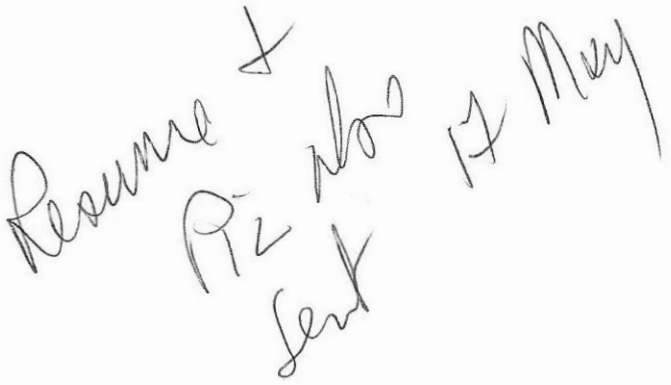
Galveston conference in November 2004—200 word summary (D.A.Henderson)

Over the past two decades, the concept of disease eradication has become, for some, a fixation, a Holy Grail, that has shaped important international health policies and the allocation of substantial health resources. Rational debate regarding the merits of control vs. eradication has been difficult. This, more than ever, is now sorely needed.

The contemporary impetus for disease eradication dates from May 8, 1980 when smallpox was declared to have been eradicated. It was a dramatic success for WHO and a tribute to the benefits of international collaboration. The total cost, in international assistance, was just under $100 million for a program that began in 1967. Within months after the declaration of smallpox eradication, numerous candidate diseases were proposed for eradication. Two, eventually were decided upon by the World Health Assembly – poliomyelitis and Guinea worm disease. Global polio eradication began in 1988. The target date for its achievement was 2000, now postponed to at least 2007. International assistance costs are approaching $4 billion. Guinea worm eradication began about the same time with a similar target date but, like the polio campaign, the end is not yet in sight although dramatic progress has been made.

It is important that we now explore the question of what next should be targeted for eradication.



Role of Eradication in Disease Control

DA Henderson, MD, MPH
McLaughlin Symposium
University of Texas at Galveston

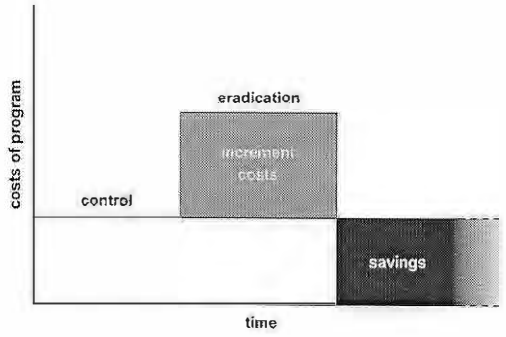
November 12, 2004

"It now becomes too manifest to admit of controversy, that the annihilation of the Small Pox, the most dreadful scourge of the human species, must be the final result of this practice."

Edward Jenner, 1801

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

Charles Chapin, 1888



Global Eradication Campaigns

Disease	Method	Duration	Years
***Yellow Fever**	Vector control	1915-32	17
***Yaws**	Penicillin	1948-66	18
***Malaria**	DDT	1955-73	18
Smallpox	**Vaccine**	**1967-80**	**13**
Guinea Worm	Water: Rx	1986-	18+
Poliomyelitis	**Vaccine**	**1988-**	**16+**

***Failed**

Reflections on Eradication

"Eradication involves a new biological philosophy. It implies that it is possible and desirable to get rid of certain disease problems by eliminating completely the etiological agents, once and for all...

Eradication programs will eventually become a curiosity item on library shelves, just as have all social utopias."

Man Adapting, Rene Dubos (1965)

Smallpox eradication highlights

- 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**

Smallpox Epidemiology

- Surveillance-Containment
  - **Visible rash – all cases**
  - **Easily diagnosed**
  - **Minimal lab demand**
  - **Targeted containment**
- Epidemiology
  - **Transmitted only by clinical cases**
  - **No long-term carriers**
  - **Moderately contagious**

Smallpox Vaccine-attributes

- Vaccine
  - Heat stable
  - Production in endemic countries
  - One dose
  - Protects against all strains
  - No reversion to virulence
  - Easily stored for 45+ years

Comparison -- Smallpox and Polio

Smallpox	Polio
Surveillance-Containment	
Visible rash – all cases	1/200 with paralysis
Readily diagnosed	Flaccid paralysis problem
Minimal demand for lab	Heavy lab demand
Targeted containment	Area-wide campaigns
Epidemiology	
Transmission only by cases	Primarily by asymptomatic
Moderately contagious	Very contagious

