

## WHITHER POLIO?

**P**OLIOMYELITIS, ACUTE — *A viral infection most often recognized by the acute onset of flaccid paralysis...*

A simple definition for a disease that terrified Americans in the 1950's and continues to cause heartbreak in South Asia and Africa today. During 1950–1954, the United States' largest documented polio outbreak was reaching a crescendo, with over 58,000 cases of poliomyelitis reported in 1952 alone. In Oregon, the epidemic peaked at 520 cases in 1950 (see figure). High rates of bulbar polio in this epidemic intensified the already urgent search for a vaccine.

In 1954, an inactivated polio vaccine (IPV) developed by Jonas Salk was field tested by Thomas Francis in the largest controlled field trial ever conducted — about 1.8 million children nation-wide. Six months after completion, the results were in: IPV was as much as 90% effective against the development of paralytic polio in children. A national vaccination campaign was initiated in 1955. By 1961, when Sabin's oral polio vaccine (OPV) was introduced, polio cases were down 80% from 1956 levels, and by 1973 the rate of paralytic polio had been reduced almost 10,000-fold. The last indigenous case of polio in the United States was in August 1979.<sup>1,2</sup>

Despite its elimination in the United States, polio remained endemic elsewhere in the world. However, in May 1988 the World Health Organization (WHO) took on the job of eradicating of polio by the year 2000. This issue of the *CD Summary* outlines the progress made toward this monumental goal.

Acute poliomyelitis is caused by an enterovirus of the picornavirus<sup>†</sup> family. Polio viruses are spread through the fecal-oral route. Although they replicate primarily in the human gastrointestinal tract, all three polio serotypes can also replicate in the motor neurons of the anterior horn cells of the spinal cord, causing paralytic polio, and in brainstem cells, causing bulbar polio. No cross-immunity is generated among serotypes, though immunity to each, once developed, is life-long.

Polio is highly contagious, infecting almost all exposed susceptible persons. Approximately 90–95% of infected children remain asymptomatic. Three to five days after exposure, 4–8% of children develop a febrile disease, which resolves with no serious sequelae. Vomiting, abdominal pain, appetite loss and sore throat may also be seen in this early illness. Less than 1% of infected children develop aseptic meningitis. The 1 in 200 infected children who develop paralytic disease do not always exhibit signs of the early febrile illness. However, 10–21 days after exposure, they develop fever, muscle pain, spasms, and acute (usually within 72 hours) flaccid paralysis. This paralysis is descending, is generally asymmetric, and leaves sensory nerve function intact. The degree of residual paralysis and disability depends on the number of muscle groups affected and the intensity of subsequent physical therapy. A small proportion of paralytic cases are bulbar, with dramatically increased mortality. Post-polio syndrome, a recurrence of weakness or paralysis years after the initial illness, is

still seen in countries where polio has been eliminated.<sup>3</sup>

### ERADICATING POLIO

Polio eradication is possible because humans are its only natural reservoir, chronic carriage is extremely rare, survival in the environment is poor, and effec-

tive vaccines are available. OPV is shed from vaccinated children, allowing “transmission” of vaccine virus in areas where sanitation is poor and thereby providing additional coverage to the highest-risk children. Flooding an area with vaccine-strain virus is key to the WHO polio eradication strategy. The three main components are:

- Strong routine immunization programs;
- National Immunization Days (NIDs) and sub-national “mop-up” immunization campaigns; and
- Acute flaccid paralysis (AFP) surveillance.

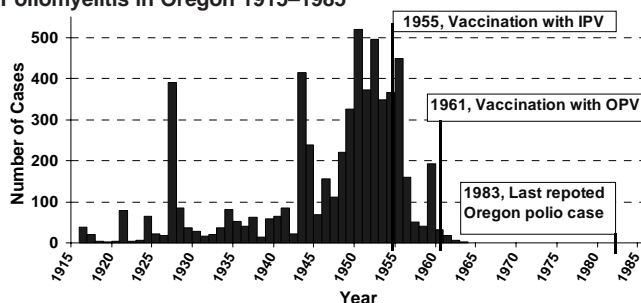
NIDs are held in endemic regions in two sets of 1–8 days, 4–6 weeks apart. The goal is to provide OPV to every child under five years old. During one NID in India, health workers and volunteers vaccinated an estimated 93 million children in one day! In addition to improving individual immunity, flooding an area with OPV allows vaccine strains to “out-compete” wild virus strains.

