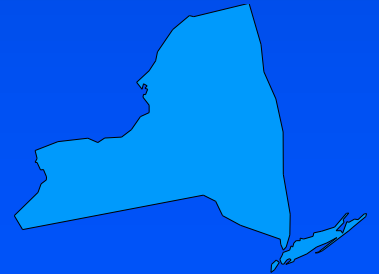


Smallpox: A Continuing Public Health Issue

New York State Department of Health



**Henderson DA, et al. Smallpox as a
biological weapon. Medical and
public health management.**

JAMA 1999;281:2127-2137.

Smallpox Prodromal Illness

- 12-14 days following exposure (range 7-17 days)
- Symptoms:
 - High fever -- Malaise -- Prostration
 - Headache -- Backache
 - Sometimes present: severe abdominal pain, delirium
- Maculopapular rash appears 2-3 days later.
- Patients generally not infective until rash appears.

Rash Appearance and Progression

- Maculopapular rash first appears:
 - Mucosa of mouth and pharynx, face and forearms;
 - Lesions in mouth and pharynx ulcerate quickly.
- Rash Progression:
 - Within 1-2 days to vesicular, then pustular
 - Then spreads to trunk and legs.

Henderson DA, et al. JAMA 1999;281:2127-2137.

Rash Description

- Pustules are round, tense, and deeply embedded in the dermis (chickenpox lesions more superficial);
- Crusts begin to form around day 8-9 of rash;
- Scabs separate and characteristic pitted scarring develops, resulting from destruction of sebaceous glands and fibrosis;
- Patient no longer infectious when scabs start to separate.

Henderson DA, et al. JAMA 1999;281:2127-2137.

Differential Diagnosis of Rash

Smallpox

Chickenpox

Timing in a given area

**Simultaneous
(1-2 days)**

**New crops appear
every few days**

**Stage of
maturation**

**Same stage in a
given area**

**Vesicles, pustules,
scabs adjacent
areas**

**Distribution/
progression**

**Face, forearms
first, then trunk,
+palms/soles**

**Concentrated on
trunk, then face &
extr; -palms/soles**

Atypical Presentations

- **Hemorrhagic form:**

- Uniformly fatal, pregnant women more susceptible;
- Shorter incubation, severe prostrating illness;
- High fever, head, back and abdominal pain;
- Dusky, erythema followed by petechiae and purpura;
- Confused with meningococemia.

- **Malignant form:**

- Similar prodrome;
- Vesicular rash becomes confluent without forming pustules: skin feels velvety, reddish-crepe appearance;
- Confused with hemorrhagic chickenpox.

Complications of Classic Form

- Death occurs during the second week resulting from toxemia associated with circulating immune complexes and soluble variola antigens;
- Encephalitis sometimes occurs similar to acute perivascular demyelination in measles or c-pox;
- Secondary bacterial infection is rare;
- Other organs are seldom involved.

Transmission

- Person-to-person primarily by droplet nuclei or aerosols from coughing;
- Also by direct contact with oral or pustular fluid or with contaminated blankets, bedding;
- No animal/insect reservoir or vector;
- Transmissibility begins with appearance of rash.

Henderson DA, et al. JAMA 1999;281:2127-2137.

Transmission Factors

- Historically less contagious than measles or chickenpox, in part because patients are often confined to bed by prodromal symptoms;
- Family/household outbreaks, but not in schools;
- Seasonal occurrence due to increased survival of smallpox virus in cold, dry air;
- Imported cases in Europe led to outbreaks more often in winter than in summer.

Diagnosis

- Clinical index of suspicion for febrile rash illness;
- Laboratory specimens:
 - Pustular fluid on a cotton swab;
 - Scabs removed with forceps.
- Transport to State Lab ASAP:
 - Place specimens in vacutainer tube, top taped on;
 - Ship in durable, watertight container.

Laboratory Diagnosis

- Requires BSL-4 laboratory (CDC);
- Electron microscopy: typical orthopoxvirus appearance (brick-shaped virions);
- Viral culture on cell cultures or chorioallantoic egg membrane;
- PCR, RFLP for characterization.

Smallpox Vaccine

- Vaccinia virus;
- Currently available vaccine is NY Board of Health strain;
- 7-15 million doses available at CDC; may be able to be diluted 1:5 to yield up to 75 million doses;
- Administered by bifurcated needle.

Vaccination and Immune Status

- Routine vaccination in US stopped in 1972; military vaccinated until early 1990s;
- Duration of immunity is not clear; experience of naturally exposed persons never fully measured;
- Neutralizing antibodies following single dose decline significantly over 5-10 years;
- One study showed stable antibody levels over 30 years after vaccination at birth, 8 & 18 years.*

*El-Ad R, et al. JID 1990;161:446-448.

Passive Immunity

- Vaccinia Immune Globulin (VIG) obtained from vaccinated donors;
- Given with vaccine for persons at high risk for complications.
- Estimated 250/million vaccinees would require VIG for vaccine-related complications;
- Vaccinated soldier with HIV in early 1980s was treated with VIG and survived.

Post-Exposure Therapy

- Vaccination may prevent or ameliorate illness if given within 4 days of exposure;
- Cidofovir (nucleoside analog DNA polymerase inhibitor) may be effective if administered within 1-2 days;
 - Given IV. Limited quantities, serious renal toxicity.

