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Smallpox

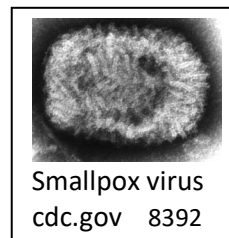
The only human disease to have been eliminated in nature, smallpox remains internationally notifiable. Recently the response measures for smallpox that were maintained proved to have use.

The Disease

The Orthopoxvirus genus includes true pox viruses. Variola (smallpox virus) and the related vaccinia vaccine virus are the main members affecting humans. Horsepox, cowpox, camelpox, mpox (previously known as monkeypox but more likely a pox in rodents), and borealpox (previously Alaskapox) affect other animals. Some of these such as cowpox, mpox, and borealpox can infect humans, although the numbers of such cases have been limited except for a recent global increase in mpox. In spite of its name, chickenpox is not a true pox virus.

Variola virus, the cause of smallpox, has humans as the only reservoir. The variola major form of disease had a case fatality ratio of about 30% when introduced into an entirely susceptible population while less than 1% of cases of the more mild variola minor form were fatal.

Historically smallpox was endemic throughout Asia, Africa, and Europe. The virus was spread during wars, exploration, and colonization, with particularly high mortality when introduced into an entirely susceptible population. Even when established as endemic, smallpox remained a major source of mortality. About 10% of deaths in 16th century Europe were attributed to smallpox, with deaths affecting all social strata including crowned heads of state and heirs to the throne. In the 16th century, Spanish and Portuguese explorers unintentionally brought smallpox to the Americas along with other infectious agents such as measles and influenza, which together resulted in an estimated 90% drop in population prior to the arrival of English colonists in the 17th century. Smallpox may have been deliberately spread to weaken Indigenous Tribes. The disease reached Puget Sound through trade routes with about 30% of the population lost before the 1791 arrival of George Vancouver's expedition.



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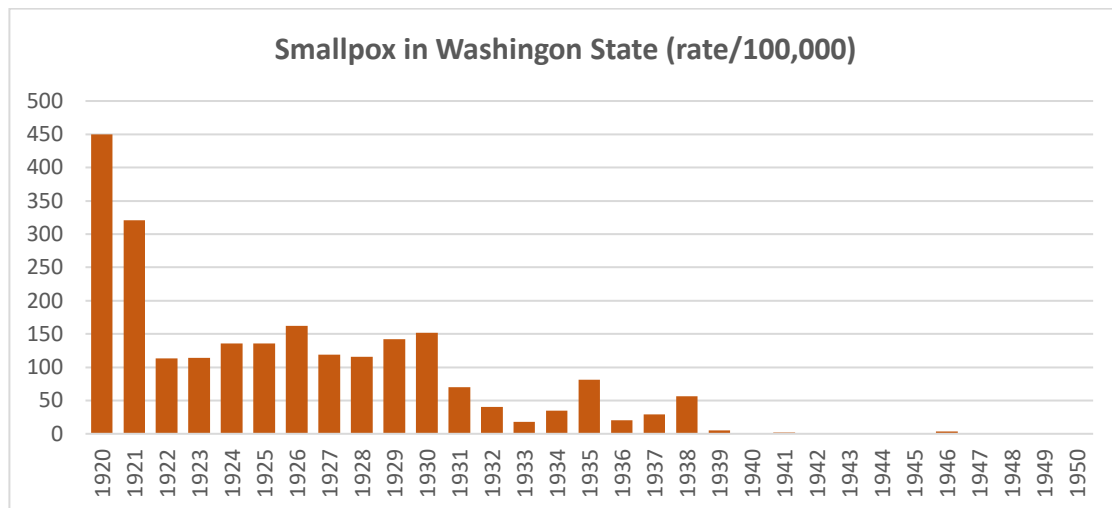
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Response

The first method to protect against smallpox was variolation. A dried smallpox scab was crushed and put either into the nose or into a small skin wound. The method was used in Asia and Africa, and eventually introduced in England in 1717 by Lady Montagu who learned about variolation in Constantinople. Due to smallpox outbreaks, colonial troops were given variolation in 1777.

