

Smallpox: death of a disease

.... birth of a new era

D.A. Henderson, MD, MPH

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

Penn State Undergraduate Research Conference
March 26, 2011

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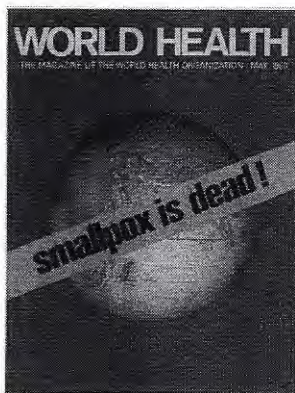
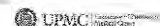


World Health Assembly --1980

- 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*

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- *"This may well have been the greatest lifesaving achievement in the history of medicine"*

Richard Preston, author

- *"The success of the eradication campaign is a testament to the difference the global public health community can make when it truly comes together for a common purpose"*

Secretary of Health and Human Services Thompson

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A challenge through the ages

- Smallpox antedates the era of the Pharaohs
One of the greatest of pestilences throughout history
- Sole disease represented by deities in Asia and Africa
- Primary factor in the European settlement of the Americas
- A contemporary concern – 1967
> 10,000,000 cases
2,000,000 deaths
Reported from 43 countries
US required school-entry vaccination until 1972

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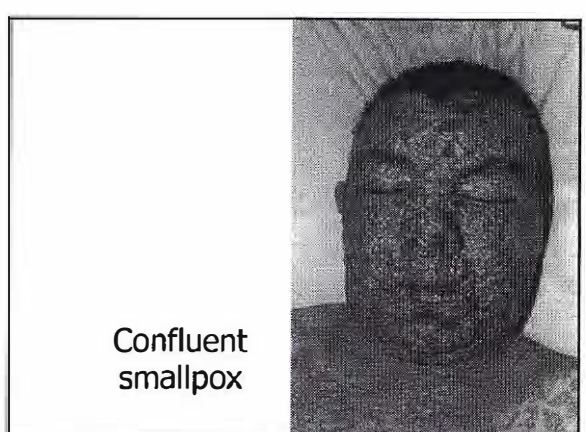
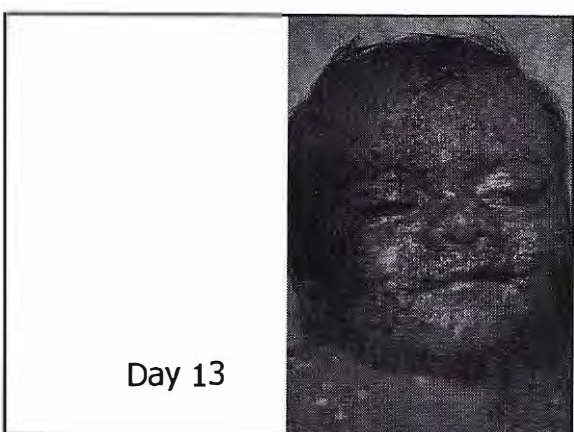
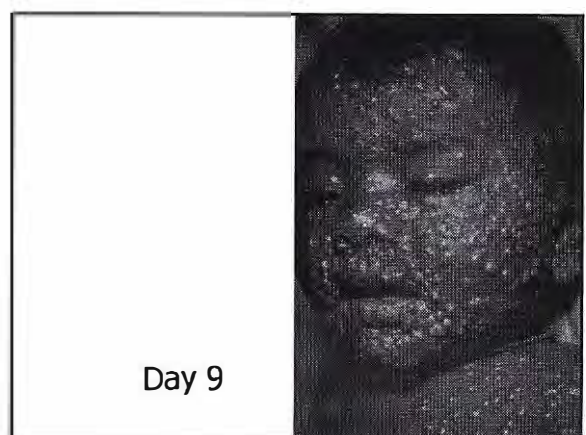
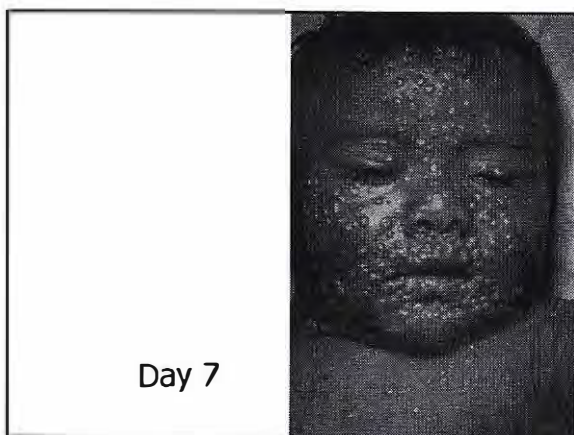
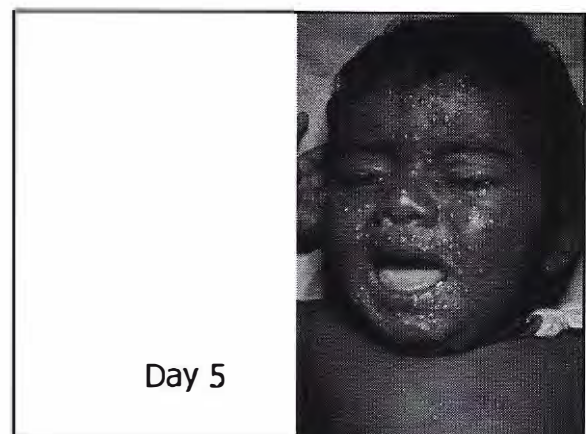
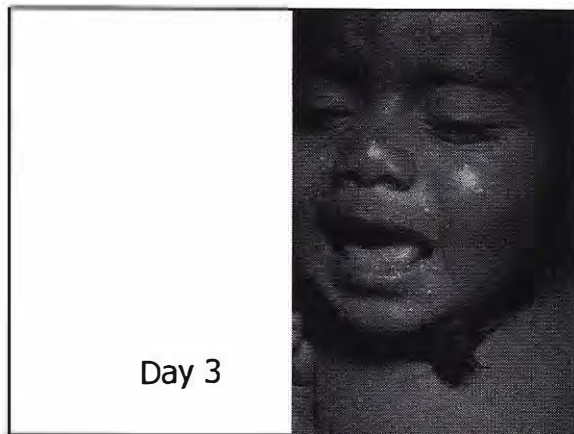


