century. This report summarizes the temporal trends in CVD, advances in the understanding of risk factors for CVD, development of prevention interventions to reduce these risks, and improvements in therapy for persons who develop CVD.

Decline in CVD Death Rates

Age-adjusted death rates per 100,000 persons (standardized to the 1940 U.S. population) for diseases of the heart (i.e., coronary heart disease, hypertensive heart disease, and rheumatic heart disease) have decreased from a peak of 307.4 in 1950 to 134.6 in 1996, an overall decline of 56% (1) ([Figure 1](#)). Age-adjusted death rates for coronary heart disease (the major form of CVD contributing to mortality) continued to increase into the 1960s, then declined. In 1996, 621,000 fewer deaths occurred from coronary heart disease than would have been expected had the rate remained at its 1963 peak (1).

Age-adjusted death rates for stroke have declined steadily since the beginning of the century. Since 1950, stroke rates have declined 70%, from 88.8 in 1950 to 26.5 in 1996. Total age-adjusted CVD death rates have declined 60% since 1950 and accounted for approximately 73% of the decline in all causes of deaths during the same period (1).

Disease Epidemiology

Intensive investigation into the CVD epidemic largely began in the 1940s following World War II, although causal hypotheses about CVD and recognition of geographic differences in disease rates occurred earlier (2-4). Landmark epidemiologic investigations, including the cross-country comparisons of Ancel Keys (5) ([see box](#)) and the Framingham Heart Study (6), established the major risk factors of high blood cholesterol, high blood pressure, and smoking and dietary factors (particularly dietary cholesterol, fat, and sodium). The risk factor concept--that particular biologic, lifestyle, and social conditions were associated with increased risk for disease--developed out of CVD epidemiology (3,4). In addition to the major risk factors (i.e., high blood pressure, high blood cholesterol, and smoking), other important factors include socioeconomic status, obesity, and physical inactivity (7). Striking regional differences were noted particularly for stroke mortality, with the highest rates observed in the southeastern United States (1). Cross-national and cross-cultural studies highlighted the importance of social, cultural, and environmental factors in the development of CVD.

Coronary heart disease and stroke, the two major causes of CVD-related mortality, are not influenced to the same degree by the recognized risk factors. For example, elevated blood cholesterol is a major risk factor for coronary heart disease, and hypertension is the major risk factor for stroke. Physical activity, smoking cessation, and a healthy diet, which can lower the risk for heart disease, also can help lower the risk for stroke (8).

Advances in Prevention

Early intervention studies in the 1960s sought to establish whether lowering risk factor levels would reduce risk for CVD (2-4). During the 1970s and 1980s, along with numerous clinical trials demonstrating the efficacy of antihypertensive and lipid-lowering drugs, community trials sought to reduce risk at the community level (9). Public health interventions to reduce CVD have benefitted from a combination of the "high risk" approach--aimed at persons with increased risk for CVD--and the population-wide approach--aimed at lowering risk for the entire community (10). National programs that combine these complementary approaches and that are aimed at health-care providers, patients, and the general public include the National High Blood Pressure Education Program (11), initiated in 1972, and the

National Cholesterol Education Program, initiated in 1985 (12). Although earlier CDC community demonstration projects focused on cardiovascular health (9), CDC established its National Center for Chronic Disease Prevention and Health Promotion in 1989, with a high priority of promoting cardiovascular health.

Factors Contributing to the Decline in CVD Deaths

Reasons for the declines in heart disease and stroke may vary by period and across region or socioeconomic groups (e.g., age, sex, and racial/ethnic groups). Prevention efforts and improvements in early detection, treatment, and care have resulted in a number of beneficial trends (Table 1), which may have contributed to declines in heart disease and stroke. These trends include

