Biology & Community Intertwined:
Example of Smallpox

Lois Levitan, Ph.D.
Environmental Risk Analysis Program
Department of Communication & Center for the Environment
Cornell University
Ithaca NY, USA 14853
Biological & Social Factors Entwined through History

- Scourge
- Eradication
- Resurgence
- Current vaccination campaign
Ancient & More Recent History

- Probably originated in Nile Valley >3000 years ago
- Killed Pharaoh Ramses V 1157 BCE
- Reached Europe 710 CE
- Conquistador Hernando Cortez brought to Central Mexico 1520
- Devastated Aztecs — estimated 3.5 million died within 2 years
- Arrived New England early 17th cen
- 18th Century European Plague — Killed reigning monarchs in 5 states
The Organism: Variola Pox Virus

- Large, brick-shaped, about size of small bacteria.
- Complex internal structure
- Surface covered with filamentous protein, so virus particles look like a ball of knitting wool
- Enclosed in an envelope derived from host cell membranes.
Disease Symptoms

- Incubation: 1-2+ weeks. No symptoms. Not infective
- Pre-Eruption (days 1-3): flu-like symptoms
- Lesions, Papules, Pustules (days 4-10): increasingly infective via aerosol
- Scabbing, Crusting (days 11-14): somewhat infective until all scabs gone

Day 10
Disease Outcomes

- Patient dead or recovered w/in month
- Historically killed 3-4 million per year
- Children & elderly most susceptible (10% of those born, died)
- Mortality rate nearly 30%
- Most survivors scarred (~ 75%), many blind
Prevention & Inoculation

- Prior to “vaccine,” people were knowingly inoculated (variolated) to gain immunity

- People were also knowingly inoculated as means of germ warfare (bioterrorism)
Isolation & Quarantine

- Isolation — segregation of the diseased
- Quarantine — preventative segregation of the exposed

- Requires trust
- Fear & anger toward the sick
- Counters urge to flee
- Messes with the mind
- Interferes with livelihood
- Wreaks havoc on social interaction
Smallpox Hospitals

Does disease adhere to bounds of class & privilege?
Vaccinia

- Dr. Edward Jenner discovered benefits of injecting people with Vaccinia virus (cowpox), 1796
- Vaccine from fluid scraped from sores on skin of infected calves
- Antibodies protect against smallpox as well as cowpox

Vaccines rank among top ten public health achievements of 20th century (CDC)
Smallpox Vaccine

James Phipps, 8-year-old son of Jenner’s gardner, was inoculated with cowpox, given 8 weeks to develop antibodies for resistance, & then exposed to smallpox. Success! — No infection!

- Civil liberties
- Medical ethics
NYC 1947—public health & politics

- Man infected in Mexico develops smallpox in NYC
- Massive free vaccination campaign reaches > 6 million in NYC within 2 weeks
- Outbreak controlled with minimal illness
- Neighboring counties charge NYC hoarded vaccine
Stress & Mental Health

April 17, 1947: NYC police charge woman with illegal medical practice for posing as nurse to vaccinate 500 persons with water

April 18, 1947: woman is sent to Bellevue Hospital for observation (NYTimes Archives).
Trade & Travel

- Moves with people along routes of immigration, trade, & pilgrimage
- Trans-oceanic travel created global scourge
- Long understood to be highly contagious, especially in close quarters
Smallpox Eradication

- How was it done?
- Why was it successful?

Trust
Fear
Coercion
Incentives
Political will
Self Interest
Investment of resources
Highly motivated public health team
Sense of responsibility to community

Donald Henderson
William Foege
Ring Vaccination Strategy
Surveillance/Containment
Panic & Fear
Community (Ir)Responsibility

- Ali Maow Maalim
- Last known natural case of smallpox, Somalia, 1977
- As 21-year-old health worker evaded vaccine due to FEAR
- Exposed to smallpox, became ill, went to natural healer who rubbed spit on his body
Coercion

- Europe Jan 1972: smallpox-free
- Yugoslavia Feb 1972: smallpox re-introduced by cleric returning from pilgrimage to Mecca
- All transportation halted: entire nation quarantined
- Army vaccinated 18 million in 10 days

Outbreak successfully aborted
Civil Liberties trampled
Weaponizing Smallpox

- Current attention to smallpox primarily because of threat of use in germ warfare
- Risk difficult to assess because uncertainty is huge
BioTerrorism

Harvard survey:

- US public does not trust any single spokesperson re: bioterrorism
- Nearly 3 in 10 African Americans believe there would be discrimination in treatment during an outbreak

(Source: Harvard Public Health NOW. June 2002)
Vaccination Campaign

Why were earlier vaccination campaigns seen as a “godsend” & this one thought to present unacceptable risk?
Mass Vaccination Strategy
Lack of Trust & More

- Public understands social impacts & personal risk of vaccine
- Public does not trust they will be “taken care of”
- Population at greater health risk from vaccine than before: older, more are immuno-compromised
- Lack of trust in government vaccination strategy
- Comparative Risk: Abstract risk of smallpox vs. known risk of vaccine side-effects
- Germ Warfare is difficult & terrifying to contemplate
- Infectious disease doctors know how to treat smallpox.
- Vaccine effective up to 4 days after exposure
“We have a system where people dealing with disasters don’t have a clue about what the public is thinking”