

Healthy World

Polio



Progress in eradication

NCIRD's polio eradication efforts contributed to a significant decline in the number of cases worldwide in 2007. In particular, there were significant achievements in India and Nigeria, two of the four countries (including Afghanistan and Pakistan) that have never stopped indigenous transmission of polio:

- In the poor and densely populated Indian state of Uttar Pradesh, considered the most challenging area in the world for polio eradication, there was a sharp drop in wild poliovirus type 1 cases: from 520 in 2006 to only 21 in 2007. This small number of cases represents a major achievement in cutting the chain of transmission of the most dangerous type of poliovirus in a highly endemic area.
- Nigeria also experienced a significant decline in wild polio cases: from 1,122 in 2006 to only 286 as of December 31, 2007. During the year, Nigeria also saw stronger ownership and support for its eradication program among political, traditional, and religious leaders, as well as a marked improvement in community participation in immunization activities.

As of December 31, 2007, 1,303 confirmed polio cases had been reported globally for the year, compared with 1,874 cases during the same period in 2006. In addition, there was a 31% decline in polio-infected districts in endemic countries, and polio outbreaks were stopped in 10 countries. During the year, CDC purchased more than 260 million doses of oral polio vaccine for large-scale vaccination campaigns in India, Nigeria, and other priority countries. As part of these efforts, NCIRD staff provided a range of technical assistance: planning and monitoring national immunization days; designing and conducting programmatic research; developing enhanced data-management tools; and conferring with other polio experts.

Changes in how outbreaks are tested and understood

Oral polio vaccine (OPV) has long been the primary tool in global efforts to eradicate poliovirus. The vaccine has several advantages, including its simple oral delivery, low cost, and potential to achieve secondary immunization in people who come into close contact with those who have been vaccinated. In poorly immunized communities, however, this last property can, on occasion, lead to the creation of vaccine-derived polioviruses (VDPV) that continue to transmit in populations until they are stopped by increased immunization activities. VDPVs are very similar to the strains found in vaccine but have much greater potential to cause paralytic disease and outbreaks.

In late 2006, an observation in the NCIRD polio laboratory led to a series of discoveries that changed standard laboratory protocol/testing throughout the Global Polio Laboratory Network (GPLN)—a group of 145 sub-national, national, and regional laboratories responsible for detecting wild polioviruses—as well as the scientific community's understanding of the outbreak risk associated with VDPVs. Scientists found that an excess of poliovirus type 2 vaccine-related isolates were geographically clustered in northern Nigeria. Genetic sequencing of the suspect isolates revealed, surprisingly, that they included VDPVs missed by established screening methods. During the next year, CDC initiated a three-part response.

- First, the extent of the problem needed to be determined. NCIRD launched epidemiologic and laboratory investigations into other potential clusters of vaccine-related polioviruses and also began testing archived specimens throughout the GPLN; when completed, nearly 15,000 virus isolates from the last two years will have been re-screened or sequenced to ensure the highest level of virologic surveillance sensitivity.

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- Second, new molecular screening methods already in development at NCIRD were rapidly deployed to selected GPLN laboratories. These new methods allow for rapid screening of large numbers of isolates, which eliminates the need for more expensive sequencing and will enable many more laboratories to reliably screen for these VDPVs in the future.
- The third activity involved the careful and comprehensive characterization of the VDPV isolates to better understand the nature of the genetic changes associated with their increased transmissibility. Along with epidemiologic data, this examination of the isolates makes clear that a smaller number of genetic changes than previously thought can result in outbreaks of polio. This information will help NCIRD more effectively assess the risks associated with OPV use.



Measles and Rubella

Measles deaths continue to decrease globally

Along with the World Health Organization, the American Red Cross, the United Nations Foundation, and UNICEF, CDC is helping to spearhead the Measles Initiative, a global partnership committed to reducing the number of deaths caused by measles, which occur primarily among young children in the developing world. Due in large part to the commitment and resources of national governments, together with technical assistance and funding from the Measles Initiative, annual worldwide deaths from measles plummeted 68% between 2000 and 2006—from an estimated 757,000 to an estimated 242,000. The largest percentage reduction in deaths was in the African region (91%); this means the region appears to have met the U.N. goal of a 90% reduction in measles deaths from 2000 to 2010 four years early. Sustaining this achievement is a priority.