- a decline in cigarette smoking among adults aged greater than or equal to 18 years from approximately 42% in 1955 (13). Substantial public health efforts to reduce tobacco use began soon after recognition of the association between smoking and CVD and between smoking and cancer and the first Surgeon General's report on smoking and health published in 1964.
- a decrease in mean blood pressure levels in the U.S. population (11,13,14).
- an increase in the percentage of persons with hypertension who have the condition treated and controlled (11,13,14).
- a decrease in mean blood cholesterol levels (12-14).
- changes in the U.S. diet. Data based on surveys of food supply suggest that consumption of saturated fat and cholesterol has decreased since 1909 (15). Data from the National Health and Nutrition Examination surveys suggest that decreases in the percentage of calories from dietary fat and the levels of dietary cholesterol coincide with decreases in blood cholesterol levels (16).
- improvements in medical care, including advances in diagnosing and treating heart disease and stroke, development of effective medications for treatment of hypertension and hypercholesterolemia, greater numbers of specialists and health-care providers focusing on CVD, an increase in emergency medical services for heart attack and stroke, and an increase in coronary-care units (13,17). These developments have contributed to lower case-fatality rates, lengthened survival times, and shorter hospital stays for persons with CVD (1,17).

Challenges for the 21st Century

Despite remarkable progress, heart disease and stroke remain leading causes of disability and death. Estimated costs for morbidity and mortality from CVD, including health expenditures and lost productivity, are expected to be \$286.5 billion in 1999 (18). In addition, the overall declines in heart disease and stroke mortality mask important differences in rates of decline by race/ethnicity, sex, socioeconomic status, and geographic region. During 1985-1996, for example, heart disease age-adjusted mortality declined 29% among white men, but only 10% among American Indian/Alaskan Native women (13). Persons of lower socioeconomic status have higher mortality, morbidity, and risk factor levels for heart disease and stroke than persons of higher socioeconomic status (13,19). In addition, the social class gap in heart disease deaths may be increasing as the rates of heart disease decline faster among higher social classes (19). Geographically, declines in heart disease deaths did not occur at the same time for all communities. Areas with poorer socioeconomic profiles were more likely to experience a later onset of the decline of heart disease (19).

Public health programs at the state level for heart disease and stroke have been limited. In fiscal year 1999, through a new program, CDC funded 11 states with the highest CVD mortality rates to plan, develop, and implement state-based efforts for CVD prevention. In addition to activities such as surveillance, these programs will emphasize policy and environmental interventions, both social and physical, aimed at sustaining positive health behavior change.

Although many trends have been positive, trends for some important indicators have not improved substantially, have leveled off, or are reversing. For example, approximately 70% of persons with hypertension do not have the condition controlled at levels below 140/90 mm Hg, and death rates for stroke have not declined in recent years (1,11,13). Heart failure has emerged as a health concern for older adults (20), and adults who survive a myocardial infarction or other hypertension-related diseases remain at increased risk for heart failure. In addition, the prevalence of obesity has increased among both children and adults in the United States (13).

Major public health challenges for the 21st century include

- reducing risk factor levels and preventing the development of adverse risk factors. Continued research is needed

to understand the determinants (social, psychological, environmental, physiologic, and genetic) of CVD risk factors.

- reducing the racial/ethnic disparities in heart disease and stroke mortality.
- increasing the ability to reach underserved groups with appropriate and effective public health messages.
- promoting policy and environmental strategies that enhance healthy behavior.
- determining the relation between genetics and disease. The associations of genetic variants with CVD, and especially the interplay between genetic and environmental factors, may play increasingly important roles in the nation's efforts to prevent CVD.
- identifying new or emerging risk factors and determining their potential for public health intervention. New or emerging risk factors that have been associated with CVD include elevated levels of total homocyst(e)ine, fibrinogen, and C-reactive protein, and infectious agents such as *Helicobacter pylori* and *Chlamydia pneumoniae*.
- focusing on secondary prevention and disability. An aging U.S. population and an increasing number of persons surviving life-threatening cardiovascular conditions requires public health programs to focus on issues such as disability and quality of life. Persons with existing cardiovascular conditions are at increased risk for future life-threatening events related to those conditions.
- addressing the needs of the global community. Although CVD death rates are higher in developed nations, most cases occur in developing nations (8). Developing countries may face a double burden of infectious and chronic diseases. International collaboration to improve cardiovascular health (9) will need to continue to reduce the burden of CVD worldwide.

Reported by: Cardiovascular Health Br, Div of Adult and Community Health, National Center for Chronic Disease Prevention and Health Promotion, CDC.

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Table 1

Note: To print large tables and graphs users may have to change their printer settings to landscape and use a small font size.