The observation that variolation failed in those who previously experienced cowpox infection led to the production of a vaccine (Latin for cow: vacca) developed from the virus causing cowpox. In 1800 Thomas Jefferson used cowpox to vaccinate enslaved persons, and then family and friends. Vaccinia may have been derived from horsepox but the origins are unknown for the various vaccine strains of the virus that came into use. By the 19th century vaccinia had replaced cowpox for smallpox prevention and became a routine childhood vaccine. Although safe in most cases, vaccinia administration could result in rare severe complications.

A century ago the rate of reported smallpox cases in Washington was 450/100,000 (similar to current rates of chlamydial infections) with deaths usually under 1/100,000 annually. The state's last cases were during a 1946 King County outbreak. The last United States outbreak was in 1947 in New York, and vaccination recommendations ended for the country in 1972.



With smallpox vaccination increasingly available worldwide, attention turned to disease control. Almost all smallpox infections cause face lesions, so acute cases of smallpox were easily recognized. Face or arm scars were evidence of prior infection or vaccination. In 1966, WHO proposed global eradication efforts. Instead of aiming to achieve universal vaccination, the approach was surveillance for cases and ring vaccination for those living near each case. Challenges were considerable, including staffing, acceptance of vaccine, unsafe situations, refugee movement, and competing political priorities. Advantages were a stable free-dried vaccine and two vaccine delivery methods: bifurcated needles with automatic dosing, low cost, and ease of use in remote areas; and jet injectors applicable for rapid mass vaccination. Counties with ongoing smallpox cases responded by training thousands of outreach workers, providing supplies and travel resources, and offering rewards for reports of a case. By 1977 all direct transmission of smallpox had ended on the planet. Two laboratory-related cases occurred in 1978.

Smallpox Response Redirected

Although smallpox had stopped circulating for over 20 years, smallpox was a target of emergency response planning as a select agent with a potential severe public health threat. Two vaccines remained available, ACAM2000 and JYNNEOS, as well as an FDA approved antiviral medication (Tecovirimat or TPOXX) and other antiviral medications that could be used in an emergency (cidofovir and brincidofovir). Some of these were maintained in the Strategic National Stockpile.

In 2022 a global outbreak of mpox developed. Due to preparations for smallpox response, there were resources for testing, vaccination, and treatment that were deployed rapidly. Cases in the United States peaked by August, with over 30,000 cases identified during 2022, but are continuing to occur at lower numbers. During this outbreak, mpox was mainly spread through sexual and intimate contact, particularly, but not exclusively among men who have sex with men.

On an ongoing basis, vaccination with JYNNEOS is recommended for persons at risk (see Resources) and for those who need post-exposure prophylaxis. Protection is critically important with the recent risk of the spread of a more virulent type of mpox. Controlling disease at its source is a public health principle and should also be part of a public health response.

Resources

Smallpox

<https://www.cdc.gov/smallpox/history/smallpox-origin.html>

<https://www.who.int/news-room/feature-stories/detail/smallpox-vaccines>

Mpox

<https://www.cdc.gov/poxvirus/mpox/response/2022/index.html>

<https://doh.wa.gov/you-and-your-family/illness-and-disease-z/mpox>

Vaccine recommendations:

<https://www.cdc.gov/poxvirus/mpox/vaccines/index.html>

<https://doh.wa.gov/sites/default/files/2022-08/348906-GuidelinesForJYNNEOSVaccineUse.pdf>

Mpox communications tools: <https://www.ncsddc.org/resource/mpox-communications-toolkit/>

<https://nationalcoalitionforsexualhealth.org/tools/communicating-to-the-public/mpox-toolkit>

<https://www.cdcfoundation.org/programs/preventing-mpox-resurgence>