Smallpox and Polio Vaccines

Smallpox	Polio
Heat stable	Labile
Production in endemic countries	No
One dose	5+ OPV: 4+ IPV
Protects-all strains	3 vaccine strains
Easily stored for 45+ years	? years

Polio eradication landmarks

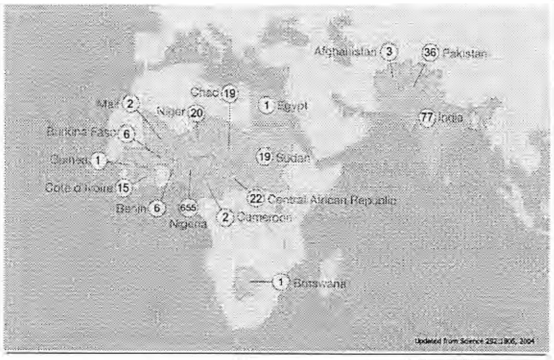
- 1985 - Program launched in the Americas
- 1988 - Global program launched
- 1991 - Last cases in the Americas

- **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+

Confirmed Wild Poliovirus Cases - 2004



Center for Biosecurity

African countries with polio--2004

- Land area of the 13 African countries
  4.730 million miles^2 (pop. 323 million*)
- Land area of contiguous 48 US states
  3.054 million miles^2 (pop. 284 million*)

* 2001 estimated population

Center for Biosecurity

Two Critical Poliovaccine Problems

Unknown in 1988

- **Poliovaccine virus can be excreted for many 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 ? years

Center for Biosecurity

Confining the 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

Center for Biosecurity

A view of the Americas is pertinent but still a little known

What next ~~do we~~ eradicate?

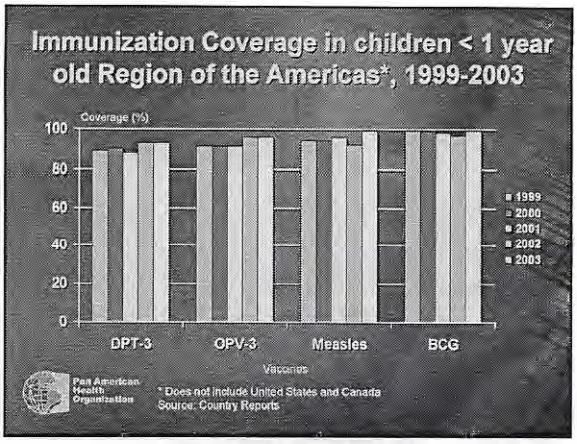
What are the most critical disease challenges that can be effectively controlled?

