

Smallpox Part II: Its History and Future

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Smallpox was a scourge that terrorized the world for 3000 years. The last major epidemic occurred in Somalia in 1977 with the last known case occurring in 1978. Because the disease has been eradicated, there has been no routine vaccination for smallpox for over 25 years. In most third world countries, the majority of the population is not immune. Can this deadly disease return? What conditions are conducive to the evolution and spread of this type of disease?

The origins of smallpox are not known; however, there is evidence of the disease in Egypt and India about 3000 years ago. It did not become a widespread problem until people began to live in communities with domesticated animals. Relatives of the smallpox virus live in other animals, and some of them can also infect humans. The viruses that infect cows (cowpox) and monkeys (monkeypox) are the best examples of this. One possibility is that humans in primitive communities acquired a pox infection from an infected animal and passed that infection to others in the community. The severity of an infectious agent depends on its virulence (ability to cause disease) and its transmissibility (ability to move from host-to-host). Over time it is likely that a poxvirus mutated to a more virulent form that was transmitted more easily because people lived in larger communities. Smallpox epidemics were localized because the virus required a human host and communities were usually separated by relatively large distances. In modern times communities became larger and transportation afforded a mechanism for the virus to spread.

The disease was easily recognized and its high mortality rate as well as the disfigurement that it caused in survivors resulted in many early attempts at immunization. The crusts from smallpox lesions contain live viruses that can live for many years, even in dried materials. As early as 300 BC Chinese applied such powders to their nostrils while some Indians inoculated the powder under their skin. Others ingested material from smallpox lesions or even injected it under their skin. Those who survived the usually milder disease caused by the immunization were then immune to the disease. By the early 18th century it was known that inoculation of material from patients with a very mild form of the disease would protect the individual from future smallpox infection.

Apparently people in areas where smallpox was prevalent had a higher level of natural immunity than did those who lived in areas that had never seen the disease. When European colonists conquered Mexico and North America they brought with them many diseases that the native people had never seen. The conquest of the natives of North and Central America by the Europeans is probably due in large part to the ravages of the diseases they brought. While Europeans typically had about a 10% mortality rate from smallpox, American natives had about a 90% mortality rate. On Hispanola (modern day

Haiti and the Dominican Republic) all of the 2.5 million indigenous people perished between 1509-1518 after the Spanish introduced smallpox to the island. Similar decimation of the Aztecs followed the invasion of Cortes into Mexico in the early 16th century. In the early 18th century 90% of the Indians in one area of Massachusetts were killed by a smallpox epidemic.

One incident involving the Mandan Indians of North Dakota is well documented by the fur traders who arrived by steamboat in 1837. Some members of the crew had smallpox, which they did not tell the Indians. Over the next three months, 1563 Mandans died, leaving only 31 survivors of their tribe. Chief Ma-to-toh-pah, who also contracted smallpox, blamed the fur traders for the epidemic. He is reported to have said to his tribe:

"I have never called a white man a dog, but today I do pronounce them to be a set of black hearted dogs, they have deceived me, them that I always considered as brothers, has turned out to be my worst enemies . . . I do not fear death, my friends. You know it, but to die with my face rotten, that even the wolves will shrink with horror at seeing me, and say to themselves, that is the Four Bears, the Friend of the Whites."

The eradication of smallpox is one of the medical triumphs of the World Health Organization. One concern is whether it can return. There are two possibilities for a recurrence of the disease. The stored vials of the virus could be used to produce smallpox as a biological weapon. Since so many people are no longer immune to the disease, the effect would be devastating. Another possibility is that the monkeypox virus could, over time, mutate into a virus that is more infectious for humans than it is now. Monkeypox can infect humans and causes a disease undistinguishable from smallpox, with about a 15% mortality rate. It has not been a major problem because it is not readily transmitted between humans. This disease only occurs in African countries with monkeys, which are the primary source of the monkeypox virus. Nevertheless, the potential for a new form of poxvirus that can infect humans exists in animal reservoirs. Since there is still at least the potential for smallpox to emerge again, even if the known samples of the virus are destroyed, it is important that research on the poxvirus family continues. In particular, we need a treatment for the disease that will work rapidly. Mass immunization is no longer reasonable and in the event of an outbreak immunization would be too slow to help those who contract the disease.