

Smallpox: Death of a Disease

...an historic saga

D.A. Henderson MD, MPH

Center for Biosecurity
Professor of Medicine and Public Health, U. of Pittsburgh
Dean Emeritus, Johns Hopkins School of Public Health

Oberlin College

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For perspective

"There has been no greater medical – or humanitarian – miracle in modern times than the eradication of smallpox... it offers a winning blue print for the great medical challenges to come."

David Oshinsky – Winner of the 2006 Pulitzer Prize in History

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World's 5 most important historic sites

(from BBC World History Series, Oct. 2012)

- Yellow River, China
- Great African Rift Valley
- Athens, Greece
- Los Alamos, New Mexico
- ?

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Smallpox in history

- Last case –1978
- Most serious of the pestilential diseases
- Ramses V and three other mummies died of smallpox 3500+ years ago
- Smallpox gods in Asia and Africa
- Massive numbers of deaths in Amerindians changed the course of European settlement
- Abraham Lincoln and the Gettysburg address

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Sitala Mata



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Smallpox in the 20th century

- Deaths – 300,000,000 died
- NYTimes: 120,000,000 died directly or indirectly as a result of armed conflict
- Compulsory vaccination in the U.S. until 1972
Last case in U.S. – 1949
- International travelers carried a "yellow booklet" documenting vaccination in past 3 years

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Summary of presentation

- Smallpox – the disease
- Landmarks of the program
- Strategies
- The legacy of the smallpox campaign
...not polio eradication

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Smallpox – clinical features

- Severe virus disease
- Transmission by face-to-face contact
- Incubation period – 10-12 days
- Fever, flu-like symptoms then rash
- No therapy available
- Survivors scarred for life; many were blind

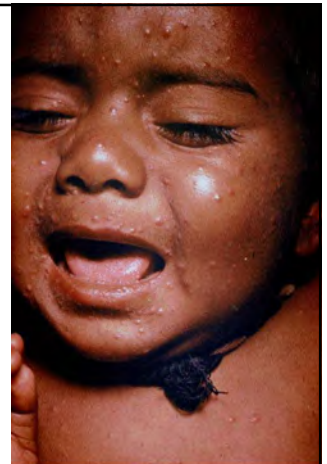
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Day 1



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Day 3



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Day 5



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Day 9



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Global Eradication Campaigns

*Hookworm	Treatment	1909-22	13
*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-	26+
Poliomyelitis	Vaccine	1988-	24+
*Failed			

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Characteristics favoring eradication

- Man -- the only host
- Virus spread -- only during rash
- Permanent immunity after recovery
- Transmission stops in remote areas
- Vaccine is easy to administer
- One dose provides long-lasting protection

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Landmarks in smallpox eradication

- 1958 Soviet Minister proposes smallpox eradication
 - U.S. was supporting malaria eradication
- 1966 U.S. joins USSR to propose intensified effort
 - World Health Assembly agrees by 2 votes
 - A 10 year goal is established
 - A Chief Medical Officer for smallpox is named

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The challenge

- Global status of smallpox -- 1967
 - >10,000,000 cases
 - 2,000,000 deaths
 - 43 countries reported cases
- WHO smallpox program
 - Budget -- \$2.4 million and hope for donations
 - Headquarters -- 4 medical; 2 admin; 3 secretaries
 - Never more than 150 international staff

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The strategy

- Vaccination
 - Target: 80% of population
 - Heat-stable vaccine
 - Quality control
- Surveillance-containment
 - Report every week from each health center
 - Team to investigate and do "ring vaccination"

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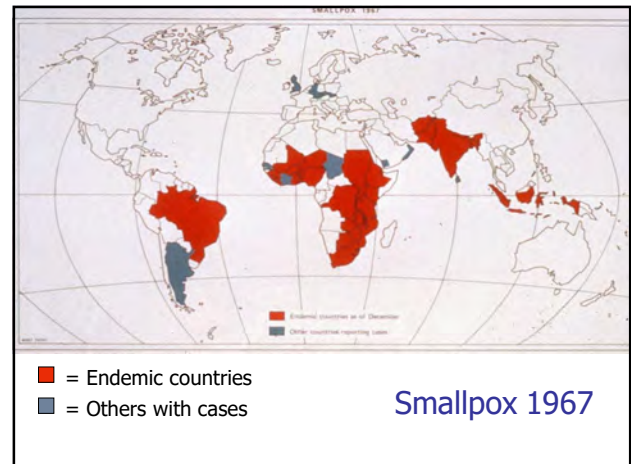
A new technique for vaccination

- Need for a more rapid, effective method
 - Traditional
 - scratch through a drop
 - Bifurcated needle—multiple puncture method*
 - One-fourth as much vaccine required
 - Training time -- 15 minutes
 - Easily sterilized and reused
 - Cost -- \$5 per thousand

