

A Cow and a Needle ...and the end of smallpox

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1

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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2

2

An ancient disease

- Last case in the world –1978
- Most serious of all the great pestilences
 - Plague, cholera, yellow fever, malaria
- Earliest known victims – 3500+ years ago
Ramses V and three other mummies
- Smallpox gods in Asia and Africa

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3

Sitala Mata



4



T'ou-Shen Niang-Niang



Pan-chen

5

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"
- Massive epidemics among American Indians
Death rates of 50 to 70%
European settlement met comparatively little resistance
- Abraham Lincoln at Gettysburg – 1863
A brief speech by an ill president

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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
- ?

7

The Drama of 1796 – Berkeley, England the world's first vaccine

Cast of characters

Sarah Nelmes
Blossom
Jimmy Phipps
Edward Jenner
Berkeley (Gloucestershire)

Vaccine virus transferred from arm to arm for next 75 years
Grown on the flank of a calf, sheep, buffalo until 2002

8

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

9

Smallpox – the disease

- A severe virus illness
Not related to chickenpox
- Spread by face-to-face contact with patient
- Fever, flu-like symptoms then rash
- No treatment
- Survivors scarred for life; many were blind

10

Day 3



11

Day 5



12



13



14

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	14
Guinea Worm	Water: Rx	1986-	27+
Poliomyelitis	Vaccine	1988-	25+
*Failed			

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What made eradication possible?

- Virus infected only humans – no animals
- Virus spread only when rash was present
Required face-to-face contact
- Patient was totally immune after recovery
- One vaccination provided protection

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A global campaign begins

- 1966 WHO Director General proposes plan to eradicate smallpox in 10 years (by 1976)
- The World Health Assembly is divided
 - “Too costly; other eradication programs have failed”
 - “No disease can ever be eradicated”
- Health Assembly agrees by 2 votes to proceed
- A Chief Medical Officer for smallpox is named

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17

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 -- 10 persons (7 nationalities)
 - Never more than 150 WHO staff in countries
 - National staff – up to 140,000

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18

The strategy

- Vaccinate 80% of the population
- Surveillance-containment
 - Report every week from each health center
 - Team to investigate and do "ring vaccination"

21

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19

A new technique for vaccination

Need for a more rapid, effective method

- Traditional --scratch through a drop
- Bifurcated needle—multiple puncture
 - One-fourth as much vaccine required
 - Training time -- 15 minutes
 - Easily sterilized and reused
 - Cost -- \$5 per thousand

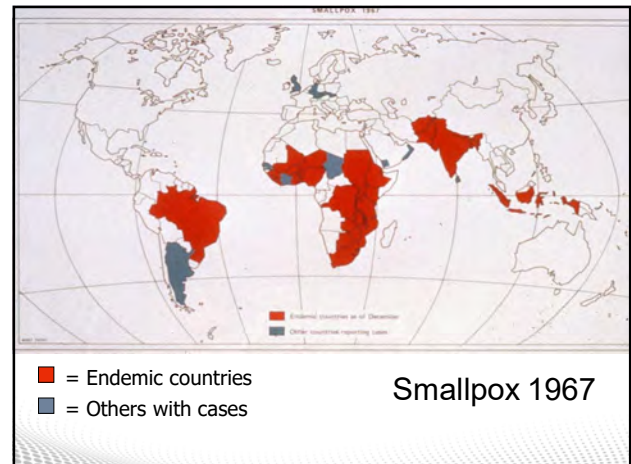
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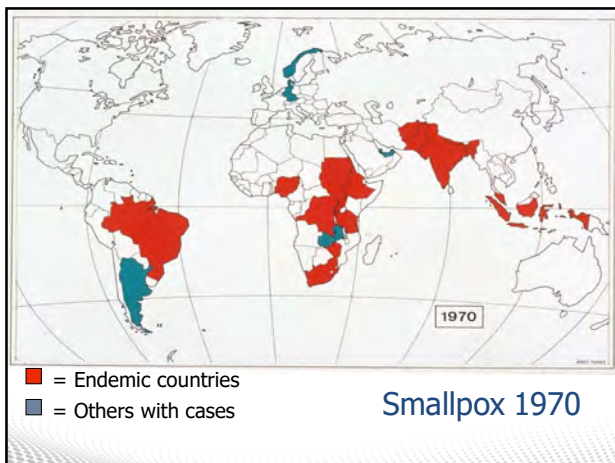
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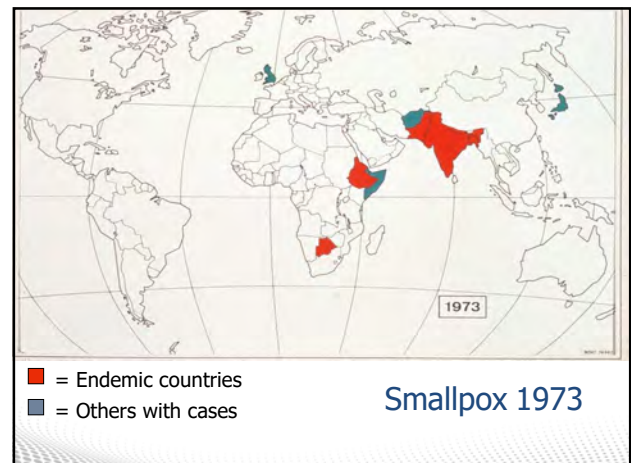
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22



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24



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26



27

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, worst floods in three decades
 - Railroads, airlines, health workers on strike
 - India detonates an atomic weapon—May 1974

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The last stronghold Ethiopia and Somalia

- Ethiopia:
 - Size: 3 times California; mostly over 5000 feet
 - Health facilities reach 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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30



Ali Maalin - 26 October 1977

31



32

The end of a campaign... the beginning of a new era

- The discovery
 - African mobile teams averaged 500 vaccinations/day
 - Nation-wide vaccination programs were possible even in the least developed countries
 - Why not add other vaccines?
Measles, polio, DPT (diphtheria, tetanus, pertussis)

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33

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”

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EPI in the Western Hemisphere a little-known success

- Eight vaccines now in continent-wide use
 - Vaccine coverage is >90% in all countries
- Polio – eliminated 1991
- Measles -- eliminated 2001
- Rubella -- eliminated 2008
Last case of congenital rubella -- 2007

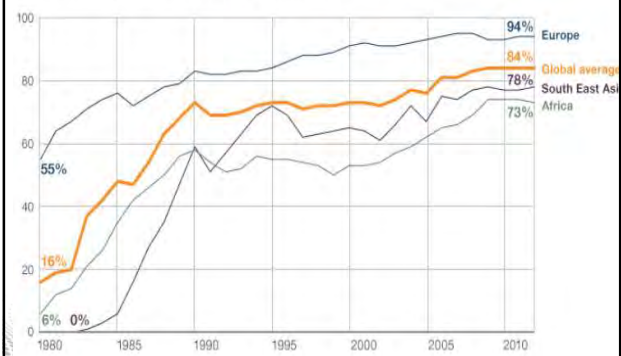
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Growth in measles vaccination coverage

Measles Containing Vaccine (MCV) coverage, 1980-2012 (%)



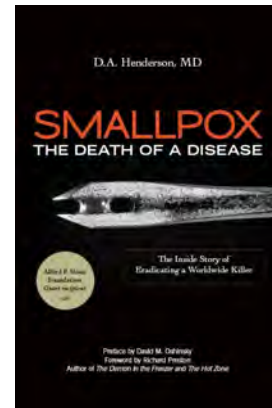
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Coda – the future

- 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."

37



38