
1889 to 1989: a Century of Health and Disease

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Synopsis

This article traces some of the most important

changes in demographics, health, and disease in the United States since 1889.

The nation has grown, urbanized, and aged. Life expectancy has increased dramatically. Major health problems have shifted from communicable diseases to those resulting from environmental and behavioral influences.

The Commissioned Corps of the Public Health Service, a uniformed cadre of professionals in all the fields of public health, was formed in 1889 and has played an important role in the health progress of the past century. It promises to play just as significant a role in the future.

AT THE BEGINNING OF 1889, there were only 38 States in the Union. During the year, North Dakota, South Dakota, Montana, and Washington were added, bringing the total to 42. In early March, Benjamin Harrison was inaugurated President even though he had lost the popular vote to Grover Cleveland. The Oklahoma Territory was opened to settlers and in the great land rush the name "Sooners" was used to describe those who had gotten in a little early. The total population of the United States was just under 63 million (1), compared with the current 241 million (2).

Several notable figures were born in 1889, including Charles Chaplin, Jean Cocteau, Adolph Hitler, George S. Kaufman, and Arnold Toynbee. 1889 was also the year in which the Wall Street Journal began publishing; George Eastman developed roll film; the safety bicycle was introduced into the United States; and electric lights were installed in the White House.

Parenthetically, neither President Harrison nor his wife would touch the switches, so an employee had to turn the lights on in the evening and they remained on until morning, when another employee would come around and turn them off.

Aunt Jemima pancake flour was invented—the first self-rising flour and the first ready-mix food produced for consumers. In England, Jerome K. Jerome wrote "Three Men in a Boat," arguably the funniest book ever written, and in the United States, Mark Twain wrote "A Connecticut Yankee in King Arthur's Court."

Government was much smaller in 1889 and actually made a profit (2, 3). There was a budget surplus that

year of \$88 million! It is of some interest that the majority of Federal revenues (90 percent) came from excise taxes on alcohol and tobacco, whereas now these provide only a small portion of Federal income (6 percent in 1987).

London's Savoy Hotel opened, the first British hotel to have private baths. The French Panama Canal Company went bankrupt after spending more than \$250 million and losing in excess of 20,000 workers to disease. The dam on Conemaugh Lake, Pennsylvania, the largest volume reservoir in the United States, gave way. A wall of water one-half mile wide and 40 feet high swept through the Johnstown valley, killing between 2,000 and 5,000 people. John L. Sullivan defeated Jake Kilrain in the last major bare-knuckle prize fight. They fought 75 rounds for 2 hours and 16 minutes in the 106-degree heat of Richburg, MS.

The Picture of Health

The nation's public health infrastructure was somewhat primitive. Although the decennial census began in 1790, it was not until 1880 that a Federal registration area was established for deaths. This included Massachusetts, New Jersey, the District of Columbia, and several cities and contained, in total, approximately 17 percent of the population. In 1900, annual reports of vital statistics were first reported from the death registration States, which by then totaled 10 States and the District of Columbia, containing some 23 percent of the population. Vital statistics data covering the entire country were not available until 1933 (4). Data in this

paper from before 1933 represent only the portion of the country participating in the death registration area.

With regard to morbidity data, in 1876 Massachusetts established statewide voluntary reporting of contagious diseases. In that year, only eight States had State health departments. Although many towns and cities had health officers, county health departments did not appear until 1908. Statewide reporting of contagious diseases was first made mandatory in 1883 in Michigan; Massachusetts followed suit in 1884, and by 1900 32 States required notification of contagious diseases (5).

Yellow fever was perceived as a critical public health problem. In the January 5, 1889, issue of the *Journal of the American Medical Association (JAMA)*, there was an article describing the portion of the Annual Report to Congress of the Secretary of the Treasury which dealt with the Marine-Hospital Service, the forerunner of the Public Health Service (6). In part, it said, "The history of the calamitous epidemic of yellow fever in Florida is included in this report, and it gives me pleasure to state that the officers of the Marine Hospital Service have performed the delicate duties intrusted (sic) to them with courage, skill, and enthusiasm." Showing that some characteristics may not change in 100 years, the article also says that "The Surgeon-General recommends that an additional medical officer be detailed for his office."

