

Smallpox: a threat returns

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Ali Maalin - 26 October 1977



Ramses V



Sitala Mata



Sapona

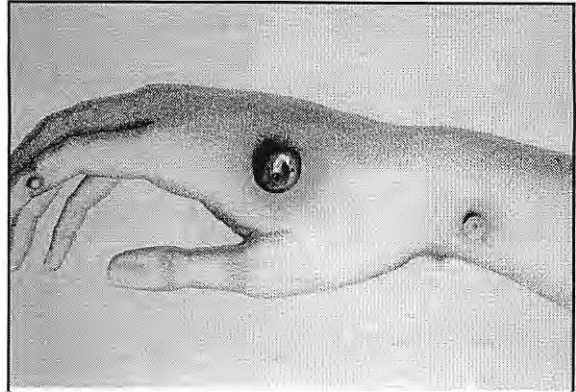


"That disease was the most terrible of all the ministers of death. The horror of the Plague...visited our shores only once or twice within living memory but the smallpox was always present, filling the churchyards with corpses...and making the eyes and cheeks of the betrothed maiden objects of horror to the lover."

Macauley



Edward Jenner



Cowpox on the hand of Sarah Nelmes

Deaths in the 20th Century

Due directly or indirectly to armed conflict:

100,000,000

Due to smallpox

300,000,000+

Smallpox -- characteristics

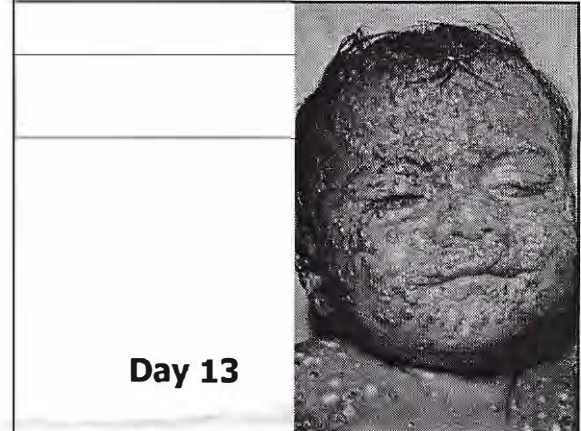
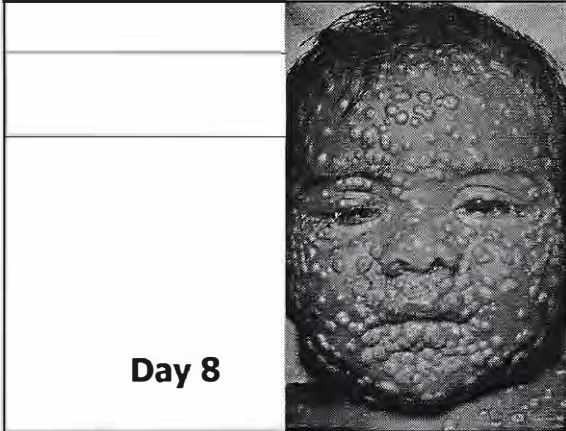
- Incubation period is 10-12 days
- Severe flu-like symptoms then rash
- Case fatality rate --30 %
- No therapy available

Day 2



Day 5





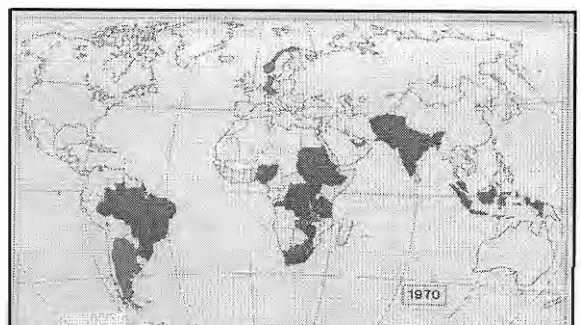
Characteristics of Smallpox Favoring Eradication

