

- WHY BE INTERESTED?
- No. BEEN common
- No / DISEASE

Why should there be concern? even interest today in smallpox
 Number three when I am sure, have some thoughts about a strange disease
 Suspect few who have been vaccinated - see (link)
 Actually - this has been the whole response

A Cow and a Needle

...and the end of smallpox

D.A. Henderson MD, MPH

Center for Health Security
 Professor of Medicine and Public Health, U. of Pittsburgh
 Johns Hopkins University Distinguished Service Professor

University of Southern California, University Park
 October 2013

In 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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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

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Sitala Mata



Little recognized facts from history

- On the landing of the pilgrims -- 1620
"Thus farre hath the good hand Of God favored our beginnings... In sweeping away great multitudes of the natives... that he might make room for us"
- Washington to Patrick Henry -- April 1777
"Smallpox is more destructive to an Army than the sword"
- Massive numbers of deaths in Amerindians
 Smallpox altered the entire course of European settlement
- Abraham Lincoln at Gettysburg -- 1863

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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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The Drama of 1796 – the world's first vaccine

Cast of characters

Sarah Nelmes
Blossom
Jimmy Phipps
Edward Jenner
Berkeley (Gloucestershire)

Vaccinia transferred from arm to arm for next 75 years
Vaccinia grown on the flank of a calf, sheep, buffalo
until 2002

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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

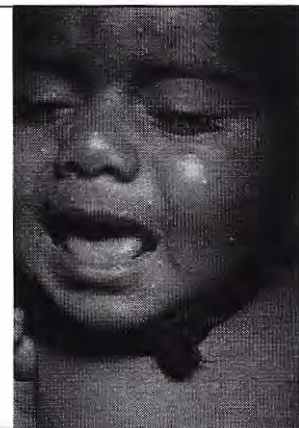
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Smallpox – clinical features

- 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 3

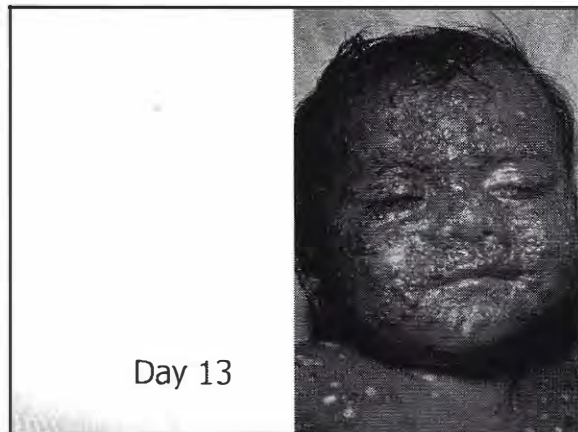


Day 5



Day 9





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-	28+
Polio	Vaccine	1988-	24+
*Failed			

Characteristics favoring eradication

- Man -- the only host
- Virus spreads -- only during rash
Face-to-face contact
- Permanent immunity after recovery
- Transmission stops in remote areas
- One dose provides long-lasting protection

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
 - General consensus -- "it can't be done"
 - World Health Assembly agrees by 2 votes to proceed
 - A 10 year goal is established
 - A Chief Medical Officer for smallpox is named

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 -- 9 persons (5 nationalities)
 - Never more than 150 international staff

The strategy

- Vaccination of 80% of the population
 - * Heatstable vaccine
 - * International quality control of vaccine
- Surveillance-containment
 - * Report every week from each health center
 - * Team to investigate and do "ring vaccination"

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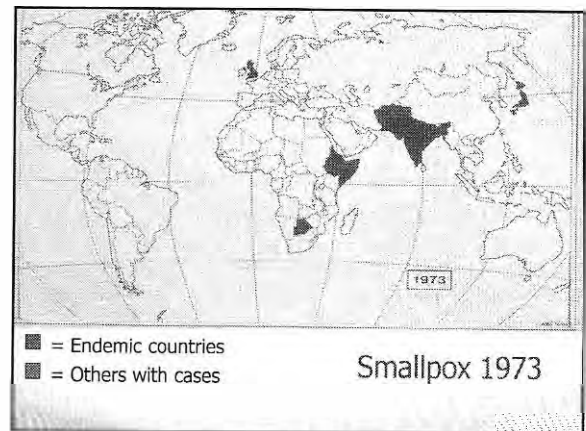
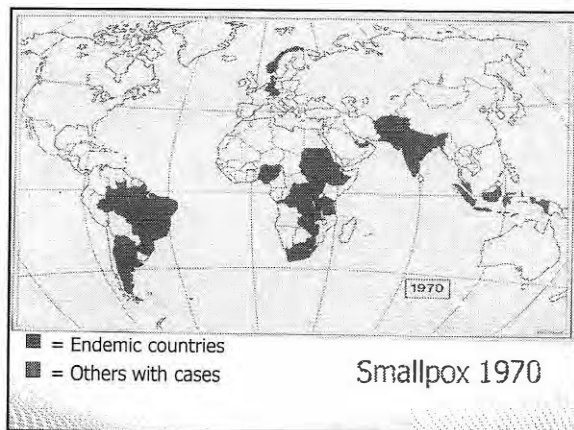
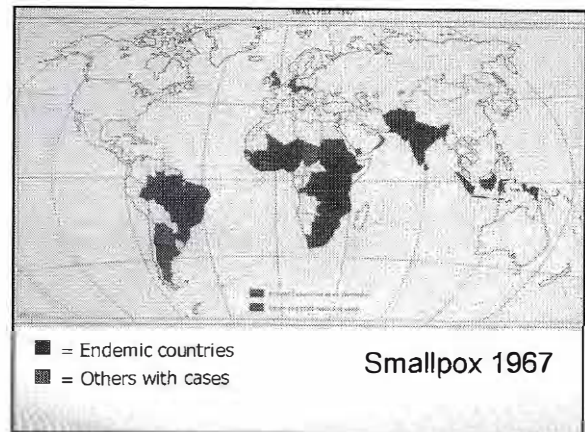
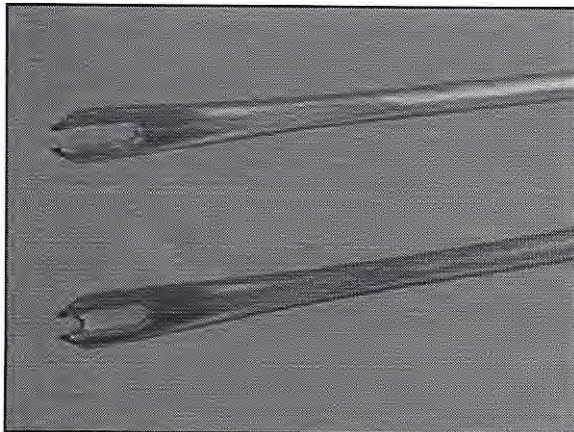
A new technique for vaccination