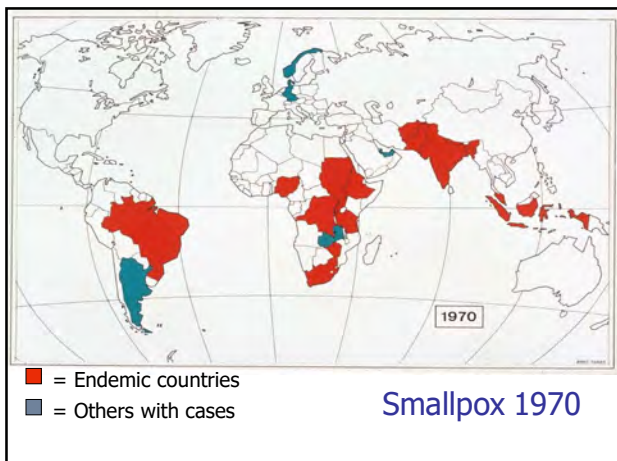
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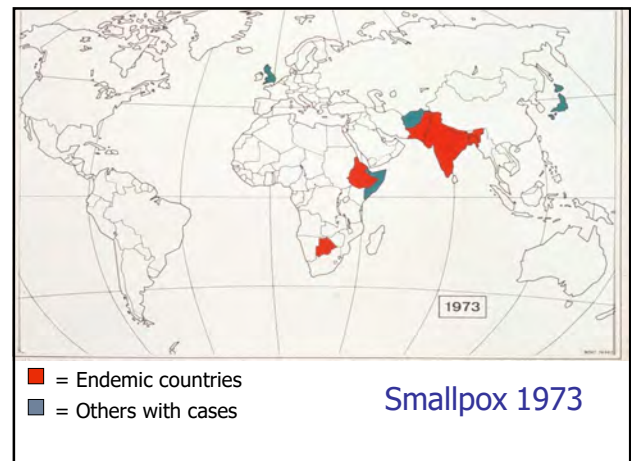
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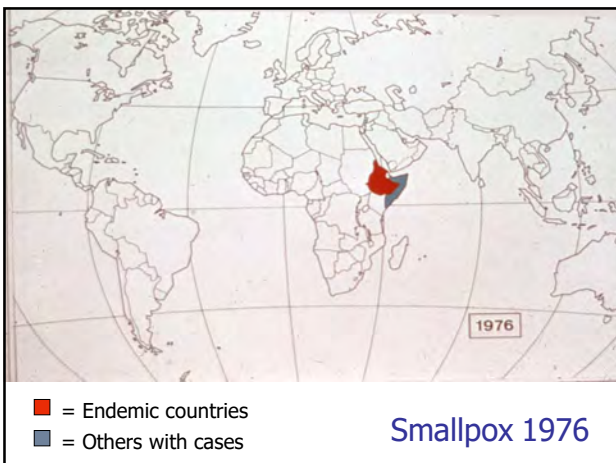
A new strategy – June 1973

- Search every village in India in 10 days
 - 120,000 health staff
 - Containment teams to go to every outbreak
 - By the third round, every house was being visited
- Catastrophic problems Jan. to May 1974
 - Gasoline crisis
 - Railroads, airlines, health workers on strike
 - Worst floods in three decades
 - India detonates an atomic weapon—May 1974

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The last stronghold Ethiopia and Somalia

- Ethiopia:
 - Twice the size of Texas; mostly over 5000 feet
 - Health facilities reached 5% of 30 million people
 - Travel largely by mule and on foot
- Scenario
 - Emperor is assassinated; Marxist take-over
 - No foreign staff allowed out of Addis
 - Civil war, floods, famine, kidnapping, hostages
- Somalia: the final chapter

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Ali Maalin - 26 October 1977

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The beginning of “the vaccine era”

- The genesis -- smallpox eradication
 - African teams averaged 500 vaccinations/day
 - One year: 400,000 vaccinations by 4 person team
 - Nation-wide smallpox elimination programs--workable even in the least developed countries
 - 1970 WHO meeting – why not give other vaccines

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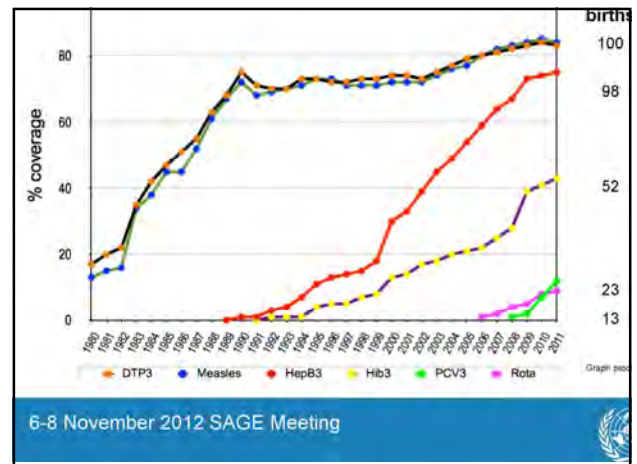
WHO begins Expanded Program on Immunization (EPI) 1974

- A global program to reach all children -- smallpox, measles, DPT, polio, BCG
- UNICEF and Rotary make this a high priority
- Target for 1990 – 80% coverage globally
 - Coverage in 1974 was about 15%

To some – “the beginning of the Vaccine Era”

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EPI in the Americas a stunning record of success

- Ten vaccines now in continent-wide use
 - >95% of purchase costs from government funds
 - Vaccine production facilities in Mexico, Brazil, Cuba, U.S., Canada
- Surveillance units reporting weekly (electronic)
 - 500 in 1975 when program began
 - > 40,000 in 2011

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EPI – notable landmarks in the Americas

- Polio elimination began in 1985
 - An intrinsic part of EPI; not a separate program
 - Last case in 1991
- Measles elimination achieved in 2001
- Rubella elimination achieved in 2008

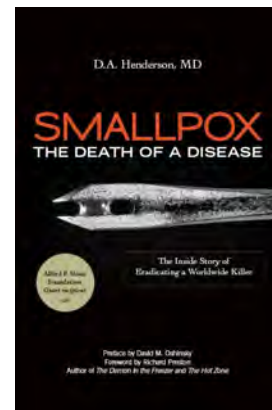
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Coda

- From *Smallpox: death of a Disease*:

"We are only beginning to realize the potential of public health...It is a field begging for fresh, resourceful ideas and *a new generation of professionals who are not constrained by 'knowing' what can't be done*. So it was with so many who contributed so much to making smallpox eradication a possibility."

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