Smallpox, the disease

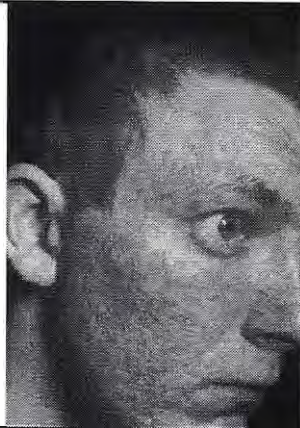
- Virus – face-to-face spread only during rash
- Man is the only host – no animal reservoir
Chain of infection going back more than 3500 years
- Death rate was 30%
 - But permanent immunity among survivors
- A heat stable vaccine protects with one dose

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Confluent
smallpox
(recovered)



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
• <i>G. worm infection</i>	1986- ?	24 years +
• <i>Poliomyelitis</i>	1988- ?	22 Years +

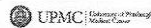
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Global smallpox eradication

- 1959 World Health Assembly adopts USSR proposal for a global program
- 1959 -1966
 - Strategy: mass vaccination (few complied)
 - Budget of <\$100,000 per year
 - Five staff members

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The WHO Eradication Program

Assembly requires DG to submit a plan --1966

- Strategy
 - Vaccinate 80% of population
 - Surveillance and containment
- 10 year program: WHO budget = \$ 2.4 million/year
- Objections by delegates
 - Not feasible
 - Demand for no further increases in WHO budget
- 58 votes for acceptance; 60 voted for approval

