Ten Great Public Health Achievements—United States, 1900-1999

MMWR. 1999;48:241-243

DURING THE 20TH CENTURY, THE HEALTH AND LIFE EXPECTANCY OF PERSONS RESIDING IN THE UNITED STATES IMPROVED DRAMATICALLY. SINCE 1900, THE AVERAGE LIFESPAN OF PERSONS IN THE UNITED STATES HAS LENGTHENED BY >30 YEARS; 25 YEARS OF THIS GAIN ARE ATTRIBUTABLE TO ADVANCES IN PUBLIC HEALTH.1 TO HIGHLIGHT THESE ADVANCES, MMWR WILL PROFILE 10 PUBLIC HEALTH ACHIEVEMENTS IN A SERIES OF REPORTS PUBLISHED THROUGH DECEMBER 1999.

Many notable public health achievements have occurred during the 1900s, and other accomplishments could have been selected for the list. The choices for topics for this list were based on the opportunity for prevention and the impact on death, illness, and disability in the United States and are not ranked by order of importance.

The first report in this series focuses on vaccination, which has resulted in the eradication of smallpox; elimination of poliomyelitis in the Americas; and control of measles, rubella, tetanus, diphtheria, Haemophilus influenzae type b, and other infectious diseases in the United States and other parts of the world.

Future reports that will appear in MMWR throughout the remainder of 1999 will focus on nine other achievements:

- Improvements in motor-vehicle safety have resulted from engineering efforts to make both vehicles and highways safer and from successful efforts to change personal behavior (e.g., increased use of safety belts, child safety seats, and motorcycle helmets and decreased drinking and driving). These efforts have contributed to large reductions in motor-vehicle-related deaths.2
- Work-related health problems, such as coal workers’ pneumoconiosis (black lung), and silicosis—common at the beginning of the century—have come under better control. Severe injuries and deaths related to mining, manufacturing, construction, and transportation also have decreased; since 1980, safer workplaces have resulted in a reduction of approximately 40% in the rate of fatal occupational injuries.3
- Control of infectious diseases has resulted from clean water and improved sanitation. Infections such as typhoid and cholera transmitted by contaminated water, a major cause of illness and death early in the 20th century, have been reduced dramatically by improved sanitation. In addition, the discovery of antimicrobial therapy has been critical to successful public health efforts to control infections such as tuberculosis and sexually transmitted diseases (STDs).
- Decline in deaths from coronary heart disease and stroke have resulted from risk-factor modification, such as smoking cessation and blood pressure control coupled with improved access to early detection and better treatment. Since 1972, death rates for coronary heart disease have decreased 51%.4
- Since 1900, safer and healthier foods have resulted from decreases in microbial contamination and increases in nutritional content. Identifying essential micronutrients and establishing food-fortification programs have almost eliminated major nutritional deficiency diseases such as rickets, goiter, and pellagra in the United States.
- Healthier mothers and babies have resulted from better hygiene and nutrition, availability of antibiotics, greater access to health care, and technological advances in maternal and neonatal medicine. Since 1900, infant mortality has decreased 90%, and maternal mortality has decreased 99%.
- Access to family planning and contraceptive services has altered social and economic roles of women. Family planning has provided health benefits such as smaller family size and longer interval between the birth of children; increased opportunities for preconception counseling and screening; fewer infant, child, and maternal deaths; and the use of barrier contraceptives to prevent pregnancy and transmission of human immunodeficiency virus and other STDs.
- Fluoridation of drinking water began in 1945 and in 1999 reaches an estimated 144 million persons in the United States. Fluoridation safely and inexpensively benefits both children and adults by effectively preventing tooth decay, regardless of socioeconomic status or access to care. Fluoridation has played an important role in the reductions in tooth decay (40%-70% in children) and of tooth loss in adults (40%-60%).5
- Recognition of tobacco use as a health hazard and subsequent public health anti-smoking campaigns have resulted in changes in social norms to prevent initiation of tobacco use, promote cessation of use, and reduce exposure to environmental tobacco smoke. Since the 1964 Surgeon General’s report on the health risks of smoking, the prevalence of smoking among adults has decreased, and millions of smoking-related deaths have been prevented.6

The list of achievements was developed to highlight the contributions of public health and to describe the impact of these contributions on the health and well being of persons in the United States. A final report in this series will review the national public health system, including local and state health departments and academic institutions whose activities on research, epidemiology, health education, and program implementation have made these achievements possible.

