

Conquering Smallpox

.....the history and the lessons

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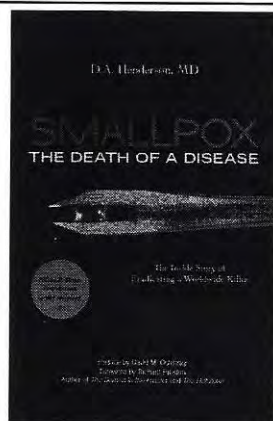
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Chair's Lecture Series

2 February 2011

Summary of presentation

- Smallpox, the disease
- Eradication strategy and progress
- Legacy of the program



"There has been no greater medical – or humanitarian – miracle in modern times than the eradication of smallpox... This book is more than a riveting account of the day-to-day struggle for international cooperation in a divided world; it offers a winning blue print for the great medical challenges to come."

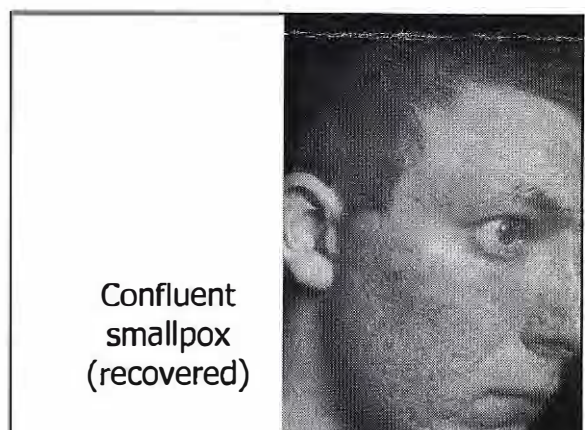
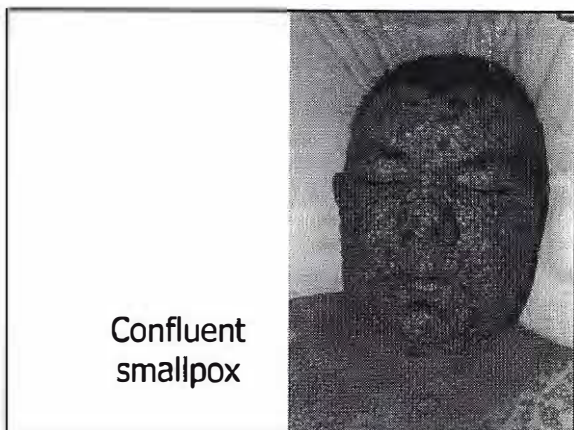
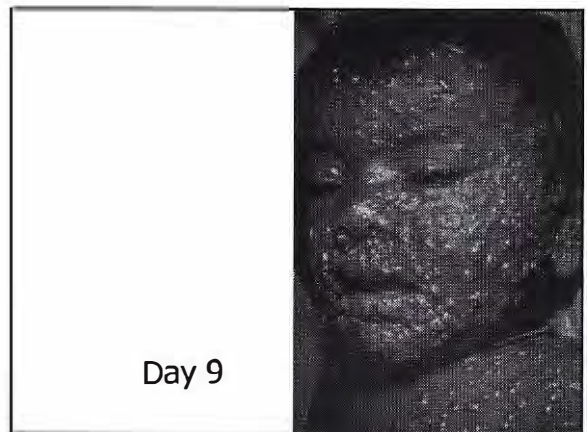
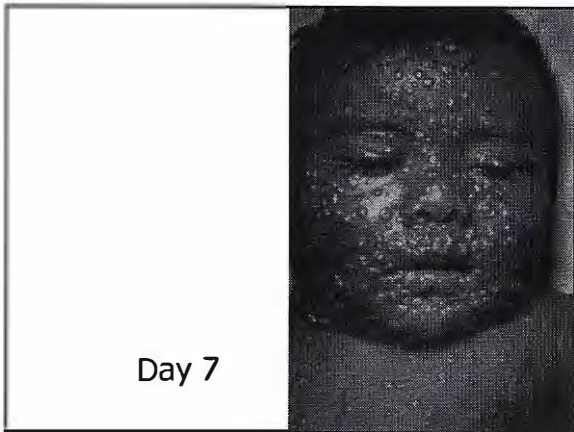
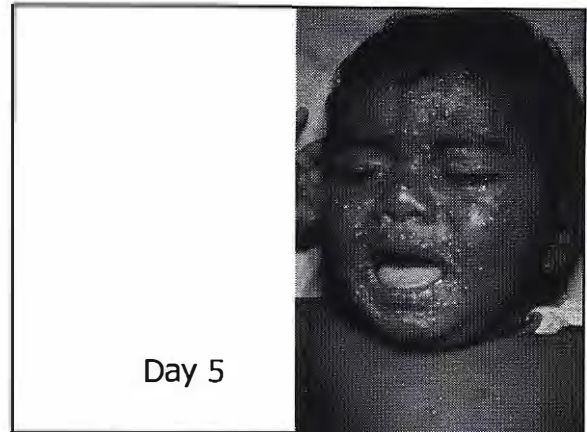
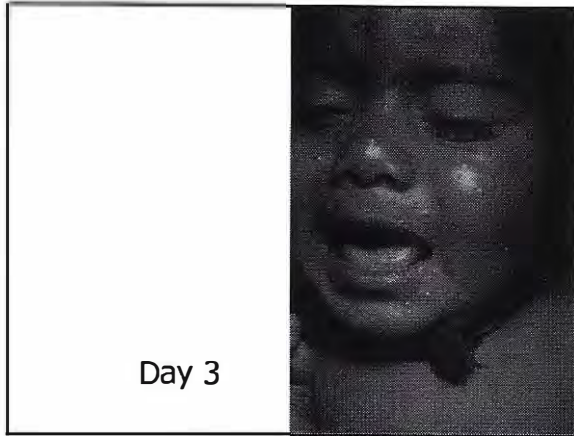
David Oshinsky – Winner of the 2006 Pulitzer Prize in History

