

Appreciation -
 Vary different pictures from one which is still as optimistic. really wanted water & cdc.
 (Altho I ~~was~~ am usually thought of as a spox mission)

PLU PAPER
 Poland.gregory@mayo.edu
 NEWS SHEET

**Polio Eradication 2006
 a Faded Dream**

Mayo Clinic

July 11, 2006

D.A.Henderson, MD, MPH
 Center for Biosecurity
 U. Of Pittsburgh Medical Center

A need to reconsider priorities

- Polio eradication is 20 years old
 Began -- 1985 in the Americas and globally in 1988
- Expenditures to date
 - International assistance \$4,000,000,000
 - National budget costs \$4,000,000,000+
 - 20+ times the total cost of smallpox eradication
- Needed for eradication (if all goes well)
 - At least \$1,500,000,000 in international costs and a comparable national expenditure
- Original target -- 2000; now -- 2010

- "We cannot refrain from examining the roots of this controversy if only because of the extreme views for and against eradication have exerted and are still exerting a highly detrimental influence on public health practice,"
 Yekutieli, 1980

Global Eradication Campaigns

*Hookworm	Sanitary treatment	1909-22	13
*Yellow Fever	Vector control	1915-32	17
*Yaws	Penicillin	1948-66	18
*Malaria	DDT treatment	1955-73	18
Smallpox	Vaccine	1967-80	13
Guinea Worm	Water: Rx	1986-	20+
Poliomyelitis	Vaccine	1988-	18+
*Failed			

**Polio-Prevaccination Era:
 magnitude of the problem**

- U.S.
 - Pre-1941 -- <5000 paralytic cases/yr.
 - 1941-51 -- 5000-15,000 paralytic cases/yr.
 - 1951 (peak) -- 21,269 paralytic cases
- Developing countries
 - 1970 Not recognized as a significant problem
 - 1988 350,000 cases (estimated)
 - Not in the same league as measles, malaria, tuberculosis and a variety of diarrheal and respiratory problems

Development of Polio Vaccines

- 1948 Tissue cell culture of poliovirus
- 1955 Inactivated poliovaccine -- IPV (Salk)
- 1962 Live oral poliovaccine -- OPV (Sabin)

Characteristics – IPV and OPV

	IPV	OPV
Admin.	Needle	Oral
Cost	\$1 to \$2	8 cents
95% protection	2 (3+)	3 (4-6)
Oral immunity	++++	++++
Intest. immunity	+	++++
Spread in house	0	++++
Use in epidemic	No	Yes

- If smallpox could be eradicated, why not polio? After all, there is a preventive vaccine for both and neither has an animal reservoir

Smallpox—much easier to eradicate

Smallpox

■ Surveillance-Containment

- Visible rash – all cases
- Readily diagnosed
- Minimal demand for lab
- Targeted containment

■ Epidemiology

- Transmission only by cases
- Moderately contagious

Polio

- 1/200 with paralysis
- Flaccid paralysis problem
- Heavy lab demand
- Area-wide campaigns

- Primarily by asymptomatic
- Very contagious

Attributes of Smallpox and Polio Vaccines

Smallpox

- Heat stable
- Production in endemic countries
- One dose
- Protects-all strains
- Easily stored for 45+ years

Polio

- Labile
- No
- 5+ OPV: 4+ IPV
- 3 vaccine strains
- c. 5 years

Polio eradication strategy

- Mass vaccination – OPV– 0 to 4 years
 - National immunization days
- Surveillance for acute flaccid paralysis
 - Clinical evaluation and stool specimens from all cases within 14 days
- Vaccination in area of case
- “Mop-up” vaccination
- Principle – industrialized countries will pay

Polio eradication landmarks

- 1985 - Program launched in the Americas
- 1988 - Global program launched
- 1991 - Last cases in the Americas
- **Expected occurrence of last case**
 - 2000 (original target)
 - Revised annually since 1999
 - 2007 (last revised in 2006)
- **“Expected” certification of eradication – 2010**