Rubella cases plummet in the Americas

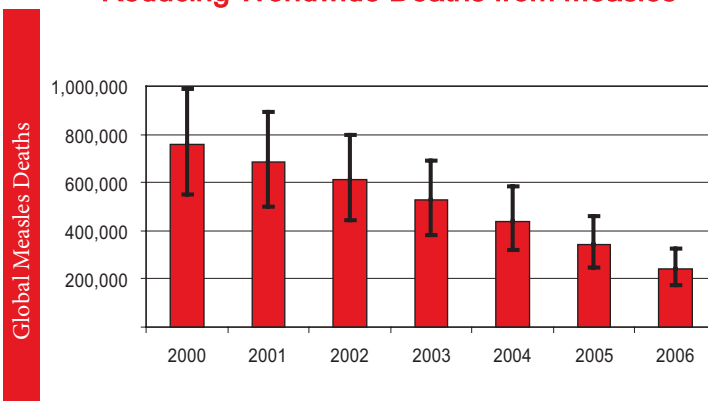
From 1998 to 2006, rubella cases in the Americas fell by an astounding 98%—a significant accomplishment that bodes well for the Pan American Health Organization's goal of eliminating the disease in the region by 2010. In 2007, rubella immunization campaigns were completed in Bolivia, Cuba, El Salvador, Guatemala, and Venezuela. NCIRD was on hand to monitor the campaign in Guatemala, and staff also provided technical assistance to health officials in Haiti as they planned that country's measles-rubella vaccination campaign. In addition, NCIRD participated in an effort in Costa Rica to develop guidelines for verifying rubella and congenital rubella syndrome (CRS) elimination in the Americas.

Contributing to global surveillance

To improve global surveillance of measles, rubella, and congenital rubella syndrome, the World Health Organization (WHO) created LabNet, a network that has grown to approximately 700 laboratories serving 166 countries. NCIRD plays a key technical support role in this effort, providing LabNet and its members with laboratory training in disease diagnostics and virologic surveillance, methods development and implementation, and protocol and field manual development.

In 2007, NCIRD scientists participated in several international LabNet meetings and consultations, including in-country laboratory training workshops in Mexico and Oman. Staff also trained several visiting LabNet scientists and helped write the new WHO Measles/Rubella Laboratory Field Manual. In addition, NCIRD worked with LabNet and state laboratories to track the transmission pathways of measles viruses from a large outbreak in Japan to the United States and Europe. Information from NCIRD was also crucial in efforts to characterize a cluster of rubella cases in Michigan and to track the origin of a rubella case in Massachusetts to its source in Uganda.