Reported by: CDC.

REFERENCES

6 available

©1999 American Medical Association. All rights reserved.

JAMA, April 28, 1999—Vol 281, No. 16 1481

Downloaded From: on 07/19/2018
Impact of Vaccines Universally Recommended for Children—United States, 1900-1998

MMWR. 1999;48:243-248
2 tables omitted

AT THE BEGINNING OF THE 20TH CENTURY, infectious diseases were widely prevalent in the United States and exacted an enormous toll on the population. For example, in 1900, 21,064 smallpox cases were reported, and 894 patients died.\(^1\) In 1920, 469,924 measles cases were reported, and 7575 patients died; 147,991 diphtheria cases were reported, and 13,170 patients died. In 1922, 107,473 pertussis cases were reported, and 5099 patients died.\(^2,3\)

In 1900, few effective treatment and preventive measures existed to prevent infectious diseases. Although the first vaccine against smallpox was developed in 1796, >100 years later its use had not been widespread enough to fully control the disease.\(^4\) Four other vaccines—against rabies, typhoid, cholera, and plague—had been developed late in the 19th century but were not used widely by 1900.

Since 1900, vaccines have been developed or licensed against 21 other diseases.\(^5\) Ten of these vaccines have been recommended for use only in selected populations at high risk because of area of residence, age, medical condition, or risk behaviors. The other 11 have been recommended for use in all U.S. children.\(^6\)

During the 20th century, substantial achievements have been made in the control of many vaccine-preventable diseases. This report documents the decline in morbidity from nine vaccine-preventable diseases and their complications—smallpox, along with the eight diseases for which vaccines had been recommended for universal use in children as of 1990. Four of these diseases are detailed: smallpox has been eradicated, poliomyelitis caused by wild-type viruses has been eliminated, and measles and *Haemophilus influenza* type b (Hib) invasive disease among children aged <5 years have been reduced to record low numbers of cases.

Information about disease and death during the 20th century was obtained from the MMWR annual summaries of notifiable diseases and reports by the U.S. Department of Health, Education, and Welfare. For smallpox, Hib, and congenital rubella syndrome (CRS), published studies were used.\(^2,3,7-14\)

**Current Delivery and Use of Vaccines**

National efforts to promote vaccine use among all children began with the appropriation of federal funds for polio vaccination after introduction of the vaccine in 1955.\(^3\) Since then, federal, state, and local governments and public and private health-care providers have collaborated to develop and maintain the vaccine-delivery system in the United States.

Overall, U.S. vaccination coverage is at record high levels. In 1997, coverage among children aged 19-35 months (median age: 27 months) exceeded 90% for three or more doses of diphtheria and tetanus toxoids and pertussis vaccine (DTP), three or more doses of poliovirus vaccine, three or more doses of Hib vaccine, and one or more doses of measles-containing vaccine. Coverage with four doses of DTP was 81% and for three doses of hepatitis B vaccine was 84%. Coverage was substantially lower for the recently introduced varicella vaccine (26%) and for the combined series of four DTP/three polio/one measles-containing vaccine/three Hib (76%).\(^15\) Coverage for rotavirus vaccine, licensed in December 1998, has not yet been measured among children aged 19-35 months. Coverage among children aged 5-6 years has exceeded 95% each school year since 1980 for DTP; polio; and measles, mumps, and rubella vaccines (CDC, unpublished data, 1998).