CDC Smallpox Response Plan and Guidelines

Draft 1.0, 9/19/01

Keys to Smallpox Response

- Surveillance
- Vaccination around cases
- Isolation

Smallpox Surveillance

Case Definition

- Clinical Case Definition. An illness with acute onset of fever >101 F followed by a rash characterized by vesicles or firm pustules in the same stage of development without other apparent cause.
- Laboratory Criteria for Diagnosis* (to be conducted in Level C or D laboratories only):
 - 1. Isolation of smallpox (Variola) virus from a clinical specimen, (Level D laboratory only), or
 - 2. Polymerase chain reaction (PCR) identification of variola DNA in a clinical specimen, or
 - 3. Negative stain Electron Microscopy (EM) identification of Variola virus in a clinical specimen (Level D laboratory or approved Level C laboratory)

* Level D: CDC or USAMRIID

Source: CDC. Smallpox Response Plan and Guidelines, Draft 1.0, 9/19/01.

Surveillance Case Classification

- *Confirmed*: A case of smallpox that is laboratory confirmed.
- *Probable*: A case that meets the clinical case definition that is not laboratory confirmed but has an epidemiological link to another confirmed or probable case.
- *Suspected*: A case that meets the clinical case definition but is not laboratory confirmed and does not have an epidemiological link to a confirmed or probable case of smallpox,
OR
A case that has an atypical presentation that is not laboratory confirmed but has a epidemiological link to a confirmed or probable case of smallpox.

Vaccine Prioritization -1

In a smallpox outbreak, the following high-risk groups will be prioritized for vaccination:

- Persons who were exposed to the initial release of the virus;
- Persons who had face-to-face, household, or close-proximity contact (< 2 meters = 6.5 feet) with a confirmed or suspected smallpox patient after the patient developed fever and until all scabs have separated (no longer infectious);
- Personnel selected for the direct medical or public health evaluation, care, or transportation of confirmed, probable, or suspected smallpox patients.

Vaccine Prioritization -2

- Laboratory personnel selected for the collection or processing of clinical specimens from confirmed, probable, or suspected smallpox cases;
- Other persons with increased likelihood of contact with infectious materials from a smallpox patient such as laundry or medical waste handlers for a facility where smallpox patients are admitted;
- 6) Other groups whose unhindered function is deemed essential to the support of response activities and who are not otherwise involved in patient-care activities but who have a reasonable probability of contact with smallpox patients or infectious materials (e.g. selected law enforcement, emergency response, or military personnel);

Source: CDC. Smallpox Response Plan and Guidelines, Draft 1.0, 9/19/01.

Vaccine Prioritization -3

- Because of the potential for greater spread of smallpox in a hospital setting due to aerosolization of the virus from a severely ill patient, consideration should be given to vaccination of all individuals present in the hospital during the time a case was present and not isolated in an appropriate manner in a room with ventilation separate from other areas of the hospital (see Isolation Guidelines).

Suggested Pre-Event Activities Associated with ~~Isolation/Quarantine~~

- Assure local and/or state legal authorities are in place to allow public health intervention and implementation of the quarantine and isolation measures outlined in this section;
- Identify personnel responsible for local/state coordination of quarantine and isolation activities;
- Identify appropriate facilities to be utilized for isolation as outlined and establish procedures for activating them;
- Identify appropriate personnel (medical, maintenance, etc.) to maintain/staff facilities;

Suggested Pre-Event Activities Associated with Isolation/Quarantine

- Establish procedures for monitoring access to facility;
- Establish procedures for appropriate disposal of medical waste from facility;
- Establish laundry service arrangements (on-site if possible) and appropriate disposal of medical waste;
- Arrange for food service support for facility occupants;
- Establish procedures for monitoring health status of facility staff.

Type R Facility (Residential)

- Asymptomatic contacts.
- May be the persons own home.
- Fever surveillance for 18 days after their last exposure or until 14 days following successful vaccination (whichever comes first).
- Asymptomatic contacts may continue routine daily activities but must monitor temperatures and telephone the health department twice a day.

Type X Facility (Uncertain)

- Vaccinated febrile contacts without rash –
2 successive temperatures $> 101^{\circ}\text{F}$ (38C)
- If the number is small, they may be housed in the Type C Facility with smallpox cases.
- If rash develops during the observation period, the individual should be moved to a Type C Facility.
- If rash does not develop within 5 days, the contact may be released to complete surveillance at home.

Type C Facility (Contagious)

- Infectious Individuals (confirmed, probable, and suspected smallpox cases)
- Examples of potential Type C facilities include any empty facility (e.g. motel, hospital, separate building of hospital, college dormitory, etc.).

Type C Facility Requirements

- Non-shared air ventilating systems that exhausts 100% of air to the outside through HEPA filter
 - **OR** - is located at least mile away from any occupied building.
- Ability to provide medical care:
 - Supportive care: vital signs, IV fluids, antibiotics, skin care, etc.
 - Oxygen monitoring (pulse ox) and oxygen (in-line or portable)
 - Ventilatory support, cardiac and respiratory resuscitation
 - Basic laboratory evaluations (blood chemistries, CBC)

General Hospital Admission

- A confirmed or suspected case of smallpox should only be admitted to a hospital that is otherwise being utilized for non-smallpox patient care, if:
 - The facility has negative pressure isolation room(s)
 - An anteroom used for changing protective clothing
 - Transfer to the Type C designated facility ASAP.

Hospital Preparation

- Set up smallpox emergency planning team.
- ER triage to isolate all febrile/rash patients.
- Identify smallpox care team.
- Provide/fit test HEPA mask all ER/care team.
- Test integrity of negative pressure isolation rooms
- Review airborne and contact isolation precautions
- Identify isolation ward or building.

Local Emergency Preparedness Planning Scenarios

- Mass Antibiotic Distribution Events
- Mass Vaccine Distribution
- Smallpox Emergency Response
- Mass Trauma Event
- Chemical/Nerve Agent Event

Local Emergency Preparedness Planning Partners

- Local Health Departments
- Hospitals/health care partners
- Physicians/nurses
- Pharmacists
- State and county agencies
 - Emergency Management
 - Transportation
 - Law enforcement
 - etc.