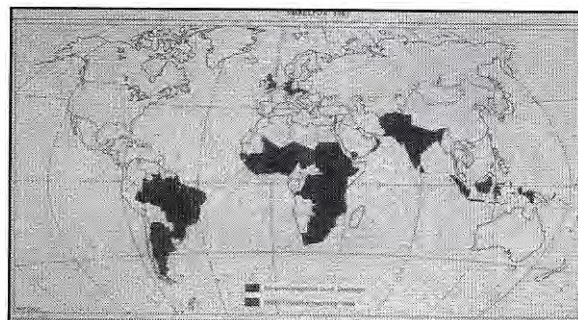
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Program leadership

- Director General believes program will fail (malaria eradication program collapsing)
- Demands an American serve as Director
 - The candidate declines:
 - Limited resources -- <\$50,000 each for 50 countries
 - Not enough even to buy the vaccine required
 - Headquarters staff of 10 (including 3 secretaries)
 - Problems of coordination

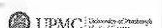
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- = Endemic countries
- = Others with cases

Smallpox 1967

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Vaccine Supply

- Heat-stable, potent vaccine is essential
 - Quality control of vaccine – 10% satisfactory
 - No country to receive WHO assistance unless vaccine meets international standards
 - 42 labs producing vaccine
 - Independent international quality control
 - Labs in Netherlands and Canada
- Development of national capacity

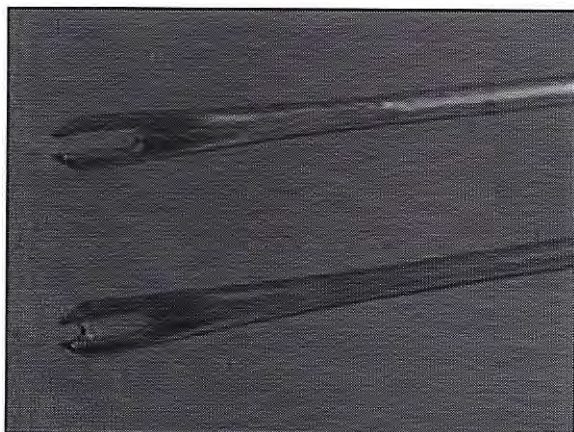
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Vaccination

- Target for coverage – 80%
 - Vaccination teams and evaluation teams
- Research to find faster, better methods
 - Jet Injector gun
 - Bifurcated needle—multiple puncture method
 - One-fourth as much vaccine required
 - Training time -- 15 minutes
 - Easily sterilized and reused
 - Cost -- \$5 per thousand

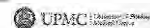
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Surveillance-containment strategy

- Operational plan
 - Surveillance – weekly report from every health unit
 - Teams – to investigate and contain outbreaks
 - Epidemiological field research
 - The textbooks prove to be wrong
 - "Smallpox spreads like a prairie fire"
 - "Revaccination is needed every 3 to 5 years"
 - "Women in purdah can't be vaccinated"

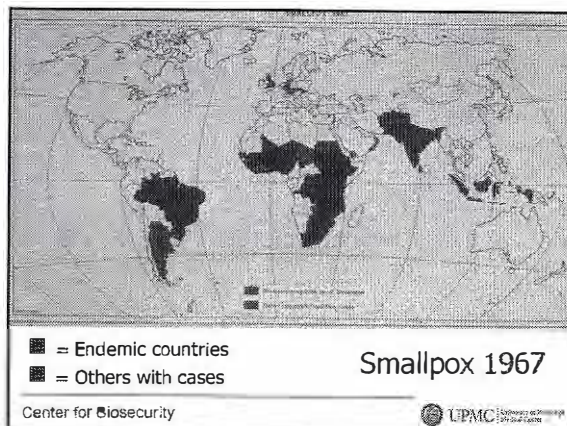
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Operational principles