**Vaccine Impact**

Dramatic declines in morbidity have been reported for the nine vaccine-preventable diseases for which vaccination was universally recommended for use in children before 1990 (excluding hepatitis B, rotavirus, and varicella). Morbidity associated with smallpox and polio caused by wild-type viruses has declined 100% and nearly 100% for each of the other seven diseases.

**Smallpox.** Smallpox is the only disease that has been eradicated. During 1900-1904, an average of 48,164 cases and 1528 deaths caused by both the severe (variola major) and milder (variola minor) forms of smallpox were reported each year in the United States.\(^1\) The pattern in the decline of smallpox was sporadic. Outbreaks of variola major occurred periodically in the first quarter of the 1900s and then ceased abruptly in 1929. Outbreaks of variola minor declined in the 1940s, and the last case in the United States was reported in 1949. The eradication of smallpox in 1977 enabled the discontinuation of prevention and treatment efforts, including routine vaccination. As a result, in 1985 the United States recouped its investment in worldwide eradication every 26 days.\(^1\)

**Polio.** Polio vaccine was licensed in the United States in 1955. During 1951-1954, an average of 16,316 paralytic polio cases and 1879 deaths from polio were reported each year.\(^9,10\) Polio incidence declined sharply following the introduction of vaccine to <1000 cases in 1962 and remained below 100 cases after that year. In 1994, every dollar spent to administer oral poliovirus vaccine saved $3.40 in direct medical costs and $2.74 in indirect societal costs.\(^14\) The last documented indigenous transmission of wild poliovirus in the United States occurred in 1979. Since then, reported cases have been either vaccine-associated or imported. As of 1991, polio caused by wild-type viruses has been eliminated from the Western Hemisphere.\(^16\) Enhanced use of the inactivated polio vaccine is expected to reduce the number of vaccine-associated cases, which averaged eight cases per year during 1980-1994.\(^17\)

**Measles.** Measles vaccine was licensed in the United States in 1963.
During 1958-1962, an average of 503,282 measles cases and 432 measles-associated deaths were reported each year.8-11 Measles incidence and deaths began to decline in 1965 and continued a 33-year downward trend. This trend was interrupted by epidemics in 1970-1972, 1976-1978, and 1989-1991. In 1998, measles reached a provisional record low number of 89 cases with no measles-associated deaths.12 All cases in 1998 were either documented to be associated with international importations (69 cases) or believed to be associated with international importations (CDC, unpublished data, 1998). In 1994, every dollar spent to purchase measles-containing vaccine saved $10.30 in direct medical costs and $3.20 in indirect societal costs.7

Hib. The first Hib vaccines were polysaccharide products licensed in 1985 for use in children aged 18-24 months. Polysaccharide-protein conjugate vaccines were licensed subsequently for use in children aged 18 months (in 1987) and later for use in children aged 2 months (in 1990). Before the first vaccine was licensed, an estimated 20,000 cases of Hib invasive disease occurred each year, and Hib was the leading cause of childhood bacterial meningitis and postnatal mental retardation.8,18 The incidence of disease declined slowly after licensure of the polysaccharide vaccine; the decline accelerated after the 1987 introduction of polysaccharide-protein conjugate vaccines for toddlers and the 1990 recommendation to vaccinate infants. In 1998, 125 cases of Hib disease and Haemophilus influenzae invasive disease of unknown serotype among children aged <5 years were provisionally reported: 54 were Hib and 71 were of unknown serotype (CDC, unpublished data, 1998). In less than a decade, the use of the Hib conjugate vaccines nearly eliminated Hib invasive disease among children.