Reducing Worldwide Deaths from Measles



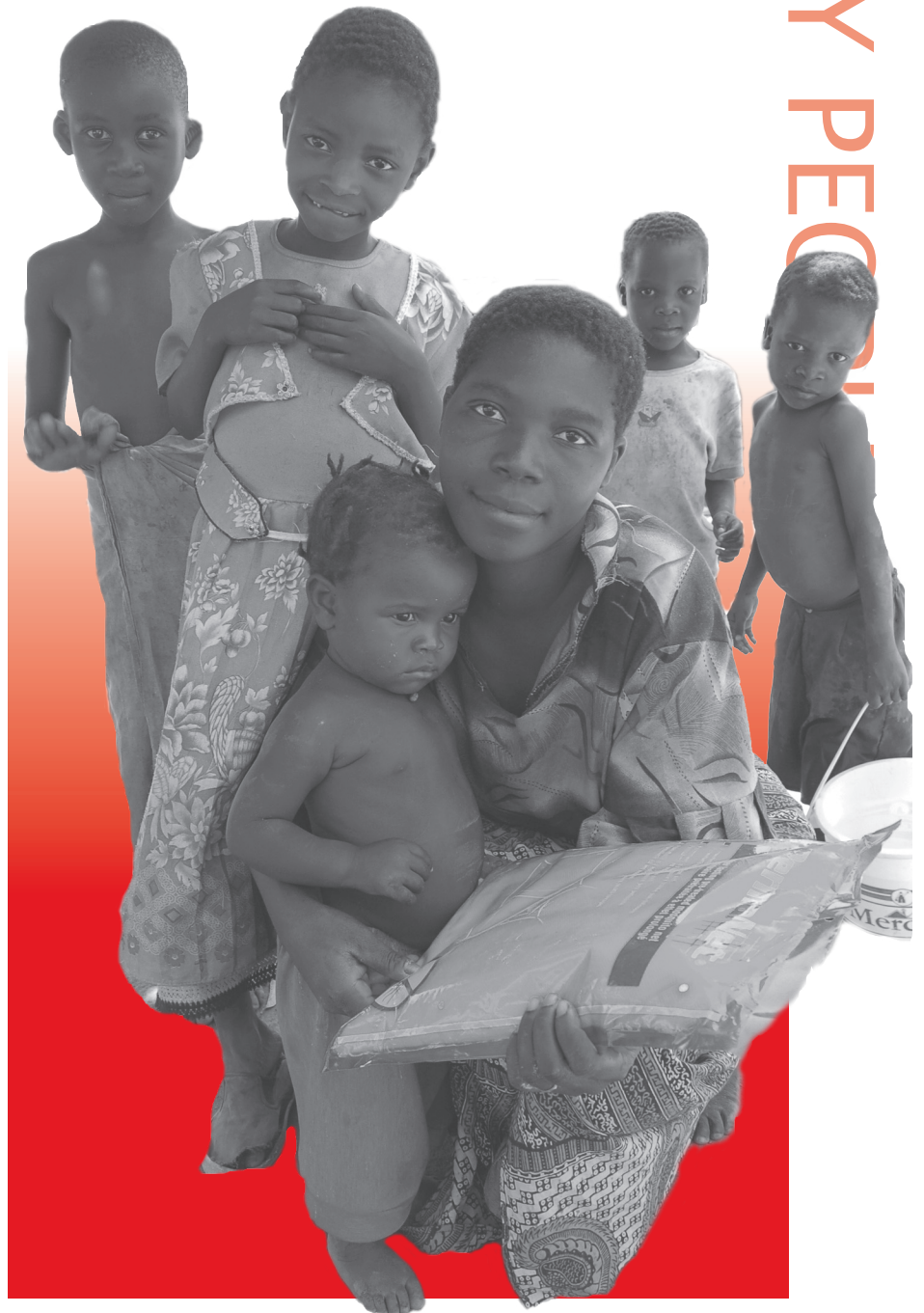
Source: MMWR, 2007;56:1237-1241; WER 30 Nov 2007, Vol. 82, 48 (pp 417-424)

Linking Routine Immunization and Malaria Prevention in Malawi

Malaria and vaccine-preventable diseases continue to cause widespread childhood illness and death in Malawi. In 2006, NCIRD teamed with the University of Malawi College of Medicine/Malaria Alert Center to launch a novel, dual-focus initiative to combat these diseases simultaneously. Implemented in two rural districts of the country, the pilot project gave children free, long-lasting insecticide-treated nets (ITNs) after they had completed their routine immunization series. The idea was that immunization sessions could be an effective venue for ITN distribution, and, conversely, the offer of free ITNs could be an incentive for families to increase timely immunization coverage for their children. ITNs were also given to pregnant women and to caretakers of children too young to complete their vaccinations.

Before this project was launched, less than 50% of children in these districts were completely vaccinated by their first birthday, and less than 30% of 1-year-olds slept under an ITN. By the end of the project, vaccination coverage in the two districts had increased to more than 60%, and more than half of all 1-year-olds were sleeping under an ITN. Over a 15-month period, more than 100,000 ITNs were distributed. *Insecticide-treated nets were donated by the Finnish and Canadian Red Cross, the Exxon Mobil Corporation, and the International American Women's Club of Geneva. The International Federation of the Red Cross coordinated the distribution.*

Not only did the project highlight the benefits of using immunization sessions as a platform for ITN distribution, it led the national Ministry of Health to fully subsidize ITNs for Malawi's most vulnerable groups. National implementation of this policy began in 2007.



Evaluating Influenza Burden Among the Poor

In developing countries, acute respiratory disease remains the most common cause of death among children under 5 years of age. Since 2004, CDC has been collaborating with the International Center for Diarrhea Disease Research in Dhaka, Bangladesh, to see how many of these deaths were caused by influenza. This ongoing study has provided the chance to examine the epidemiology of influenza among low-income urban populations and to better understand the particular virus strains circulating in the developing world.