The *New York Times* of March 28, 1889, carried a story about ports infected with yellow fever (7). There was a continuing national concern with yellow fever, which had appeared in major outbreaks during the preceding century and was mightily feared, even though by 1889 there was not a lot of yellow fever in the country. It should be remembered that 100 years ago the causative agent had not been identified, nor had it been established that this was a mosquito-borne disease. Some flavor of the 19th century fear of yellow fever can be seen in Duffy's comments:

"In 1856 lax enforcement of quarantine laws resulted in more than 500 cases of yellow fever on Staten Island and the western end of Long Island. The New York City quarantine station was located on Staten Island at this time, and outraged local residents barricaded all entrances to it. When the New York authorities responded in 1857 by buying a new site several miles away, an armed mob vandalized the buildings. The following summer, when additional yellow fever patients were landed, another mob burned the quarantine hospital to the ground. . ." (8).

Periodic outbreaks of yellow fever did serve to keep concerns high. An 1878 outbreak resulted in 27,000 cases and more than 4,000 deaths in New Orleans and wiped out almost 10 percent of the populations of Memphis and Vicksburg (8). An outbreak in Florida in

Figure 1. Percent distribution of households by number of persons, 1890 and 1980

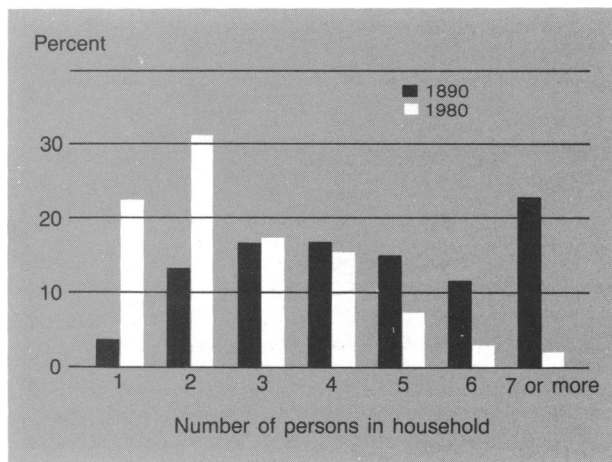
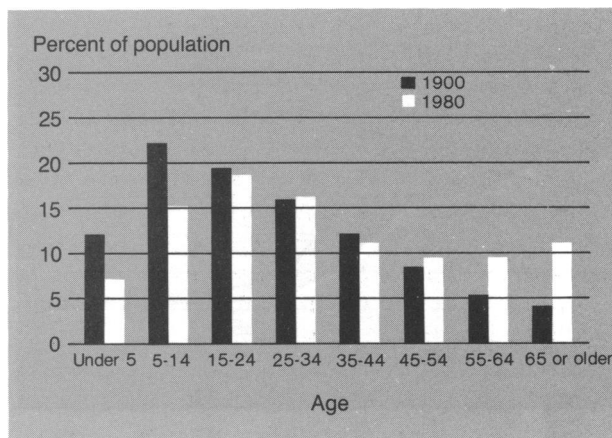


Figure 2. Percent of population in various age groups, 1900 and 1980



1888 led to the preparation of a special report by the Supervising Surgeon-General of the Marine Hospital Service. Many of the authors of the report were members of the Marine Hospital Service (9). Possibly as a result of this epidemic, Florida established a State Board of Health, eliciting the following comment in the March 23, 1889, issue of *JAMA* (10):

"The Florida State Board of Health is now, so far as the legislative act is concerned, a reality; it is thought that the Governor will soon appoint the members of the Board. We have not seen a copy of the act, and do not know its conditions and provisions. The Board is to consist of three members, who will select from the State at large a secretary and an executive or health officer, the latter to be a physician. Whether the emoluments of the officers will be sufficient to warrant them