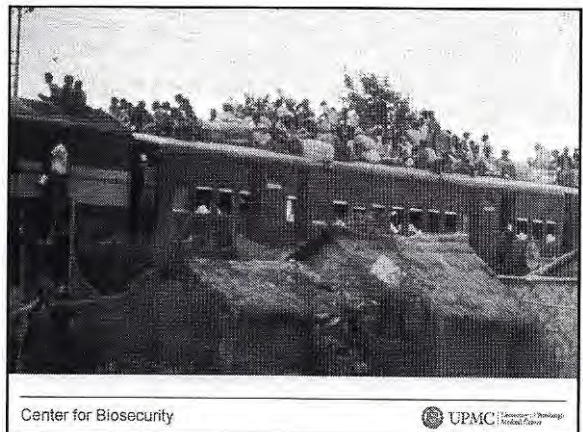
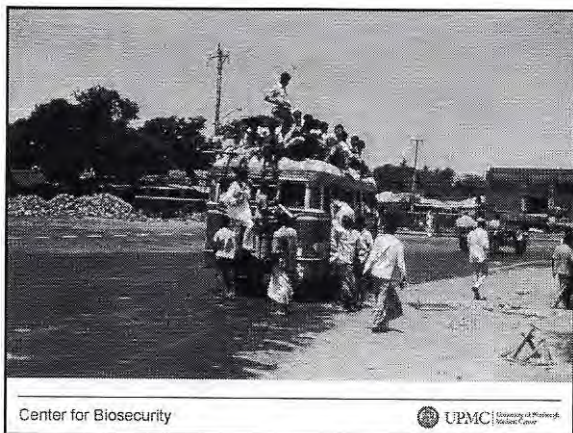
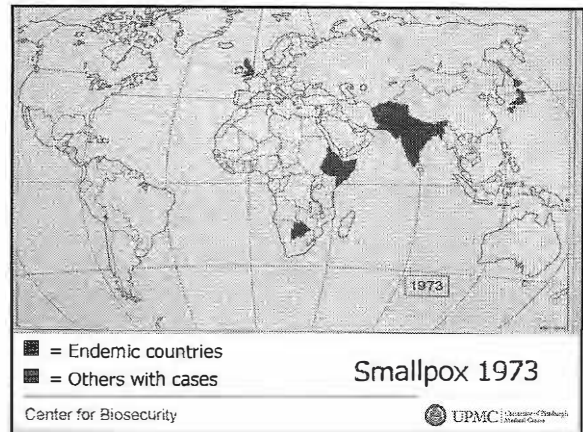
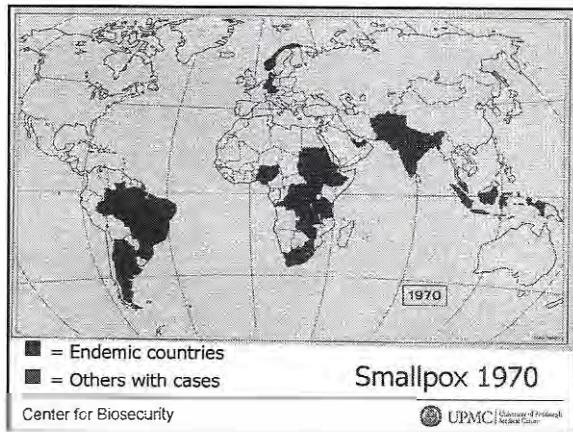
- Management
 - Adapt program to the country
 - All staff to be in the field-- at least 1/3 time
 - Communicate regularly and frequently
 - Recruit for motivation and willingness to "rough it"
- Accept "red tape" as inevitable but recognize:
 - It is sometimes better to act first and inform later
 - Exceptions to rules are always necessary

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India -- the pivotal challenge

1973-75

- India – the “home of smallpox”?
 - Population – 550,000,000
 - Surveillance-containment strategy--not working
 - June 1973 – search every village > every house
 - 130,000 health staff in 10 days
 - Results of first search in October
 - Spring 1974 – the darkest days
 - Petrol crisis + strikes by airlines, railway, health staff
 - India explodes a nuclear device
 - Containment methods tightened