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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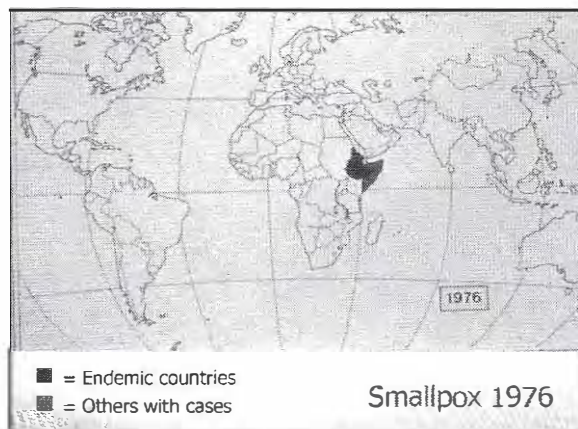


A new strategy – June 1973

- 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:
 - Size: 2.8 times California; 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

The beginning of "the vaccine era"

- The genesis -- smallpox eradication
 - African teams averaged 500 vaccinations/day
 - One year: 400,000 vaccinations by a 4 person team
 - Surveillance strategy -- a good monitor and guide
 - Nation-wide smallpox eradication programs--
 - workable even in the least developed countries 1970
- WHO-convened meeting on global targets and methods for selected vaccine preventable diseases

WHO begins Expanded Program on Immunization (EPI) 1974

EPI A global program to reach all children -- smallpox, measles, DPT, polio
 UNICEF and Rotary make this a high priority
 Target for 1990 -- 80% coverage globally

Reference-- *"the beginning of the Vaccine Era"*

EPI in the Americas a stunning record of success

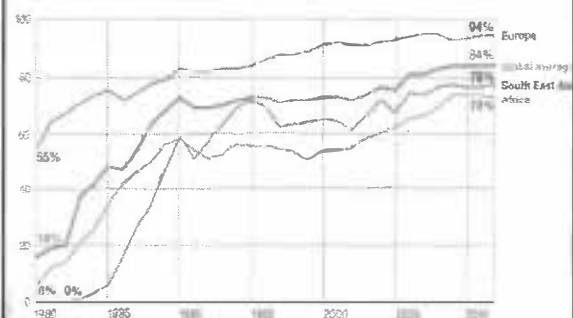
- Eight vaccines now in continent-wide use
 - Vaccine coverage is >90% in all countries
 - >95% of purchase costs from government funds
 - Vaccine production facilities in five countries
- Surveillance units reporting weekly (electronic)
 - 500 in 1975 when program began
 - > 40,000 in 2011

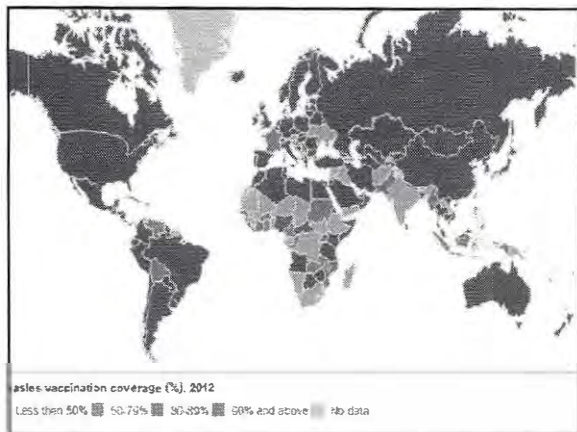
EPI -- notable landmarks in the Americas

- Polio elimination -- 1985
- Measles elimination -- 2001
- Rubella elimination -- 2008

Growth in measles vaccination coverage

Measles Containing Vaccine (MCV) coverage, 1995-2012 (%)





Coda – the future

★ 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."