Figure 3. U.S. infant mortality rates by race, at 10-year intervals, 1915-80

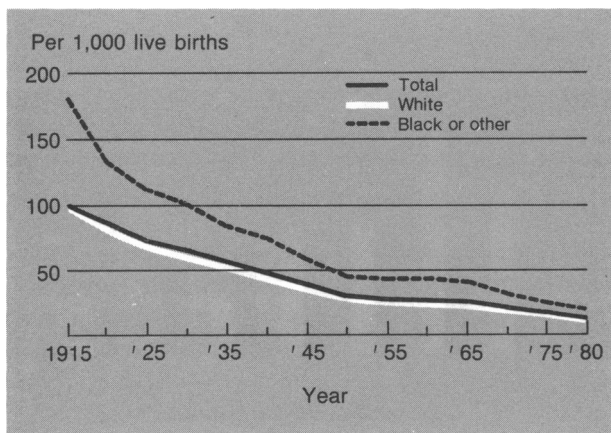
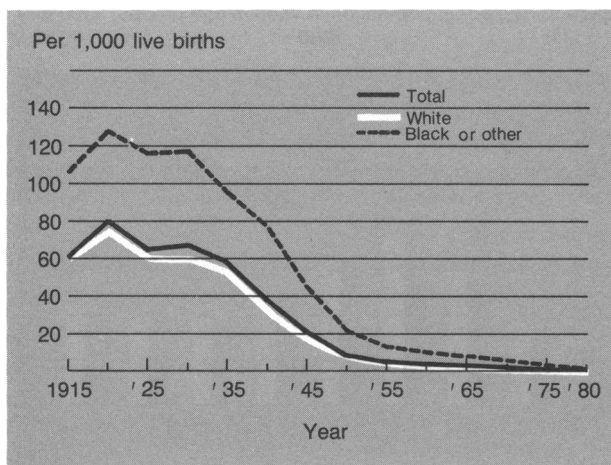


Figure 4. U.S. maternal mortality rates, by race at 10-year intervals, 1915-80



in giving the proper attention to their duties we do not know. As a general rule such is not the case. Governments cannot expect to have offices properly filled so long as private enterprise is allowed to outbid the public services. Yellow fever cost the State of Florida millions of dollars last summer; it can never recover that money, but by paying efficient men to look after its health it may avoid the loss of millions in the future."

Here is a 100-year-old article championing the cause of public health prevention and control and the need to compensate those involved. Another article in JAMA in 1889 quoted Dr. Henry Baker, Secretary of the Michigan State Board of Health, as follows (11):

"Dr. Baker pointed out how lives and money can be saved in a locality by the appointment of a health officer, if the people and the health officer cooperate for the restriction and prevention of scarlet fever, typhoid fever, diphtheria, and so on. He showed how at

least one physician in a village or small city can be employed to prevent instead of cure disease, with pecuniary profit to the people and at least a salary to the physician of not less than one thousand dollars a year."

A somewhat defensive attitude towards public health was put forth by John Billings, Curator of the Army Medical Museum and Library, writing in Pepper's 1894 "Textbook of the Theory and Practice of Medicine" (12).

"Instruction in hygiene for the medical student has, until recently, been considered as theoretically desirable (sic), but practically unessential. To the student entering on his course of medical study the question may arise, 'Why should a physician be compelled to learn how to prevent disease?' From the business point of view he is to support himself and his family by treating the sick: why, then, should he try to prevent the occurrence of sickness and thus lessen the chance for his employment?"

Fortunately for preventionists, Billings answers his own rhetorical questions. It is interesting that the first answer he gives is that "from the business point of view the man who has studied modern hygiene is more apt to obtain and retain employment as a practitioner than one who has not. . ." The second answer is that "it is the duty of the physician to prevent disease whenever and wherever he can. . ."