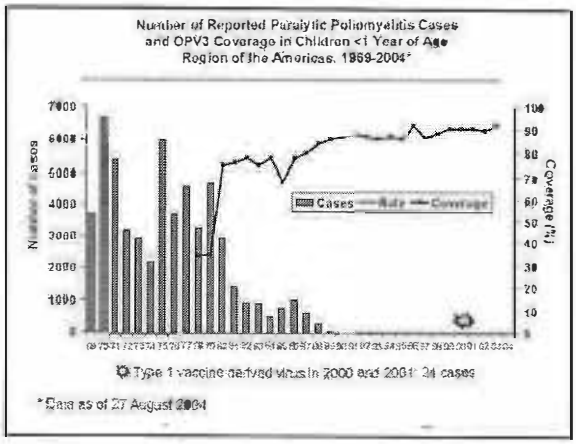
Center for Biosecurity

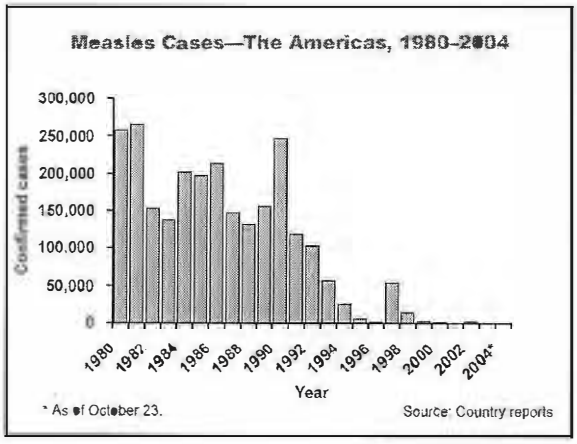
Immunization in the Americas

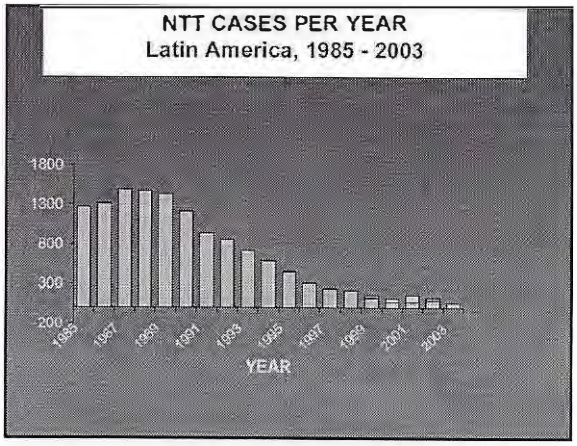
- Polio eradication – a first paragraph in a chapter (by-product)
- 1977 – Limited immunization
  - ~ 10-15% coverage – DPT, polio, BCG, measles (a catalytic element)
- 2004 – Ten antigens
  - >90% coverage -- DPT, polio, BCG, measles, rubella, H. influenzae b
  - Yellow fever in endemic and at risk areas
  - Hepatitis B in high risk areas
- Vaccine expenditures/ year –
  $2,000 million – 95 % from national budgets

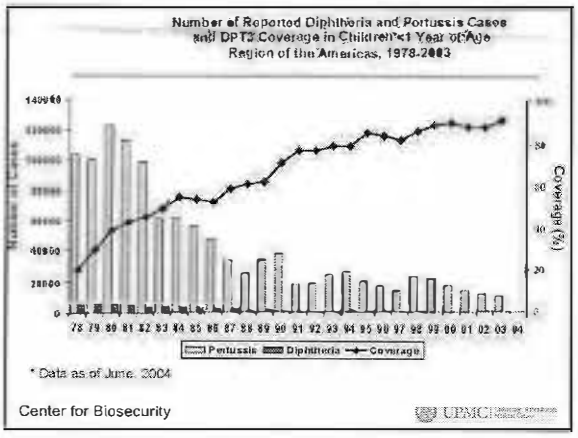
Center for Biosecurity

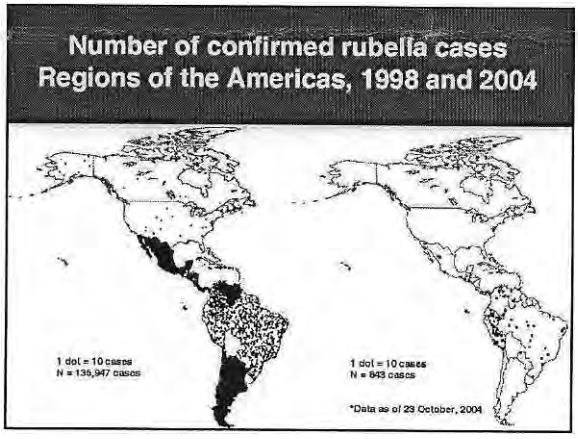

Immunization Coverage in children < 1 year old Region of the Americas*, 1999-2003
Coverage (%)
100
80
60
40
20
0
DPT-3
OPV-3
Measles
BCG
Vaccines
1999
2000
2001
2002
2003
Pan American Health Organization
* Does not include United States and Canada
Source: Country Reports


Number of Reported Paralytic Poliomyelitis Cases and OPV3 Coverage in Children <1 Year of Age Region of the Americas, 1969-2004*
Number of cases
Coverage (%)
Cases
Rate
Coverage
Type 1 vaccine-derived virus in 2000 and 2001: 34 cases
* Data as of 27 August 2004


Measles Cases—The Americas, 1980-2004
Confirmed cases
300,000
250,000
200,000
150,000
100,000
50,000
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004*
Year
* As of October 23.
Source: Country reports


NTT CASES PER YEAR
Latin America, 1985 - 2003
1800
1300
800
300
-200
YEAR


Number of Reported Diphtheria and Pertussis Cases and DPT3 Coverage in Children <1 Year of Age Region of the Americas, 1978-2003
Number of Cases
Coverage (%)
Pertussis
Diphtheria
Coverage
* Data as of June, 2004
Center for Biosecurity
UPMC


Number of confirmed rubella cases Regions of the Americas, 1998 and 2004
1 dot = 10 cases
N = 135,947 cases
1 dot = 10 cases
N = 843 cases
*Data as of 29 October, 2004

Horizons for disease control— remarkable !

- Malaria
- HIV
- Tuberculosis
- Schistosomiasis
- Hookworm
- Hepatoma
- Cervical Cancer
- Gastric Cancer
- ?CVD

Eradication?

Center for Biosecurity UPMC

Summary: American polio erad. was only a chapter in a continent wide vaccine & effort an effort to establish a vaccination infrastructure

<5 mortality rate since 1980
3-4%/year
unprecedented decrease for any region in the world
not all vaccines.