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



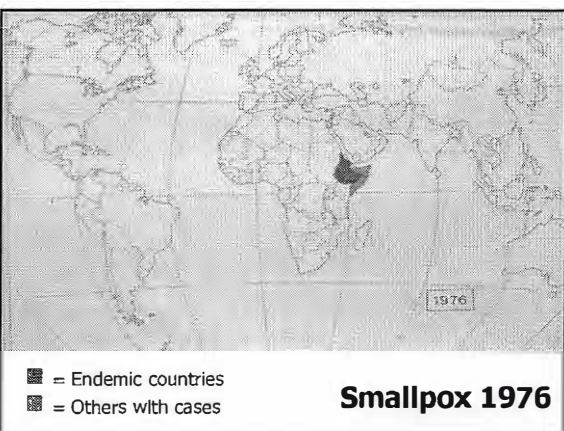
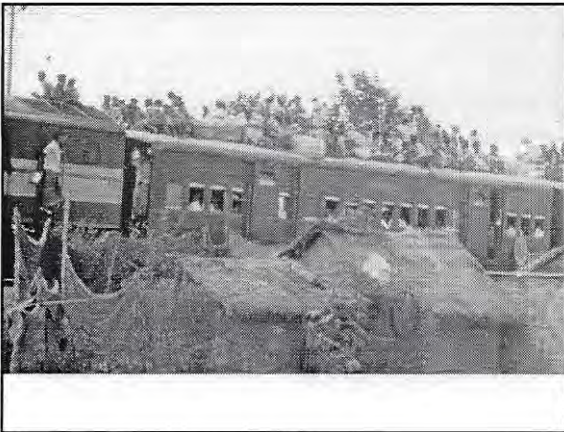
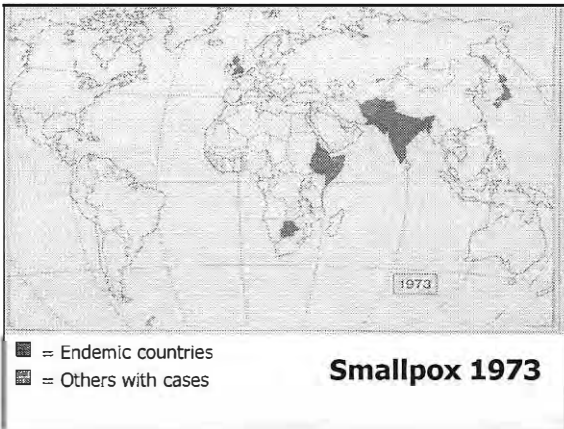
■ = Endemic countries
■ = Others with cases

Smallpox 1967



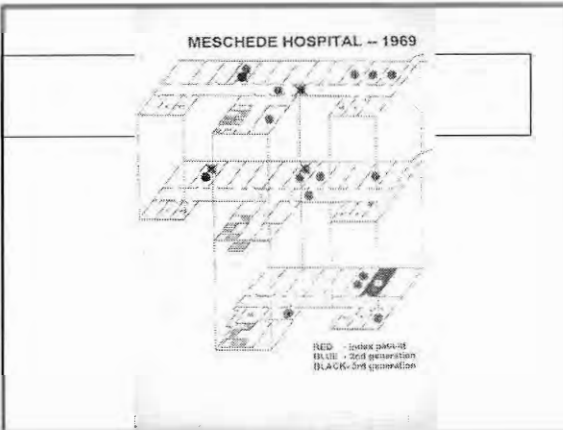
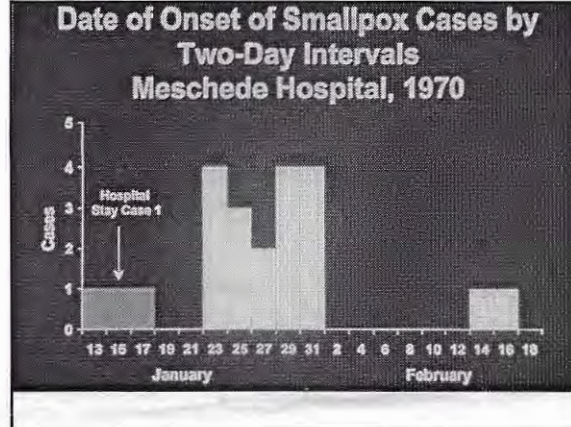
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Smallpox 1970





Meschede, Germany - January 1970



"On May 8, 1980, WHO announced that smallpox had been eradicated from the planet... Soon after the WHO announcement, smallpox was included in a list of viral and bacterial weapons targeted for improvement in the 1981-85 Five-Year Plan.... Where other governments saw a medical victory, the Kremlin perceived a military opportunity...the Soviet military command issued an order to maintain an annual stockpile of 20 tons."

