



Morbidity and Mortality Weekly Report (*MMWR*)

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Ten Great Public Health Achievements --- Worldwide, 2001--2010

Weekly

June 24, 2011 / 60(24);814-818

Worldwide, a child born in 1955 had an average life expectancy at birth of only 48 years (1). By 2000, the average life expectancy at birth had increased to 66 years and, if past trends continue, is projected to rise to 73 years by 2025 (1). These improvements in longevity have resulted from improved living conditions overall, advances in medical science, and a number of population-level interventions. However, major disparities persist. During the past decade, in low-income countries, average life expectancy at birth increased from 55 to 57 years (3.6%), while increasing from 78 to 80 years (2.6%) in high-income countries (2). Analogous to the recent *MMWR* report highlighting 10 public health achievements that occurred in the United States over the first 10 years of the new century, this report describes global public health achievements during the same period (3). Experts in global public health were asked to nominate noteworthy public health achievements that occurred outside of the United States during 2001--2010. From them, 10 have been summarized in this report. As with the previous report, the 10 global public health achievements are not ranked in any order. Additional information regarding these achievements is available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6019a5_addinfo.htm.

Reductions in Child Mortality

Child mortality, a key measurement of United Nations Millennium Development Goal 4, is defined as deaths in children aged <5 years and serves as a major indicator of a nation's health and development, tracking health services and outcomes as well as important social and economic indicators. Currently, an estimated 8.1 million children die each year before reaching their fifth birthday, a decrease of approximately 2 million during the past decade. From 77 deaths per 1,000 live births in 2000, the child mortality rate declined to 62 per 1,000 in 2009. The annual rate of decline in the child mortality rate has increased substantially, from 1.3% per year in the 1990s to 2.2% since 2000. Approximately 99% of all childhood deaths occur in low-income and middle-income countries, with 49% occurring in sub-Saharan Africa and 33% in southern Asia.

Approximately 68% of deaths among children aged <5 years are attributable to infectious diseases, most notably diarrhea, pneumonia, malaria, and acquired immunodeficiency syndrome (AIDS). Undernutrition contributes to at least one third of all childhood deaths, usually in interaction with infectious causes. The vast majority of gains in child survival have been accomplished through scale-up of interventions such as immunization, micronutrient supplementation, access to safe water, insecticide-treated bednets, oral rehydration therapy, antibiotics, antimalarial therapy, and antiretroviral therapies. Increased financial resources, strong partnerships, intensified country support, and innovations in service delivery approaches have made these gains possible. Because of the success in reducing the number of deaths caused by infection, 41% of childhood deaths now occur among neonates; leading causes of neonatal death are preterm birth complications, birth asphyxia, and sepsis (4).

Vaccine-Preventable Diseases

Expanded vaccination coverage is one of the most cost-effective ways to advance global welfare (5). In the first decade of the 21st century, an estimated 2.5 million deaths were prevented each year among children aged <5 years through the use of measles, polio, and diphtheria-tetanus-pertussis vaccines. Expanded coverage with measles vaccine resulted in a 78% decline in measles mortality from 2000 to 2008, averting an estimated 12.7 million deaths. Polio eradication efforts decreased the number of countries with endemic disease from 20 to four, with fewer than 1,500 cases reported in 2010. Global coverage with the third dose of diphtheria-tetanus-pertussis vaccine (a performance measure for vaccination programs) increased from 74% to 82%. Newer vaccines, including hepatitis B vaccine and *Haemophilus influenzae* type B (Hib) vaccine also are now widely used in national immunization programs globally. The number of countries using hepatitis B vaccine increased from 107 in 2000, to 178 in 2009; with global vaccination coverage of 70% achieved by the end of the decade, at least 700,000 deaths from cirrhosis and liver cancer are expected to be averted in each annual birth cohort in these 178 countries. During

2000--2009, the number of countries using Hib vaccine worldwide increased from 62 to 161; the resulting global coverage of 38% prevented an estimated 130,000 pneumonia and meningitis deaths annually among children aged <5 years.


Studies of disease burden and vaccine efficacy and creation of innovative financing mechanisms accelerated development and use in developing countries of vaccines licensed during the decade. As a result, new and underutilized vaccines for global use (i.e., pneumococcal conjugate [PCV], rotavirus, and rubella vaccines), and vaccines recommended for introduction in certain regions or in countries where certain criteria are met (e.g., Japanese encephalitis, human papillomavirus, meningococcal group A conjugate, and typhoid vaccines) are expected to be available around the world much more quickly than they have been in the past. By the end of 2009, 44 countries had introduced PCV (11% of the global birth cohort), 23 had introduced rotavirus vaccine (11% of the global birth cohort), and 130 had introduced rubella vaccine (42% of the global birth cohort). Substantial work remains for these vaccines to be more widely introduced in developing countries.