Smallpox, the disease

- Virus disease with rash – no silent infections
Transmission by face-to-face contact
- Man is the only host
A chain of infection going back >3500+ years
Only disease for which there are deities
- No treatment; death rate = 30%
- Permanent immunity upon recovery

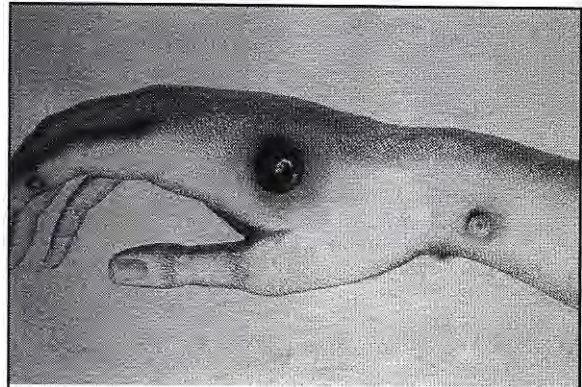
Sitala Mata







Edward Jenner



Cowpox on the hand of Sarah Nelmes

Vaccine grown on animal skin through 1980

- Animals: calves, sheep
- Method:
 - Scarification of skin
 - Growth of vaccinia for 6 to 9 days
 - Sacrifice animal, scrape off pustular matter
 - Purify

Smallpox in the 20th Century

- Deaths – 300,000,000 --1900 to 1977
N Y Times: 120,000,000 died directly or indirectly due to 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

Global efforts to eradicate a disease

■ Hookworm	1909-23	14 years
■ Yellow fever	1915-32	17 years
■ Yaws	1948-66	18 years
■ Malaria	1955-73	18 years
■ Smallpox	1967-80	14 years
■ G. worm infection	1986- ?	24 years +
■ Poliomyelitis	1988- ?	22 Years +

Birth of the WHO eradication program

- Director General submits a plan to World Health Assembly-- May 1966
10 year program – WHO budget of \$ 2.4 million/year
- Objections by delegates
 - Not feasible
 - Demand that WHO budget not be further increased
- 58 votes needed to pass; 60 voted in favor