So far, the study has found that influenza is a common cause of respiratory illness among young children in developing countries, a fact that can assist public health authorities in those countries in evaluating the benefits of flu vaccination. Researchers have also discovered that in the tropics, influenza occurs in seasonal peaks—a finding that will help improve the focus and efficiency of flu surveillance efforts as well as clinical care for children. In addition, a better understanding of the epidemiology of influenza may lead to improved prevention strategies, like a seasonal influenza vaccination program tailored to tropical settings.

During the study, NCIRD has been able to gather and characterize flu virus strains from Bangladesh to further its work as a World Health Organization Collaborating Center for Influenza. These samples will contribute to a better understanding of influenza virus evolution and global strain prevalence, and will also improve the strain selection process used in vaccine production.



Getting New Vaccines to Children in Developing Countries

Pneumonia and meningitis are major killers of young children in the developing world. For a variety of economic and other reasons, vaccines to prevent these diseases are often underutilized or unavailable. In response, NCIRD is working with partners around the world to make life-saving vaccines available to those who need them most.

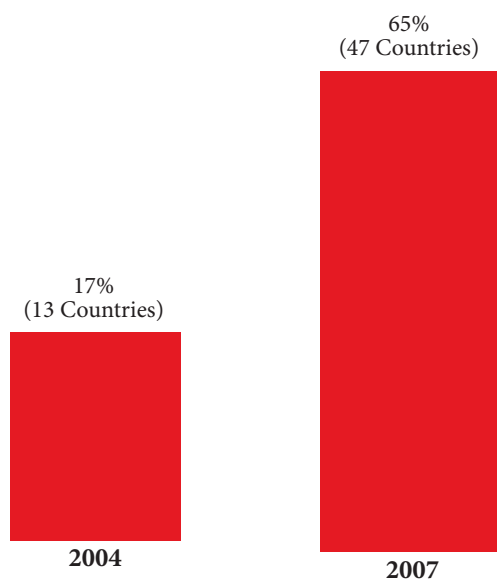
- While a vaccine targeting *Haemophilus influenzae* type b (Hib) disease has been available for years, uptake in developing countries has been slow until recently. NCIRD epidemiologists and laboratory scientists are supporting efforts in a number of these countries to establish the burden of Hib and pneumococcal diseases, documenting the impact of vaccination, and evaluating vaccination strategies.
- Around the world, millions of young lives could be saved if developing countries quickly adopted a relatively new vaccine targeting pneumococcal infections in children. In 2006, NCIRD staff coauthored several documents on pneumococcal conjugate vaccine for the World Health Organization's Strategic Advisory Group of Experts; these documents outlined policy for routine vaccine use in developing countries, alternative dosing schedules, and a target product profile for new vaccines.
- In the "meningitis belt" of sub-Saharan Africa—extending from Ethiopia in the east to Senegal in the west—bacterial meningitis is caused by *Neisseria meningitidis* serogroup A, a strain that rarely causes disease in industrialized countries, and for which there is not yet a vaccine to effectively protect young children. As part of its work with global partners to encourage the adoption of new vaccines, NCIRD has been collaborating with the Meningitis Vaccine Project (MVP) to create and test a *Neisseria meningitidis* serogroup A vaccine for Africa and other low-income regions.



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GAVI-Eligible* Countries Using or Approved to Use Hib Vaccine



* Global Alliance for Vaccines and Immunization
Source: MMWR, Vol. 57 No. 6



Better Data Management Means Better Disease Surveillance and Service Delivery

One of the major stumbling blocks for global immunization programs is lack of rapid access to accurate and complete information. To address this problem, CDC is working with the World Health Organization to develop ways to more effectively manage data, which will strengthen both organizations' global efforts to eradicate polio, reduce measles mortality, and increase routine immunization delivery. In 2007, NCIRD developed, piloted, and deployed a trio of systems for disease surveillance.

- A case-based measles surveillance computer system was deployed for the entire African region. This system will help CDC and its partners monitor the impact of programs to reduce measles mortality and also detect and respond to epidemics as quickly as possible.
- In September, a measles/rubella case-based surveillance data system for the European region was piloted in Albania and Kyrgyzstan.
- In December, a system was deployed to enhance sentinel surveillance for pediatric bacterial meningitis. It will indicate the pathogens causing the meningitis and provide data to inform decisions on vaccine policy and impact.

