

The Siren Song of Eradication

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- *"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

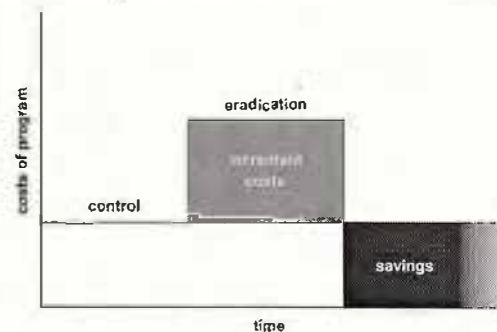
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*"Any disease that can be prevented in part,
can be prevented in its entirety."*

Charles Chapin, 1888

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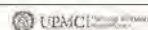


Global Eradication Campaigns

Disease

*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-	19+
Poliomyelitis	Vaccine	1988-	17+
*Failed			

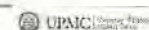
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Smallpox Program Strategy -- I

- Vaccination of 80% of population
- Exclusive use of freeze-dried vaccine
 - Heat stable
 - One dose
 - Protects against all strains
 - Vaccine does not revert to become more virulent
 - International quality control
 - Production in endemic countries
 - Easily stored for 45+ years

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Smallpox Program Strategy -- II

- Surveillance-Containment
 - Very feasible
 - Visible rash – all cases
 - Easily diagnosed –lab not needed
 - No longterm carriers
 - Only moderately contagious
 - Methodology
 - All hospitals/health centers report weekly
 - Containment teams investigate promptly and contain outbreaks by vaccination

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Smallpox eradication landmarks

- 1967-- Launch of global campaign
 - 10 to 15 million cases (2 million deaths)
 - 43 countries report cases (31 endemic)
- 1970-- Last cases in the Americas
- 1975-- Last cases in Asia
- 1977-- Last cases in the World
- 1980-- Certification of eradication
 - International contributions \$ 98 million
 - National expenditures \$ 200 million
 - Estimated annual savings \$ 1350 million

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What next to eradicate ?

- Symposium National Institutes of Health-1980
 - Keynote speakers—Henderson, Fenner
 - Some proposals
 - Poliomyelitis
 - Measles
 - Urban Rabies
 - Hunger
 - Schistosomiasis
 - Guinea worm

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What next to eradicate ?

- Symposium National Institutes of Health-1980
 - Keynote speakers—Henderson, Fenner
 - Some proposals
 - Poliomyelitis – the next easiest to eradicate
 - Measles
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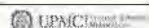
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Polio-Prevaccination Era How serious a problem?

- United States
 - Pre-1941 --<5000 paralytic cases/year
 - 1941-51 -- 5000-15,000 paralytic
 - 1951 -- 23,000 paralytic
- Developing countries
 - Not a recognized problem until 1970s
 - Not high priority among infectious diseases

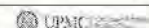
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Development of Polio Vaccines

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

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Comparison -- Smallpox and Polio

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

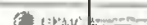
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Characteristics -- IPV and OPV

	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

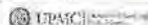
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Polio eradication landmarks

- 1985 - Program launched in the Americas
- 1988 - Global program launched
- 1991 - Last cases in the Americas
- **Expected occurrence of last case**
 - 2000 (original target)
 - 2002 (revised in 1999)
 - 2005 (revised in 2002)
- **"Expected" certification of eradication -- 2008**
 - International expenditures -- >\$3,000 million
 - National costs -- \$3,000 million+

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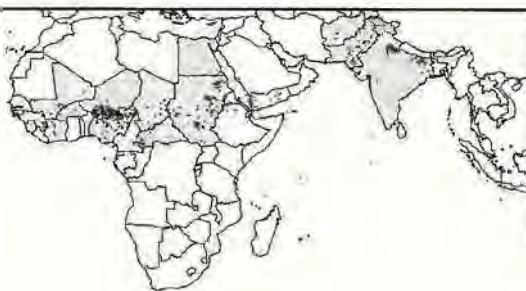
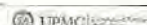


Two Critical Poliovaccine Problems

Unknown in 1988

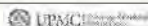
- Poliovaccine virus can be excreted for years
 - More than 20 cases with excretion >1 year
 - One well studied case with 22 years excretion:
 - High titer
 - Virulent in monkeys
 - Resistant to antiviral therapies
- Poliovaccine virus can revert to virulence
 - Several outbreaks of paralytic disease
 - Egypt, Hispanola, Madagascar, Philippines
 - Silent Spread for 2 to 7 years

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Polio Cases -- May 2002--May 2005 (WHO)

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Status of polio -- 2005

- No. of confirmed paralytic cases: thro April 386
No. of infections 77,200
- Land area (population) of the polio endemic countries (WHO)*
 - in Africa (9 countries) 4,207,000 miles² (290,268,000)
 - USA (48 states) 3,173,000 (279,583,000)
- Countries that are possibly endemic
 - Dem Rep of Congo 905,400 (53,625,000)
 - Yemen 182,000 (18,878,000)
 - Ethiopia 437,000 (65,892,000)