There were other health-related events in 1889 (2, 13, 14).

A worldwide pandemic of influenza began; in 2 years it would affect approximately 40 percent of the world's population.

The diphtheria bacillus was shown to produce a toxin.

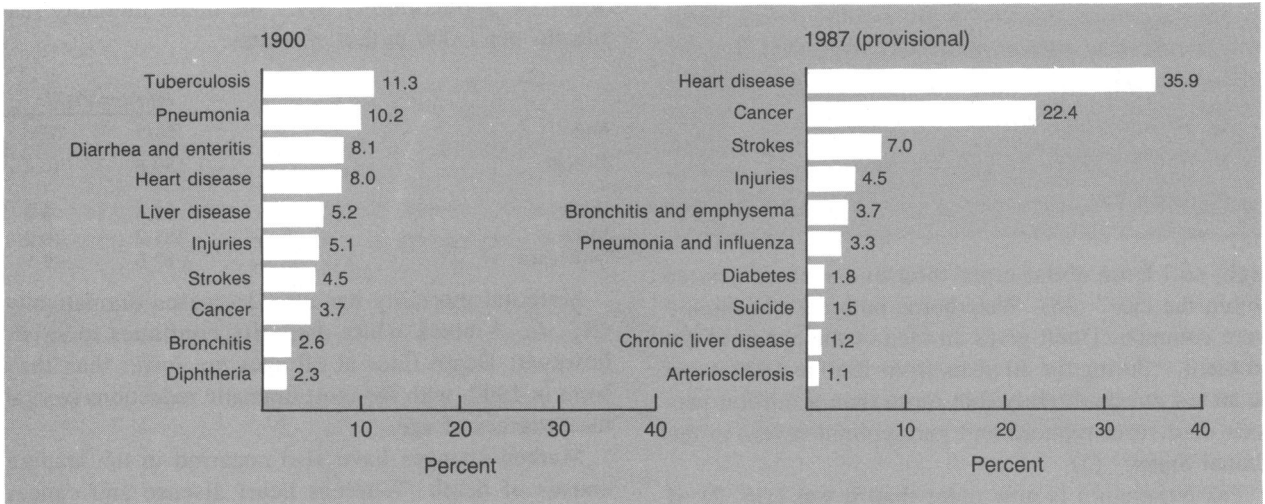
The Mayo Clinic had its beginnings. St. Mary's Hospital was opened in Rochester, MN, by the Sisters of St. Francis. The medical staff consisted of William Worrall Mayo and his two sons, William James Mayo and Charles Horace Mayo.

A pure food law was proposed in Congress but met with ridicule.

The Commissioned Corps of the Public Health Service was established by the Congress in "an Act to regulate appointments in the Marine-Hospital Service (15)."

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That medical officers of the Marine-Hospital Service of the United States shall hereafter be appointed by the President, by and with the advice and consent of the Senate; and no person shall be so appointed until after passing a satisfactory examination in the several branches of medicine, surgery, and hygiene before a board of medical officers of the said service. Said exam-

Figure 5. The 10 leading causes of death, as a percent of all deaths, U.S. 1900 and 1987



SOURCE: National Center for Health Statistics

ination shall be conducted according to rules prepared by the Supervising Surgeon-General, and approved by the Secretary of the Treasury and the President.

Sec. 2. That original appointments in the service shall only be made to the rank of assistant surgeon; and no officer shall be promoted to the rank of passed assistant surgeon until after four years' service and a second examination as aforesaid; and no passed assistant surgeon shall be promoted to be surgeon until after due examination: Provided, That nothing in this Act shall be so construed as to affect the rank or promotion of any officer originally appointed before the adoption of the regulations of eighteen hundred and seventy-nine; and the President is authorized to nominate for confirmation the officers in the service on the date of the passage of this Act.