Access to Safe Water and Sanitation

Water-related diseases, principally the 2.5 billion cases of diarrhea that occur annually, are the second leading cause of childhood mortality worldwide (6). Diarrhea, almost 90% of which is related to inadequate water, sanitation, and hygiene (WASH), kills 1.5 million children aged <5 years annually, more children than AIDS, malaria, and measles combined (6). From 2000 to 2008, the world's population increased from 6.1 billion to 6.7 billion, while the proportion of the world's population with access to improved drinking water sources increased from 83% to 87% (covering an additional 800 million persons), and the proportion with access to improved sanitation increased from 58% to 61% (covering an additional 570 million persons) (7). These gains were made through WASH initiatives to increase water and sanitation coverage and promote hygienic behaviors (e.g., handwashing), as well as through maintaining existing services.

During the previous century, in Europe, North America, and Japan, drinking water treatment virtually eliminated waterborne diseases such as cholera and typhoid (8,9). More recently, although improved WASH access has resulted in significant progress in controlling water-related disease in certain countries (e.g., Mexico and Chile), neglect of WASH infrastructure has contributed to large, deadly, waterborne outbreaks in others (e.g., cholera in Zimbabwe) (10). Continued improvements in global WASH coverage require intensifying current efforts, including long-term, multisectoral commitment to constructing and maintaining water and sanitation systems, behavior change promotion, and WASH-related disease surveillance.

Malaria Prevention and Control

Malaria is the fifth leading cause of death from infectious disease worldwide and the second leading cause in Africa, after human immunodeficiency virus/(HIV)/AIDS (11). The Roll Back Malaria partnership launched in 1998 is a coordinated response to malaria (additional information available at <http://www.rollbackmalaria.org> ). During 2003--2010, financial assistance to malaria-endemic countries increased from approximately \$100 million annually to nearly \$1.8 billion annually, enabling increased coverage with insecticide-treated bednets, indoor residual spraying, rapid diagnosis and prompt treatment with artemisinin combination therapy, and intermittent preventive treatment during pregnancy (12). As a result, in sub-Saharan Africa, household ownership of insecticide-treated bednets increased from 3% in 2000 to 42% in 2009, protecting approximately 75% of the at-risk population. Protection with indoor residual spraying increased from 13 million households in 2005 to 75 million in 2009. Over the course of the past decade, the estimated number of malaria cases worldwide peaked at 244 million in 2005 but declined to 225 million in 2009. This decline was associated with a 21% decrease in estimated global malaria deaths, from approximately 985,000 in 2000 to 781,000 in 2009.

Prevention and Control of HIV/AIDS

The HIV epidemic continues to be a major global health challenge, with an estimated 33.3 million persons living with HIV at the end of 2009, compared with 28.6 million in 2001 (13). In 2009, 68% of persons living with HIV (22.5 million) were in sub-Saharan Africa (13). Despite this increase, the number of new infections annually has declined from an estimated 3.1 million in 2001 to 2.6 million in 2009. A decline also has been observed in the estimated number of AIDS-related deaths worldwide, from a peak of 2.1 million in 2004 to an estimated 1.8 million deaths in 2009 (13). Public health interventions possibly contributing to decreasing global HIV incidence have included the expansion of programs for provider-initiated HIV testing and counseling, prevention of mother-to-child HIV transmission, which covered an estimated 53% of pregnancies in HIV-positive mothers in 2009 (14), expanded availability and use of condoms and sterile injection equipment, improved blood safety, and antiretroviral therapy (ART). The scale-up of these interventions, including the provision of ART to 5.25 million persons in low-income and middle-income countries in 2009, has been concurrent with the decline in mortality (15). By averting new infections and offering improved health and longer lives to those already infected, these programs have enabled millions to contribute productively to families, communities, and economies.

Tuberculosis Control

During the past decade, 81 million new tuberculosis (TB) cases and 10 million deaths from TB occurred, largely in sub-Saharan Africa and Asia (16). In 1995, the World Health Organization (WHO) published its directly observed therapy, short-course (DOTS) strategy for TB control, focusing on finding and successfully treating TB cases with standardized regimens and rigorous treatment and program monitoring (16,17). Since 1995, DOTS has resulted in 41 million cases cured and 6 million deaths prevented (16). Since 2000, case detection and treatment success rates each have risen nearly 20%, with incidence and prevalence declining in every region. The world is on track to reduce TB mortality to 50% of 1990 levels by 2015 (16). DOTS also is cost effective: in sub-Saharan Africa, implementation of DOTS at a cost of \$12 billion (U.S.) would produce \$129 billion in economic benefits to the region in 10 years (18).