* Endemic or where transmission has become reestablished (WHO)

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End Game Strategy

- National Immunization Days throughout endemic areas in 2005
 - Infected areas of Africa, Asia
 - Stop global transmission by December
- Certification surveillance – 2006-2008
 - IPV used in many industrialized countries
 - OPV used in developing countries
 - Sequester all possible poliovirus
- December 2008 – stop all OPV vaccination; IPV vaccination probably to continue in industrialized countries

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Virus Sources for Reemergence

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

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- *If, in 2008, WHO announced that polio was eradicated (3 years after last known case), would you as Minister of Health stop all polio vaccinations?*
- Considerations
 - Surveillance, at best, would still be incomplete. There is no reason to believe it will improve over the years ahead
 - Silent excretors or lab escape will remain a possibility
 - Once vaccination is stopped, population immunity, in 4 years will be the same as it was 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?

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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
 - Over \$3,000,000,000 in international expenditures
 - Perhaps twice this amount spent by national governments
 - 30 times more than was spent for smallpox
- Likely achievement of eradication remains very uncertain

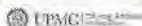
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Sensible next steps

- Plan now to sustain a longterm control program utilizing both IPV and OPV, as appropriate, in the not unlikely circumstance that eradication is not achieved
- Initiate an intensive research program to develop OPV strains that will not revert to virulence.
- Devote both energy and resources to strengthening the Expanded Programs of Immunization in all countries with special emphasis on measles and DPT vaccines

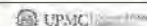
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What next ~~do we~~ eradicate?

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

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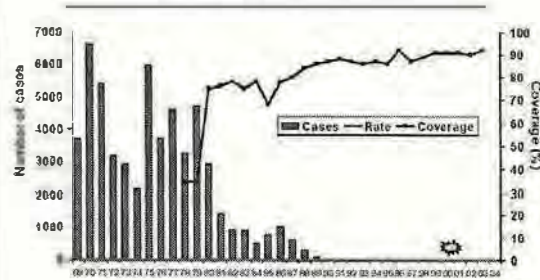
Immunization in the Americas

- Polio eradication – an emphasis in the first phase of the broader Expanded Program on Immunization
- 1977 – limited immunization
 - ~ 10-15% coverage – DPT, polio, BCG, measles
- 2005 – Ten antigens
 - >90% coverage -- DPT, polio, BCG, measles, rubella, H. influenza b
 - Yellow fever in endemic and at risk areas
 - Hepatitis B in high risk areas
- Vaccine expenditures/ year – \$2,000 million – 95 % from national budgets

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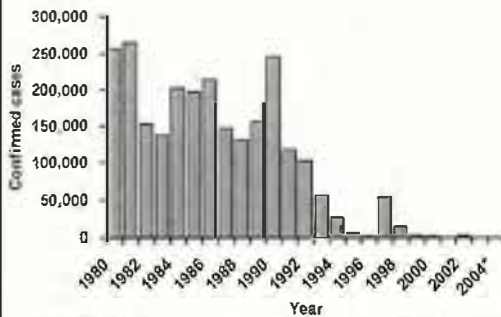
Number of Reported Paralytic Poliomyelitis Cases and OPV3 Coverage in Children <1 Year of Age Region of the Americas, 1969-2004*



* Type 1 vaccine derived virus in 2008 and 2001: 21 cases

* Data as of 27 August 2004

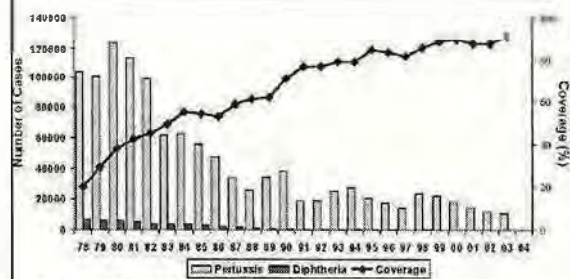
Measles Cases—The Americas, 1980-2004



* As of October 23

Source: Country reports

Number of Reported Diphtheria and Pertussis Cases and DPT3 Coverage in Children <1 Year of Age Region of the Americas, 1978-2003



* Data as of June, 2004

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Number of confirmed rubella cases Regions of the Americas, 1998 and 2004



*Data as of 23 October, 2004

Horizons for disease control—remarkable !

- Malaria
- HIV
- Tuberculosis
- Schistosomiasis
- Hookworm
- Hepatoma
- Cervical Cancer
- Gastric Cancer
- PCVD

Eradication ? An antiquated concept.

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As it should have been

- In the Americas, polio eradication was a chapter not a book
- Since 1980, under 5 year mortality rates have decreased at rate of 3 – 4 %/ year
 - Unprecedented decrease
 - Fertility rate has paralleled this