The JAMA of January 12, 1889, carried information of changes of stations and duties of medical officers of the U.S. Marine-Hospital Service, for the 2 weeks ending December 22, 1888. This included the fact that the Supervising Surgeon-General (John B. Hamilton, who served from 1879 to 1891) was granted leave of absence for 60 days and that Assistant Surgeon C. M. Magruder, upon expiration of leave of absence, was to proceed to New Orleans, LA, for temporary duty (16).

It should be remembered that 1889 was less than 10 years after Koch's description of the etiology of tuberculosis and Pasteur's description of the prevention of rabies through the application of vaccine. It was in the middle of the exciting bacteriologic era when etiologic

agents were being discovered. It was, however, also before insect transmission of disease was established, before the concept of inapparent infection leading to immunity was developed, and before the significance of the apparently healthy carrier of disease was appreciated.

Health Changes, 1889–1989

Some of the data presented are from 1890 or 1900 or later, but they represent the earliest available. By the same token, some of the modern data presented reflect 1980, the year of the last census.

As already stated, the population of the country is now much larger and its distribution has changed. Whereas in 1890 the United States was predominantly rural, it is now an urban-suburban nation (17). There has been only a small increase in the rural population, while the urban population has increased more than sevenfold. Overall population density has increased substantially. Although Americans now tend to live in cities, households are much smaller than they were in 1890 (fig. 1). In 1890, more than a third of households contained six or more persons; in 1980 more than half of households contained only one or two persons.

Those who lived in cities were generally served by municipal water supplies, often drawing water from rivers and streams. Only 1.5 percent of the urban population was supplied with filtered water, and no one had chlorinated water until 1908. Municipal sewerage was not widespread. In fact, the Atlanta Constitution of March 28, 1889, carried an advertisement soliciting bids for "the collection, removal, and disposal of the

'Much of the health progress made in the past century has been the result of the conquest of infectious diseases, often by environmental means or through the use of simple preventive or therapeutic measures such as vaccines and antibiotics.'

night soil from about eight thousand surface privies within the city" (18). Waterborne outbreaks of disease were common. Doull gives an idea of the extent of the problem, "during the 40 years from 1880 to 1920 it can be stated conservatively that more than a million persons died from typhoid and paratyphoid fevers in the United States" (5).

The population is now older than it was (fig. 2), if not wiser. An increasing proportion of the population is now older than 65 years. Life expectancy at birth has increased by more than 25 years since 1900 (1, 17).

Life expectancy	Male	Female
At birth:		
1900	46.3 years	48.3
1986	71.3	78.3
Change	+ 25.0	+ 30.0
At age 40:		
1900	27.7	29.2
1986	34.5	40.2
Change	+ 6.8	+ 11.0

This amounts to a 2-day increase in life expectancy every week since the turn of the century. The increase in life expectancy at birth is largely due to the reductions in mortality from infectious diseases in infancy and childhood, and there have not been such dramatic increases in expectation of remaining life for those who survive to age 40.

All races have shared in the increases in life expectancy, and blacks have actually had a greater increase than whites—32 years versus 25 years for males and 40 years versus 30 years for females. In fact, the life expectancy at birth of a black female is now more than double what it was at the turn of the century. Nonetheless, blacks still have significantly shorter life expectancy at birth than whites.

Sex and race	Life expectancy		Difference
	1900	1987	
Male:			
White	46.6 years	72.1	+ 25.5
Black	32.5	65.4	+ 32.9
Difference	- 14.1	- 6.7	...
Female:			
White	48.7	78.8	+ 30.1
Black	33.5	73.8	+ 40.3
Difference	- 15.2	- 5.0	...

Infant mortality rates have declined more than 90 percent for both whites and blacks (fig. 3) but blacks still have approximately twice the infant mortality rate (deaths per 1,000 births) of whites.

Race	Infant mortality	
	1915	1986
Overall	99.6	10.4
White	98.6	8.9
Black	181.2	18.0
Difference	+ 82.6	+ 9.1

Maternal mortality has also decreased dramatically (fig. 4). A black-white disparity continues to exist, however. Death rates at all ages are lower than they were in 1900, with the most dramatic reductions seen at the extremes of age.