The Challenge

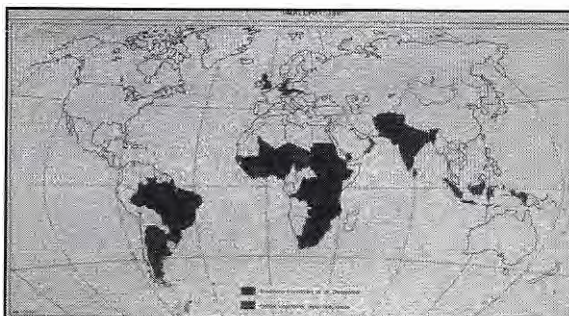
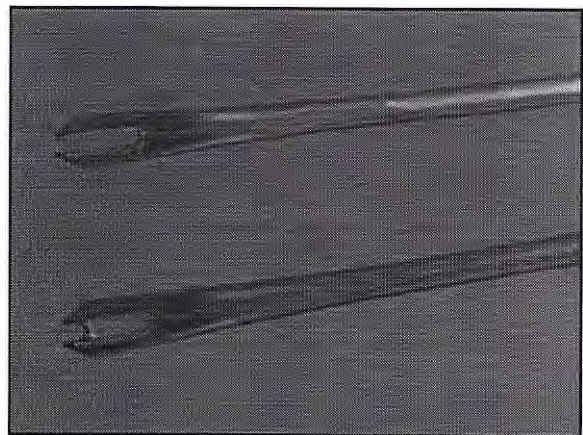
- **Status of smallpox – 1967**
 - >10,000,000 cases
 - 2,000,000 deaths
 - 43 countries reported cases
- **Program staff**
 - Headquarters – 6 professional and 3 secretaries
 - Regions – one each in 4 WHO Regions
 - International staff – never more than 150

The strategy

- **Vaccination of 80% to minimize spread***
 - **Surveillance***
 - To obtain a weekly report from every health center and hospital
 - **Containment***
 - "Fire-fighting teams"
 - Investigate every case
 - Contain outbreaks with ring-vaccination
- *quality control measures

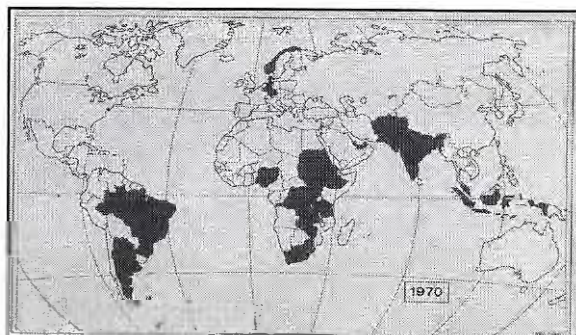
A new technique for vaccination

- **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



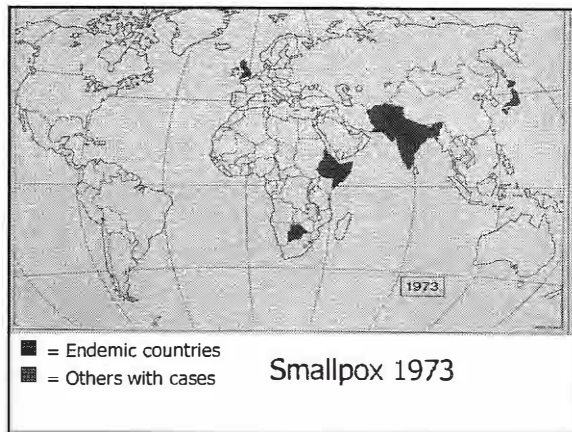
- = Endemic countries
- = Others with cases

Smallpox 1967



- = Endemic countries
- = Others with cases

Smallpox 1970



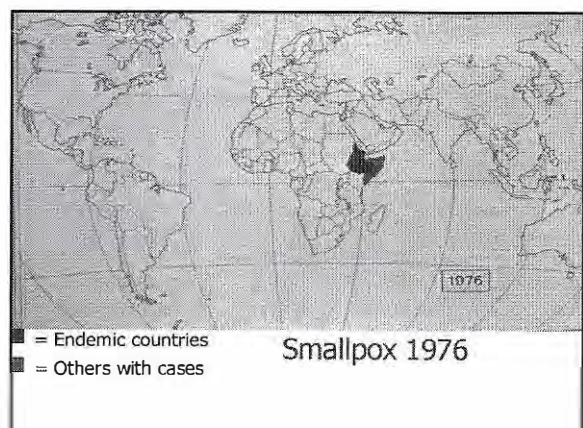
A new strategy – June 1973

- Search every village in India in 10 days
550 million people; 120,000 health staff for search
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, finally health workers on strike
 - Worst floods in three decades
 - India detonates an atomic weapon—May 1974