TABLE 1. Estimated change in risk factors and correlates for heart disease and stroke, by selected characteristics -- United States

Characteristic	Baseline year	Baseline estimate	Follow-up year	Follow-up estimate
Adults aged 20-74 years with hypertension*+	1960-1962	37%	1988-1994	23%
Persons with hypertension who are taking action to control their blood pressure (e.g., medication, diet, reducing salt intake, and exercise)	1985	79%	1990	90%
Persons with hypertension whose blood pressure is controlled	1976-1980	11%	1988-1991	29%
Adults aged 20-74 years with high blood cholesterol+&	1960-1962	32%	1988-1994	19%
Mean serum cholesterol levels mg/dL of adults aged >=18 years+	1960-1962	220	1988-1994	203
Adults aged >=18 years who are current smokers+	1965	42%	1995	25%
Persons who are overweight+@	1960-1962	24%	1988-1994	35%
Percentage of calories in the diet from fat**	1976-1980	36%	1988-1994	34%
Percentage of calories in the diet from saturated fat**	1976-1980	13%	1988-1994	12%
Number of physicians indicating cardiovascular diseases as their primary area of practice	1975	5,046	1996	14,304

* Systolic pressure >=140 mm Hg, diastolic pressure >=90 mm Hg, or taking antihypertensive medication.

+ Estimate is age-adjusted to the 1940 U.S. population.

& Serum cholesterol level >=240 mg/dL (6.2 mmol/L).

@ Defined as a body mass index >=27.8 kg/m² among men and 27.2 kg/m² among women.

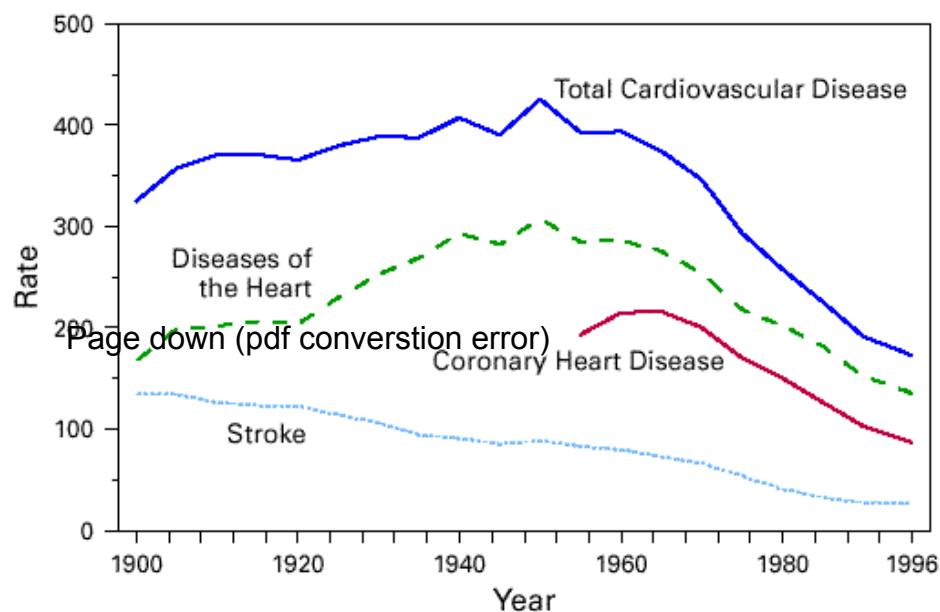
** Based on 1-day dietary recall.

Source: References 11-14.

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Figure 1

FIGURE 1. Age-adjusted death rates* for total cardiovascular disease, diseases of the heart, coronary heart disease, and stroke,† by year — United States, 1900–1996



*Per 100,000 population, standardized to the 1940 U.S. population.

†Diseases are classified according to *International Classification of Diseases* (ICD) codes in use when the deaths were reported. ICD classification revisions occurred in 1910, 1921, 1930, 1939, 1949, 1958, 1968, and 1979. Death rates before 1933 do not include all states. Comparability ratios were applied to rates for 1970 and 1975.

Source: Adapted from reference 1; data provided by the National Heart, Lung and Blood Institute, National Institutes of Health.

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