Marked changes have also occurred in the leading causes of death. Whereas heart disease and cancer accounted for less than 12 percent of all deaths in 1900, they now account for more than half. Infectious diseases headed the list of causes of death then and accounted for approximately one-quarter of all deaths; they now account for approximately 5 percent (fig. 5).

A technique has been developed for assessing the impact of disease by combining the death rate and the age at which death occurs. This technique assumes that any death that occurs before age 65 is a premature death. Looking at the current roster for the leading causes of years of potential life lost, there is a substantial rearrangement compared to overall causes of death (table 1) (19). Unintentional injuries now head the list and intentional injuries (homicide and suicide) occupy fourth place.

Somewhat surprisingly, the ratio of physicians to population has not changed dramatically. In fact, if one compares 1890 and 1970 (rather than 1980), there is an identical ratio of 166 per 100,000 (1, 20). Although the supply of physicians was comparable to the present situation, training was substantially different. In 1887, only 48 of the 92 medical schools in the country were affiliated with universities or academic colleges. Welch, Dean of the Johns Hopkins University School of Medicine, said that in about half of these "the academic connections are schools scarcely known beyond the boundaries of the States in which they are situated" (21). An accompanying editorial in JAMA said that "We hope the time will soon come when no person will be permitted to enter upon the study of medicine without presenting proof of a good literary and scientific education" (22).

Another major difference in the health care system related to nurses. There were relatively few nurses and very few public health nurses. As Blake (23) points out, "Public health nursing also saw its first beginnings

during this period. The first modern district nursing association was founded in 1859 by a Liverpool philanthropist, William Rathbone, with the cooperation of Florence Nightingale. The movement reached this country with the formation of a similar organization in 1877 by the Women's Board of the New York City Mission. In 1886 the Instructive District Nursing Association was established in Boston, the first to include education in personal hygiene as a definite objective. By 1900 there were 58 organizations engaged in public health nursing employing 130 nurses.... the impetus had been given for a far greater development in the present century."

To compare the topics that were of concern to physicians in 1889 and with those of the present, I reviewed JAMA's indexes of 1889 and 1988 for the number of articles listed under selected headings (table 2). It is reassuring to note that the big killers of the time tend to have more articles in each of these years.

Tuberculosis, the leading cause of death and the most frequent subject of articles in JAMA in 1889, has undergone dramatic changes, according to unpublished data of the Centers for Disease Control. The impact of chemotherapy on mortality from TB is particularly notable. The overall reduction in TB is due, however, to a variety of factors, including improved nutrition and ventilation as well as specific anti-TB measures. This is brought home by the statistics from Great Britain, which show a declining death rate from TB in 1850, long before any specific measures were available (24).

The armamentarium against TB is now sufficiently complete that we believe elimination of TB from this country by the year 2010 is an achievable goal (25).

Diphtheria had been recognized in the United States for more than 150 years and came to be accepted, more or less, since there was nothing specific which could be done about it. The incidence began to rise in the 1870s, however, and major epidemics were seen in many different parts of the country (8). An editorial in the February 2, 1889, issue of JAMA stated (26):

"When the great mortality from this Northern scourge is considered, it is wonderful that no more active steps to limit its spread and propagation are undertaken. There were nearly a thousand deaths in Brooklyn, and eight hundred and fifty-eight in Chicago during the past year! And these great numbers are not materially in excess of the ratio in other cities of the Northern Section of the Union. If there were ten per centum of this mortality from yellow fever, smallpox or cholera, public opinion—the potent factor in moving things in this country—would compel immediate concentration of sanitary forces upon this important question."