Indian Independence Day August 15, 1975

Prime Minister Indira Gandhi

- Salutes India on its 28th Anniversary
- Announces India's freedom from smallpox for the first time in written history



The final chapters

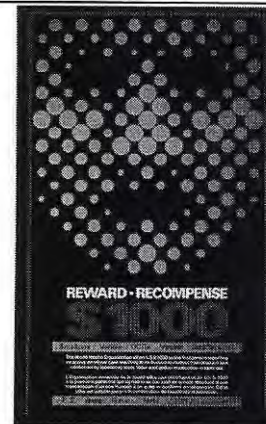
- Ethiopia -- 25 million people
 - Size = land area of all states on eastern seaboard
 - Few roads – travel on foot and with donkeys
 - Marxist revolution and continuing civil wars
 - Embassy staffs evacuated
 - No foreigners to leave Addis except smallpox staff
 - Teams kidnapped on nine different occasions
 - Program helicopter captured and held for ransom
- A "last" case in August 1975*

Somalia ...realm of the final inch

- A Marxist, secretive government
- Importations of smallpox from Ethiopia
- The Hajj –November 1977
- Intensive national searches for cases
- October 26, 1977 – the last case in a 3500 year old chain of infection



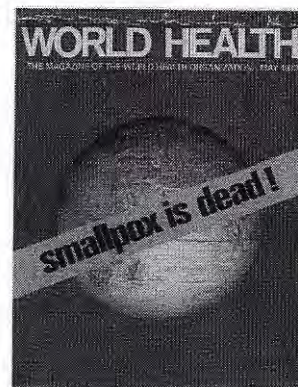
Ali Maalin - 26 October 1977



World Health Assembly --1980

- Declares solemnly that the world and all its peoples have won freedom from smallpox
- Smallpox vaccination should be discontinued in every country

Thirty-third World Health Assembly, 8 May 1980



Expanded Program on Immunization-1974

- A global program for vaccination for all children --smallpox, measles, DPT, polio
- Surveillance of vaccine-preventable diseases
- UNICEF and Rotary make this a high priority
- Target: 1990 – 80% coverage

Vaccine coverage (%) -- the Americas

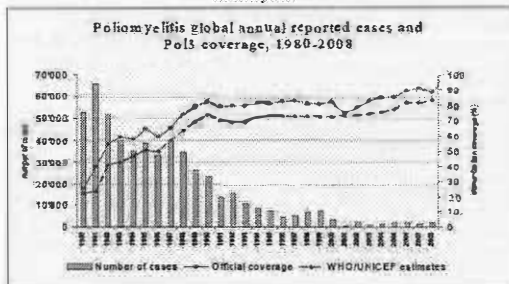
	1980	1990	2000	2008
DTP*	50	74	91	92
Measles	51	80	92	93
Polio*	57	75	90	92
HepB*	—	—	70	88
Hib*	—	—	75	90

* 3 Doses

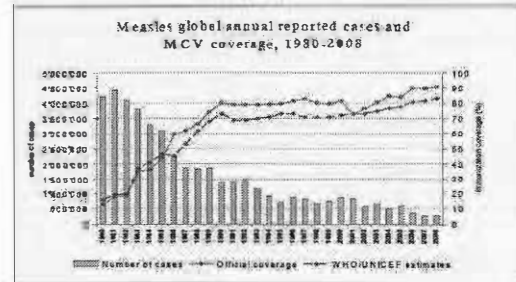
Transmission interrupted:

Polio (1991); Measles (2001); Rubella (2008)

Poliomyelitis



Measles



Coda

- From *Smallpox: the 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."