Future Direction

Vaccines are one of the greatest achievements of biomedical science and public health. Despite remarkable progress, several challenges face the U.S. vaccine-delivery system. The infrastructure of the system must be capable of successfully implementing an increasingly complex vaccination schedule. An estimated 11,000 children are born each day in the United States, each requiring 15-19 doses of vaccine by age 18 months to be protected against 11 childhood diseases.6 In addition, licensure of new vaccines is anticipated against pneumococcal and meningococcal infections, influenza, parainfluenza, respiratory syncytial virus (RSV), and against chronic diseases (e.g., gastric ulcers, cancer caused by Helicobacter pylori, cervical cancer caused by human papilloma virus, and rheumatic heart disease that occurs as a sequela of group A streptococcal infection). Clinical trials are under way for vaccines to prevent human immunodeficiency virus infection, the cause of acquired immunodeficiency syndrome.

To achieve the full potential of vaccines, parents must recognize vaccines as a means of mobilizing the body’s natural defenses and be better prepared to seek vaccinations for their children; health-care providers must be aware of the latest developments and recommendations; vaccine supplies and financing must be made more secure, especially for new vaccines; researchers must address increasingly complex questions about safety, efficacy, and vaccine delivery and pursue new approaches to vaccine administration more aggressively; and information technology to support timely vaccinations must be harnessed more effectively. In addition, the vaccine-delivery system must be extended to new populations of adolescents and adults. Each year, thousands of cases of potentially preventable influenza, pneumococcal disease, and hepatitis B occur in these populations. Many of the new vaccines will be targeted at these age groups. The U.S. vaccine-delivery system must routinely include these populations to optimally prevent disease, disability, and death.

Despite the dramatic declines in vaccine-preventable diseases, such diseases persist, particularly in developing countries. The United States has joined many international partners, including the World Health Organization and Rotary International, in seeking to eradicate polio by the end of 2000. Efforts to accelerate control of measles, which causes approximately one million deaths each year,7 and to expand rubella vaccination programs also are underway around the world. Efforts are needed to expand the use of existing vaccines in routine childhood vaccination programs worldwide and to successfully introduce new vaccines as they are developed. Such efforts can benefit the United States and other developed countries by decreasing disease importations from developing countries.

Reported by: National Immunization Program, CDC.

REFERENCES

©1999 American Medical Association. All rights reserved.
modeled on the successful tobacco-use prevention programs in California and Massachusetts.\(^1\)\(^2\) To assess the effects of the tax increase and TPEP in Oregon, OHD evaluated data on the number of packs of cigarettes taxed before (1993-1996) and after (1997-1998) the ballot initiative and implementation of the program. Oregon’s results also were compared with national data. This report summarizes the results of the analysis, which indicate that consumption of cigarettes in Oregon declined substantially after implementation of the excise tax and TPEP and exceeded the national rate of decline.

OHD obtained data on the sale of Oregon cigarette tax stamps from the Oregon Department of Revenue for 1993-1998. OHD also obtained data on the proportion of revenue received at the old and new rates after the tax change (February 1997) to calculate the number of packs sold each month. Per capita consumption was calculated by dividing the number of packs sold by the total population of Oregon each year.\(^3\)

National comparison estimates were generated using data from the Tobacco Institute on state tax receipts for wholesale cigarette deliveries. Reliable figures were available through December 1997.\(^4\) Data from Oregon and the other three states (Arizona, California, and Massachusetts) with tobacco-use prevention programs funded through state initiatives were excluded from the comparison estimates. National per capita consumption was calculated by dividing the total number of packs sold by the total population in the remaining 46 states and the District of Columbia.\(^5\) Calculations for Oregon for 1996-1998 represent the 1 year before and the 2 years after the tax increase.

From 1993 to 1996, taxable per capita consumption of cigarettes increased 2.2% in Oregon and decreased 0.6% in the 46 remaining states and the District of Columbia. In Oregon, from 1996 to 1998, taxable per capita cigarette consumption declined 11.3% (from 92 packs to 82 packs). Despite a 2.7% increase in the state’s population, 25 million fewer cigarette packs were sold in Oregon in 1998 than in 1996. In the United States during 1996-1997, per capita consumption declined 1.0% (from 93 packs to 92 packs).

**REFERENCES**

8 available