Despite these successes, HIV-related and multidrug-resistant TB threaten to undermine progress, and TB incidence is declining, but slowly. HIV infection is the primary reason for failure to meet TB control targets in settings with high HIV prevalence, and TB is a major cause of death among persons living with HIV/AIDS. Interventions such as initiation of antiretroviral therapy in TB patients coinfecting with HIV can decrease mortality. To address the threat of multidrug-resistant TB, DOTS-Plus strategies, which incorporate practical steps to improve infection control and special guidance on use and quality control of second-line drugs, have been implemented in countries with a high prevalence of this disease (18).

Control of Neglected Tropical Diseases

Neglected tropical diseases affect approximately 1 billion persons worldwide. Three of these diseases have been targeted for elimination or eradication: dracunculiasis (Guinea worm disease), onchocerciasis (river blindness) in the Americas, and lymphatic filariasis. Of these programs, those targeting dracunculiasis and onchocerciasis in the Americas are on the verge of success. In 1986, an estimated 3.5 million cases of dracunculiasis occurred in 20 countries. Using filters, safe water sources, larvicide, and most importantly, health education to encourage water filtration and prevention of water contamination, dracunculiasis transmission has been interrupted in all but four countries (Southern Sudan, Mali, Ethiopia, and Ghana), with most remaining cases in Southern Sudan. With only 1,797 cases reported in 2010, including 10 cases from an outbreak in Chad, the goal of eradication in 2012 is within reach.

The Onchocerciasis Elimination Program in the Americas began in 1992 to use mass drug administration to reduce blindness from onchocerciasis among the 500,000 persons at risk in six countries. By 2010, new cases of onchocercal blindness were eliminated in all 13 regional foci, and *Onchocerca volvulus* transmission was interrupted completely in eight of these. The goal is to eliminate transmission in all foci in the Americas by 2012.

In 2000, 1.34 billion persons in 72 countries were at risk for lymphatic filariasis and required mass drug administration, and 120 million were infected. With elimination targeted for 2020, the Global Programme to Eliminate Lymphatic Filariasis, begun in 2000, has delivered approximately 3 billion courses of antifilarial treatment at a cost of \$0.05--\$0.50 per person. Nine of the 72 countries have reached the WHO target for stopping mass drug administration. During 2000--2007, the program prevented infection in an estimated 6.6 million newborns, prevented disease in 9.5 million persons, and averted 32 million disability-adjusted life years.

Tobacco Control

In 2000, 4.8 million premature deaths were attributable to tobacco use (19). By the end of the decade, that number had risen to 5.4 million (20). In 2003, commitments were made through the WHO Framework Convention on Tobacco Control (WHO FCTC), WHO's first global health treaty, which was adopted by 168 countries by 2010 (21) and four more by June 2011. In addition, WHO developed a package of strategies called MPOWER (monitor tobacco use, protect from tobacco smoke, offer help to quit, warn about the dangers, enforce marketing bans, and raise taxes on tobacco) to support WHO FCTC (20). By 2010, 163 countries had completed youth surveys, and 14 had completed adult surveys as part of the Global Tobacco Surveillance System (22). Survey findings enable countries to track tobacco use and respond with interventions such as price increases; smoke-free policies; bans on tobacco advertising, promotion, and sponsorship; and tobacco-related health information provided via mass media campaigns and graphic health warnings (20).

Smoke-free environments, a component of WHO FCTC and MPOWER, protect persons from tobacco smoke. The U.S. Surgeon General's report conclusion that no safe level of exposure to tobacco smoke exists (23) and studies showing that smoke-free laws do not harm businesses have heightened worldwide interest in smoke-free policies. By the end of the decade, about half of the world's population was protected in health-care and educational facilities, although only about 5% of persons were protected by laws encompassing all public places (24). The total global population covered by comprehensive smoke-free laws increased from 3.1% in 2007 to 5.4% in 2008, providing protection for an additional 154 million persons (24).

Increased Awareness and Response for Improving Global Road Safety

Since 2000, when the International Federation of the Red Cross *International Disasters Report* raised an alarm regarding the worldwide impact of road traffic injuries, significant progress has been made in establishing a global response strategy (25,26). In 2001, WHO launched a 5-year plan to improve global road safety; in 2004, along with the World Bank, WHO issued the *World Report on Road Traffic Injury Prevention* (26). From 2001 to 2009, the number of annual traffic-related fatalities in the European Union declined 36%, from 55,700 to 34,900 (27). The largest declines in the traffic-related mortality rates from 2000 to 2009 were observed in Spain and Portugal; rates decreased 59.2% in Spain, from 14.5 deaths per 100,000 population to 5.9, and 47% in Portugal, from 12.9 to 6.8 (28).