Diphtheria antitoxin was introduced in the 1890s and had an important impact on diphtheria mortality. Before

Table 1. Years of potential life lost (YPLL) before age 65 by cause of death, 1987 (provisional data)

<i>Causes of death</i>	<i>YPLL</i>
All causes (total)	12,045,778
Unintentional injuries	2,295,710
Cancer	1,837,742
Heart disease	1,494,227
Intentional injuries (suicide,homicide)	1,289,223
Birth defects	642,551
Prematurity	422,813
Acquired immune deficiency syndrome ¹	357,536
Sudden infant death syndrome	286,733
Stroke	246,479
Liver disease and cirrhosis	228,145
Pneumonia and influenza	166,775
Bronchitis and emphysema	123,260
Diabetes	119,155

¹ Acquired immune deficiency syndrome is now human immunodeficiency virus infection, from the new International Classification of Disease codes used by NCHS. SOURCE: Morbidity and Mortality Weekly Report, vol. 38, no. 2.

Table 2. Citations in the index of the Journal of the American Medical Association by selected headings, 1889 and 1987

<i>Heading</i>	<i>1889</i>	<i>1987</i>
Accident, injury	1	41
Alcohol, alcoholism	1	45
Cancer, carcinoma	6	13
Cerebrovascular disease	1	11
Coronary heart disease	5	61
Diphtheria	12	7
Homicide, suicide	1	17
Measles	1	7
Smoking, tobacco	1	58
Tuberculosis	19	6

that time, the only remedies available were isolation and disinfection. The use of a toxin-anti-toxin combination to induce lasting protection as introduced in the early 1900s with substantial impact (23) and diphtheria toxoid, introduced in the 1920s, brought about the final reductions in incidence. In the last several years, there have been only one or two cases per year in the United States, almost all in unvaccinated adults.

Paralytic poliomyelitis has had a well-defined history in this country, from emergence to disappearance. The first recognized outbreak occurred in Rutland, VT, in 1894 (5). During the first half of this century there were recurrent epidemics of increasing magnitude, reaching a peak in 1952 when more than 20,000 paralytic cases were reported. The introduction and widespread use, first of the inactivated poliovirus vaccine (IPV, Salk), and subsequently of the live attenuated oral poliovirus vaccine (OPV, Sabin) have eliminated polio from this country. The last case of paralysis due to indigenously acquired wild poliovirus occurred in 1979 (27). A target

has been set for hemispheric eradication of poliomyelitis by 1990 (28) and the World Health Assembly in 1988 adopted a goal of global eradication by the year 2000 (29), only 5 years later than we had originally proposed (30).

Many problems which were commonplace in 1889 have now been eliminated, including rickets, which at one point affected approximately 40 percent of American children, and pellagra. Malaria was widespread in the southeast part of the country and has now been eliminated. The toll taken by typhoid fever, mentioned previously, has been cut to very low levels.

Health Progress

Much of the health progress made in the past century has been a result of the conquest of infectious diseases, often by environmental means or through the use of simple preventive or therapeutic measures such as vaccines and antibiotics. Public Health Service officers have played important roles in these advances.

Interventions are generally not so simple, however, for the problems that are currently the most severe. American industrial and societal developments have given rise to some new problems, motor vehicle collisions, for example, as well as older ones which were not so prominent before, such as heart disease and cancer. Many current killers and cripples are heavily affected by behavior. The principal risk factors associated with unnecessary deaths or potential years of life lost are tobacco, alcohol, injury, lack of prevention services, high blood pressure, and improper nutrition (31).

Single exposure, permanently effective preventive services comparable to vaccines do not exist to reduce or remove these risk factors. Available approaches to prevention or modification of behavior typically involve repetitive contacts (reinforcement) and many are of unproven or only partial efficacy.

The Public Health Service has played an important role in the health progress of the past century. The challenge now is to make equal progress in the years ahead. Can we increase the average life expectancy at birth by another 25 years in the next century? I am not sure, but I do know that the approaches applied in the past—surveillance, research, program design, implementation, and evaluation—will be the key to the future. I am confident that members of the Public Health Service will be leaders in the effort.

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