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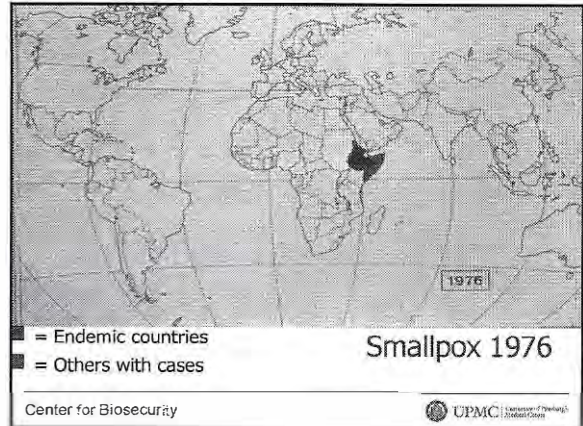
Indian Independence Day

August 15, 1975

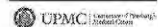
Prime Minister Indira Gandhi

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

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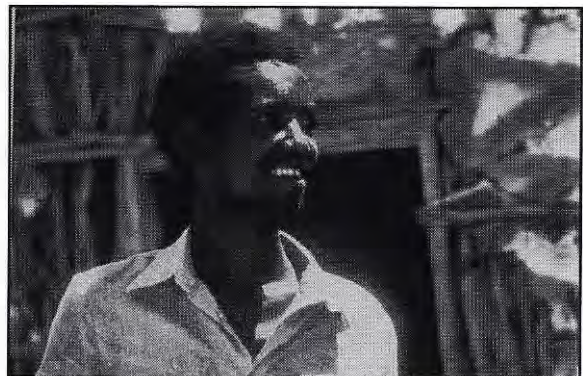
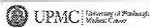


The last strongholds

Ethiopia and Somalia

- Ethiopia
 - Country – twice the size of Texas
 - Largely highland – over 5000 feet
 - Health facilities for 5% of 30 million people
 - Travel largely by donkey and on foot
- Emperor is assassinated; Marxist take-over
 - No foreign staff outside of Addis except smallpox teams
- Civil war, floods, famine, kidnapping, hostages
- Somalia – the final chapter

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Ali Maalin - 26 October, 1977

The legacy – beginning of the Vaccine Era

- The genesis
 - African vaccinators average 500/persons/day with cooperative village leadership
 - One year = 400,000 vaccinations/4 person team
 - Smallpox – the only nation-wide vaccine program in developing countries in 1967
 - Smallpox unit convenes international meeting to expand the goals - 1970

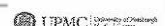
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Expanded Program on Immunization-1974

- 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

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Vaccine coverage (%) -- the Americas

	1980	1990	2000	2008
DTP*	50	74	91	92
Measles	51	80	92	93
Polio*	57	75	90	92
HepatitisB*	--	--	70	88
Hem. influenzae*	--	--	75	90

* 3 Doses

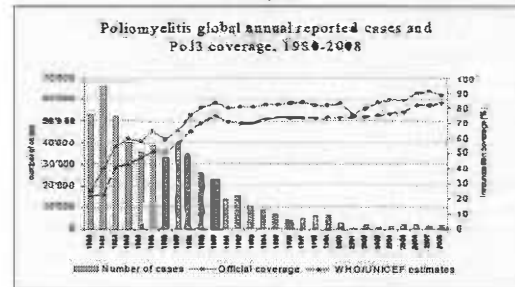
Transmission interrupted:

Polio (1991); Measles (2002); Rubella (2008)

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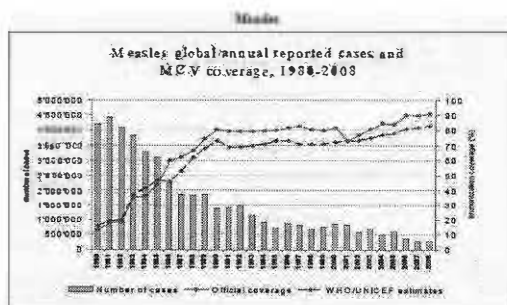
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Poliomyelitis



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Important lessons learned

- Vaccines – the best cost-benefit medical intervention (World Bank study)
- Management
 - Delegate responsibility, be flexible, listen to the village elders
 - Reports are necessary but there is no substitute for on-site inspection
 - With a common goal – political differences disappear
U.S.-Soviet cooperation throughout Cold War

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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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