Countries with polio - 2006

- No. of confirmed cases ^a 636
No. of infections 127,200
- Land area (population) of polio endemic countries
Eight countries** 4,888,000 sq.mi (1,613,800,000)
USA (48 states) 3,173,000 " (279,583,000)
** India, Pakistan, Afghanistan, Nigeria, Indonesia, Yemen, Sierra Leone
- Countries that are possibly endemic
Dem Rep of Congo 905,400 " (53,625,000)
Ethiopia (20 cases) 437,000 " (65,892,000)

^a WHO data as of 27 June

Two Critical Poliovaccine Problems

Unknown in 1988

- Poliovaccine virus can be excreted for years
 - 28 cases excreted >6 months: 4 cases, >3 years
 - One case with 22 years excretion:
 - High titer
 - Virulent in monkeys
 - Resistant to antiviral therapies
- Poliovaccine virus can revert to virulence
 - Several outbreaks of paralytic disease
 - Egypt, Hispanola, Madagascar, Philippines, Egypt, Indonesia
 - Silent Spread for 2 to ? years

End Game Strategy

- Continuing National Immunization Days throughout developing countries through 2007
 - Stop global transmission by December, 2007
- Certification surveillance – 2008-2010
 - IPV to be used in many industrialized countries
 - OPV to be used in developing countries
 - Sequester all possible poliovirus
- December 2010 – stop all OPV vaccination:
IPV to continue in use in industrialized countries

WHO Plans to Contain the Virus

- Inventory all labs throughout the world re: fecal, throat or environmental specimens that might contain poliovirus or poliovaccine virus
- When transmission is stopped (2007), materials to be destroyed or transferred to BSL3 lab
- IPV production plants to be refitted as BSL3 or new strains of virus to be used (2010+)

Provision of vaccine in the post-eradication era

- IPV is not an option for developing countries
 - Cost
 - Lack of household spread would require far more intensive programs using needles and syringes
 - Lack of intestinal immunity is primarily fecal-oral in developing countries. IPV permits spread of wild or OPV strains
- If polio were again to spread, where would the needed large quantities of OPV come from?
 - Production and storage pose serious problems
 - Standby production capacity is expensive to maintain

Confidence in surveillance

- How certain can one be that transmission has stopped?
 - Many countries with large areas of limited surveillance
 - Congo, Cote d'Ivoire, Angola, Ethiopia, Afghanistan
 - Sudan, with good surveillance indicators discovered in
 - 2005 – Type 1 strains from 3 years previously
 - Type 3 strains from 4+ years previously
 - Long-term OPV excretors
 - 28 are known but most excretors have no symptoms
 - Silent OPV transmission to start outbreaks
 - Five outbreaks now documented

Sources for Reemergence

- Polio diagnostic and research laboratories
- Other laboratories with stool specimens
- Areas where surveillance is limited or impossible
- IPV production laboratories
- Revertent OPV Polio Strains
- Long Term OPV Carriers
- Biological weapons laboratories

- *If, in 2010, WHO announced that polio was eradicated, would you, Mr. Minister of Health, be willing to stop polio vaccination in your country?*
- Considerations
 - Surveillance, at best, would still be incomplete.
 - Silent excretors or lab escape remain a source
 - When vaccination is stopped, population immunity, in 4 years, would be the same as before vaccination began
 - Studies show that poliovirus spreads rapidly, making large-scale containment necessary. If an outbreak were to occur, could vaccine be obtained quickly enough? Could the health staff respond rapidly enough?

A political and ethical dilemma

- A question from the MOH of a developing country to those in the industrialized world
 - If you are so confident that polio has been eradicated, why are you continuing to vaccinate with IPV?

Summary observations

- Many cases of polio have been prevented.
- In some parts of the world, polio eradication efforts have strengthened EPI as was intended
- The costs have been considerable
30 times more than was spent for smallpox
- Achievement of eradication is unlikely, but, even if successful, unable to be certified

Next steps

- Plan now to sustain a long-term control program utilizing both IPV and OPV, as appropriate, in the all but certain circumstance that eradication is not achieved
- Devote both energy and resources to strengthening the Expanded Programs of Immunization in all countries with special emphasis on measles and DPT vaccines

What next do we eradicate?

What are the most critical disease challenges that can be effectively controlled?