AFP surveillance has two main features: identifying new cases of polio and demonstrating the quality of surveillance. Timely detection is important for appropriate specimen collection (within 14 days of paralysis onset) and subsequent lab verification of polio. Also, countries must continue to demonstrate quality surveillance activities even after the last case of polio has been identified to be certain the virus has been eliminated. Polio surveillance exploits the fact that other diseases — e.g., Guillain-Barré Syndrome — can cause AFP. In the absence of polio, a given population should have at least one case of non-polio AFP per 100,000 children <15 years old per year. If AFP surveillance can detect this number of *non-polio* AFP cases, we assume that is good enough to detect polio AFP cases. Thus, the absence of new wild polio cases in the presence of a non-polio AFP rate of 1 per 100,000 children allows a country to obtain “polio-free” certification from the WHO.

Working with WHO, the Centers for Disease Control and Prevention (CDC) provide WHO with funding and technical support for eradication activities. UNICEF provides

<sup>†</sup> Get it? Pico (small) RNA virus!

Poliomyelitis in Oregon 1915–1985\*



\* During 1964–1983 cases never exceeded 1 case per year



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technical support and field workers that assist during NIDs in some countries. The International Rotary Foundation purchases vaccine for the global program. Other partners include private foundations and donor governments such as Japan and the United Kingdom. Needless to say, a high level of political commitment within each country is required for effective NIDs and AFP surveillance.

The Western Hemisphere was certified to be free of indigenous wild polio virus in 1994.<sup>4</sup> AFP surveillance has been discontinued in the United States, though polio is still reportable. As of January 1, 2000, the U.S. vaccination schedule includes only IPV. Although we'll forego the lasting immunogenicity of OPV, switching to IPV makes sense in the U.S., because one in 2.4 million doses of OPV causes paralytic polio. In endemic areas, this risk is much lower than that of contracting paralytic wild polio. However, after the virus has been eliminated, the chance of acquiring wild polio is so minute that OPV's benefits are outweighed by the very small risk of vaccine-associated paralysis. Until global eradication is successful, high levels of IPV coverage in the U.S. are needed to guard against the reintroduction of polio. After eradication, the necessity for polio vaccination will cease, yielding a projected global savings of 1.5 billion dollars per year.

The global eradication program's successes are exciting (see figures): wild polio has been eliminated from the Western Hemisphere, the Western Pacific<sup>5</sup>, and most of Europe. But trouble spots still exist. On Hispaniola, lapses in vaccination rates left the door open for a reverted vaccine strain to cause an outbreak.<sup>6</sup> In India, the

case counts are still high; and in parts of Sub-Saharan Africa, civil wars have devastated health services and caused massive population migrations. However, progress continues. Ceasefires in Sierra Leone, Afghanistan and elsewhere have allowed health workers to proceed with NIDs. Cold chain improvements have helped strengthen other routine immunization programs. Polio cases worldwide have decreased from over 35,200 cases in 1988 to about 6,900 cases in 1999, and AFP surveillance has markedly improved over this period. While we did not achieve our goal of global polio eradication by the year 2000, we expect to see the end of this devastating disease within the next five years.

#### REFERENCES

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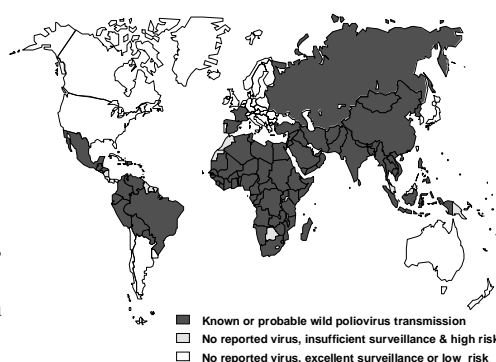
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### Measles re-appears

Measles has recently been confirmed in a 1-year-old Washington County child who developed a rash on January 5. Please recall the 3 C's of cough, coryza, and conjunctivitis, and report any suspicious rashes to your local health department promptly. Health-care workers are at elevated risk of measles, given the tendency of patients to seek health care. We encourage you to review the immunization status of yourself and any of your staff likely to encounter patients. Acceptable presumptive evidence of immunity includes any of the following:

- documented administration of 2 doses of live measles virus vaccine;
- laboratory evidence of immunity;
- birth before 1957; or
- documentation of physician-diagnosed measles.

Global Polio 1988<sup>7</sup>



Global Polio 1998<sup>7</sup>