Building upon this effort, CDC and its partners worked to develop and deploy systems around the world to support the improvement of routine immunization service delivery. In Sierra Leone, for example, CDC worked with its partners—the national Ministry of Health, WHO, the U.N. Foundation, and DataDyne—to deploy an integrated child-survival data system in every district of the country, and also a PDA-based system to provide data on integrated, supportive supervision on the provincial level. Together, these systems aim to provide program managers with timely information on routine immunization efforts as well as malaria and diarrheal disease control. NCIRD and its partners provided training and equipment for the PDA system to six other countries in 2007, with plans to expand deployment to 15 more in 2008.

Improving Detection of Respiratory Pathogens

Every year in the developing world, nearly 1 million children die from pneumonia and other infections of the lower respiratory tract. In addition, new respiratory infections, such as SARS, have demonstrated their ability to travel quickly across international borders, creating a larger global threat.

NCIRD epidemiologists and laboratory scientists have been working with CDC partners to build a new overseas network of sites that are able to detect, monitor, and prevent severe respiratory diseases using state-of-the-art diagnostic methods. In 2007, CDC investigators traveled to Bangladesh, China, Egypt, Guatemala, Kenya, and Thailand to train site investigators, analyze data, and develop system plans. They also worked with site investigators to evaluate where patients with severe respiratory infections seek care and how many of those infections are identified by the program. In addition, CDC held a Global Disease Detection laboratory workshop that trained participants from each site on new

diagnostic methods, such as polymerase chain reaction testing and addressed challenges facing scientists in developing countries, such as obtaining critical laboratory reagents. Meanwhile, NCIRD continued developing new assays to detect respiratory pathogens and began building a bank of respiratory specimens that can be used to develop new diagnostic tests and discover new pathogens.

Monitoring New Vaccines to Prevent Rotavirus Gastroenteritis

Worldwide, diarrheal diseases are the second leading cause of childhood death—nearly 1.8 million every year. Approximately one-third (530,000) of these deaths are attributable to rotavirus. In 2006, two new vaccines for preventing severe rotavirus gastroenteritis became available and have since been introduced into national immunization programs in the United States and several countries in Latin America (Brazil, El Salvador, Mexico, Nicaragua, Panama, and Venezuela). Surveillance will be crucial to assessing the field effectiveness and impact of these new vaccines. In partnership with the World Health Organization, the Global Alliance for Vaccines and Immunization, and Program for Appropriate Technology for Health, CDC has coordinated regional surveillance networks in Asia, Africa, Europe, and the Americas. In 2007, more than 80 sites in 40 countries implemented sentinel hospital surveillance, using a standard protocol developed by CDC and its partners. Field evaluations of these guidelines are underway in El Salvador, Nicaragua, and the United States, and it is anticipated that the first data on the real-world impact of rotavirus vaccines in preventing severe gastroenteritis in young infants will be available in late 2008.

Meanwhile, data from all the surveillance sites show that rotavirus accounts for approximately 40% of diarrhea-related hospitalizations — key information for countries considering the health and economic benefits of introducing rotavirus vaccines. In addition, a global network of six reference laboratories coordinated by NCIRD has trained local microbiologists on how to characterize rotavirus strains. In 2007 alone, the CDC laboratory trained seven international investigators and analyzed viral strains from more than 1,000 rotavirus gastroenteritis cases in the United States and abroad.





EPI Olympics

In October 2007, NCIRD organized and conducted an Expanded Program for Immunizations (EPI) training course for 38 Chinese national and provincial health officials in Atlanta; in recognition of the 2008 Summer Olympics in Beijing, the training course was called the “EPI Olympics.” The first part of the course focused on strategies to achieve regional goals of measles elimination and hepatitis B control by 2012. Later, it addressed broader immunization systems issues—aiming to help China expand its routine vaccinations from six to 12 recommended antigens. Not only did the EPI Olympics give Chinese officials the chance to meet public health experts from CDC, Pan American Health Organization, and World Health Organization headquarters, they were able to meet some of their provincial colleagues, many for the first time.

Exploring A New Role for CDC in International *Bordetella pertussis* Efforts

During an international CDC-hosted meeting on *Bordetella pertussis* in July 2007, there was consensus that CDC should establish and maintain a pertussis reference laboratory for serodiagnosis and vaccine evaluation. A potential focal point for government, academic, and private sector researchers, the proposed laboratory would play a crucial role in the development, standardization, validation, and global dissemination of serologic assays for the diagnosis of pertussis.