Despite such advances in road safety in developed countries, approximately 1.3 million persons die on the world's roads each year (3,000 every day), and this number is projected to double by 2030. Much of the projected worldwide increase is expected to come from low-income and middle income countries, which already account for 90% of global road deaths despite having less than half of the world's vehicles, and where the number of autos in use in rapidly emerging economies is expected to expand sixfold by 2018, potentially without corresponding improvements in road infrastructure or traffic safety. The Commission for Global Road Safety issued recommendations in 2006 and 2010, further raising the profile of global road traffic injuries and culminating in 2009 with adoption of a United Nations General Assembly resolution proclaiming the period 2011--2020 as the Decade of Action for Road Safety (29,30). The resolution established a 2020 goal of stabilizing and then reducing the forecasted growth of road traffic fatalities around the world by increasing road safety activities, including improved road and vehicle design, speed control, seat belt and helmet use, improved public transport, reduced alcohol-impaired driving, and more effective care of the injured at the national, regional, and global levels. If this goal is achieved, over the decade it could save 5 million lives and \$3 trillion and prevent 50 million serious injuries.

Improved Preparedness and Response to Global Health Threats

Pandemic diseases and emerging diseases such as AIDS, severe acute respiratory syndrome, and influenza continue to cause fear, economic instability, severe illness, and premature death. In the past decade, the public health community has improved preparedness for and detection of pandemic threats and is now responding more effectively than before. The 2005 International Health Regulations, which entered into force in 2007, have modernized the international legal framework to improve systematic preparedness and response to pandemic and other emerging public health threats. Use of the Internet and other media for public health surveillance has expanded, and the Global Public Health Information Network, CDC's Global Disease Detection Operations Center (GDDOC), additional international influenza response networks, and other systems routinely detect and respond to clusters of unusual disease earlier than traditional surveillance. Laboratory and epidemiologic capacity also has improved. For example, since 2006, GDDOC worked with ministries of health to add availability of 185 new diagnostic tests in 59 countries, enabling these countries to conduct tests for pathogens they could not previously perform. Since 2000, a total of 21 new Field Epidemiology Training Programs have been established, three of which are now self-sustained. From 2000 to 2010, these new programs graduated approximately 500 epidemiologists. Cooperative agreements with ministries of health, regional training conducted in collaboration with WHO and other international organizations, and vital public health work to reduce transmission at the animal-human interface also have contributed to reducing the risk of influenza pandemics.

As a result of these and other efforts, the global response to the 2009 influenza A (H1N1) pandemic, which affected more than 214 countries and territories, was the most rapid and effective response to an influenza pandemic in history. The pandemic virus was rapidly identified and characterized. Epidemiologic investigations were conducted to characterize the severity and risk groups, and surveillance data were used to estimate the burden of disease and guide the response in real time. Within weeks of detecting the pandemic virus, diagnostic reagents were provided to laboratories in 146 countries, and laboratory and clinical training was provided, in collaboration with partners, to more than 6,100 health professionals in 34 countries. A vaccine was developed within 20 weeks of virus detection, and through an international donation program, made available to 86 countries. The lessons and experiences of the 2009 H1N1 response continue to inform preparedness efforts for future influenza pandemics as well as future public health emergencies.

Conclusion

During the previous century, great progress was made in raising life expectancy and reducing mortality among infants and young children through improvements in living conditions and activities to combat major infectious causes of death. Collectively, interventions such as those described in this report have contributed to the shifts in major causes of death observed in the new century, with chronic, noninfectious causes increasingly prevalent not only in affluent countries, but also in lower-income and middle-income countries. Noncommunicable diseases and health conditions are expected to account for

an estimated 75% of all deaths worldwide by the year 2030 (31). The achievements described in this report demonstrate the capacity of public health agencies to harness and adapt the scientific, technical, legal, and political resources necessary to respond effectively to the problems at hand. This capacity will be tested in the years ahead as public health agencies continue to address communicable diseases while responding to the increasing prevalence of cardiovascular disease, diabetes, cancer, and other noncommunicable conditions and injuries that will require innovative responses to ensure significant public health achievements in the future.

Reported by

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Page last reviewed: June 24, 2011

Page last updated: June 24, 2011

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