Alibek, 1998

Susceptibility of the population to Smallpox -- 2004

- Vaccination stopped in 1980
- Persons under 23 years have not been vaccinated
- Persons vaccinated only once pre-1980 have little or no immunity
- Population-- >75% are fully susceptible

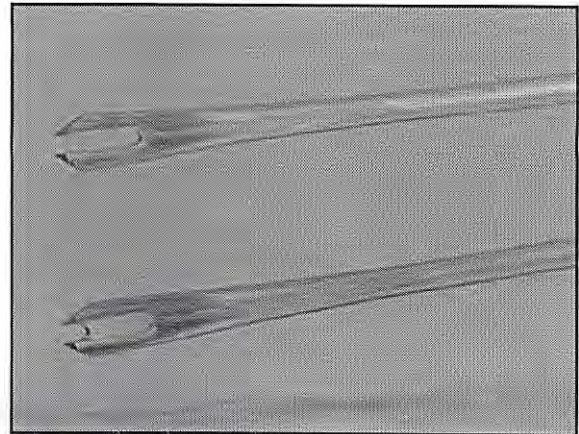
Epidemic Response Capability September 18, 2001

- Vaccine manufacturers
 - U.S. None
 - World None
- Vaccine in storage
 - U.S. 15 million doses
 - World ? 80 million doses

U.S. Smallpox Vaccine Reserve--2004

	<u>No. of doses</u>
■ Wyeth DryVax	12 million
■ Calf-lymph - 1978	
■ Aventis Pasteur	85 million
■ Calf-lymph - 1958	
■ Acambis/Baxter	209 million
■ Vero cell - 2002	

In emergency – dilution of vaccine 1:5 is possible



A Balance of Risks

- Probability that smallpox will be used as a weapon
- Frequency of adverse reactions
- Likely effectiveness of outbreak control

Smallpox Vaccine Expected Adverse Events

- **Life-threatening complications (per million)**
 - Post-vaccinal encephalitis (3)
 - Progressive vaccinia (1)
 - Eczema vaccinatum (12)
- **Less serious**
 - Generalized vaccinia
 - Accidental inoculation
 - Rash and fever
- If 100 million vaccinated, 100+ deaths might occur (1960's data)

Smallpox vaccine Military Experience to date*

- Numbers are still small – 493,000
 - None hospitalized; 10 missed 1+days of work
- **Post-vaccinal encephalitis** - 1
- **Progressive vaccinia** - 0
- **Eczema vaccinatum** - 0
- Generalized vaccinia - 33
- Infection in contacts - 29

*Note: December, 2003

Smallpox vaccine a new cardiac complication

- Myopericarditis 1:8,000
 - Almost all primary vaccinees
 - Onset 7 to 20 days
 - Fever, chest pain, EKG changes, enzymes increased
 - Recovery

Outbreak control

- Smallpox doesn't spread readily
- Patient transmits only after symptoms
- Vaccine protects even when given 3-4 days after infection

Spread of Infection

Spread of disease is slow

- **Household spread** --Secondary attack rates

Measles	76%
Chickenpox	74%
Smallpox	58%
- **Community spread** --measles and chickenpox spread before symptoms; smallpox does not

Epidemiology of Smallpox

Transmission Patterns in Europe: 1958-1973

- Outbreaks: 34
- Cases: 573
 - Transmission in hospital: 277 (48%)
 - Transmission in home: 143 (25%)
- Hemorrhagic and malignant cases – a threat to hospitals
 - Bradford, UK (1961) Hemorrhagic smallpox 10 cases
 - Germany (1970) Malignant smallpox 16 cases
 - Yugoslavia (1972) Hemorrhagic smallpox 38 cases

Surveillance and Containment

Steps in Containment -- I

- Isolate patient
- Vaccinate all persons who had been in a room with the patient since he/she became febrile (primary contacts)
- Place primary contacts under surveillance with daily temperatures
 - If contact develops fever, isolate at home or special facility until diagnosed
- Vaccinate all household members of primary contacts (secondary contacts)

Surveillance and Containment

Steps in containment -- II

- Make vaccine available on request to those in the area
- Not generally desirable:
 - Compulsory vaccination
 - Quarantine of city or groups of people
 - Closure of airports, suspension of transport

The future

- A WHO role is key
 - National planning and training
 - Emergency vaccine supplies and response
 - Reporting and laboratory diagnosis
 - International measures if an outbreak should occur
- How long must we sustain our efforts ?