

Exploring Disease in Africa:
AIDS
Sleeping Sickness
Small Pox

A curriculum for advanced high school +College students

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SMALLPOX: THE DISEASE THAT DIED AFRICAN PRACTICES AND THE CHALLENGES OF ERADICATION

BOYLSTON AND BOSTON

In 1721, a deadly epidemic of smallpox broke out in Boston. All around the city, people were dying painful deaths, covered all over their bodies with oozing, pus-filled sores. The disease was terrifying not just for the astonishing number of people it killed, but also because it was so misunderstood. During this period of time, science existed alongside superstition, and medicine next to magic. People were not clear about how the disease was transmitted, and because of that, virtually nothing could be done to prevent it. Smallpox was an equal opportunity killer.

While the epidemic was worsening and people becoming increasingly desperate, Dr. Zabdiel Boylston learned of a process of inoculation used by slaves in the Boston area. In general, a handful of different slaves described a practice of taking the liquid from a smallpox lesion, and putting it into a cut made on a healthy person. The healthy person would get sick with a mild form of smallpox, but would recover shortly. The slaves attested to the fact that the practice of inoculation seemed to provide lifetime immunity to smallpox, and that very few people died undergoing the procedure.

Based on that information gleaned from the Boston-area slaves Boylston decided to begin inoculating people. His actions created a huge controversy and he defended his decision, stating:

I don't know why 'tis more unlawful to learn of Africans, how to help against the Poison of the Small Pox than it is to learn of our Indians, how to help against the Poison of a Rattle Snake.

Dr. Boylston continued to inoculate people to great criticism. Only when the epidemic had subsided could his technique be compared to the standard care at the time (doing nothing). At the end, he showed that of the 300 people he inoculated, only 6 died. At worst, the death rate for those undergoing his procedure—or really, the slaves' procedure—was only 2%. Among the general population in Boston, the death rate was 14%.

AFRICANS AND INOCULATION

Smallpox is an ancient disease and was present in Africa, Asia and Europe since 400 BC. It is unclear whether smallpox was indigenous to Africa or was introduced early on. By 600 AD, smallpox was widespread in North Africa, and probably moved into West Africa by virtue of the caravan trade that crossed the Sahara desert. In addition to the disease arriving from across the desert, it was also introduced and reintroduced on the coast by foreign ships.

By 1700, there is record of West African people using the practice of inoculation. If the practice had been adopted, it likely came from visitors or travelers who had crossed the Sahara desert from the Middle East. If it emerged independently in West Africa, it's hard to establish when it began since we are reliant on documents written by foreign travelers and traders—many of whom never left the coast. An African account was collected in the twentieth century, although it describes the woman's own inoculation around 1892. She reported that:

they used to scratch your arm until the blood came, then they got the fluid from someone who had the smallpox and rubbed it in. It all swelled up and you covered it until it healed. Some children used to die...

Although it was the practices of Africans that informed Dr. Boylston's actions in Boston, Africans were not the only group to use inoculation. The practice had a long history in Asia and the Middle East, and reports from the 1700s describe it being used widely to contain smallpox outbreaks in Constantinople. It is unclear whether the practice of inoculation arose spontaneously in multiple sites, or if the knowledge had been passed around the globe.

Ironically, despite these techniques being used outside of Europe with great success, the practice did not catch on quickly. There was little understanding of why inoculation worked, just a body of very persuasive evidence. It was not until the experiments by Edward Jenner half a century later that more light was shed on the practice of inoculation and how to prevent smallpox.

JENNER AND VACCINATION

In 1796, Edward Jenner conducted an experiment that would change the way the West dealt with smallpox, and that would set the stage for eradication attempts nearly two hundred years later. In that year, he made the observation that milkmaids in England were never stricken with smallpox. Rather, they suffered from “cowpox” lesions all over their hands and arms due to their constant contact with the cows they milked. Jenner guessed that the women's exposure to cowpox granted some degree of immunity to the related smallpox disease. (In fact, smallpox is the human form of cowpox, and the disease mutated once cattle were domesticated and there was greater contact between humans and cows.)

In order to test his hypothesis he conducted a very useful experiment, but one that would never be allowed to occur today. He inoculated an eight-year-old boy with fluid from a cowpox lesion on the arm of one of the milkmaids. The boy developed a cowpox lesion, and after a few days it healed. This was the first part of the experiment, but then Jenner had to challenge the boy's immunity, and this is the part that would be deemed quite unethical today. Jenner exposed the boy to smallpox victims—essentially *trying* to infect the boy with smallpox. When the boy remained free of smallpox Jenner knew that his hypothesis had been correct and that it was possible to prevent against smallpox.

From Jenner's experiments came the practice of “vaccination.” The term was originally derived from the Latin word for cow, “vacca”. Thus, the practice of injecting someone with cowpox in order to provide immunity to smallpox was referred to as vaccination. Only later did the term take on its more general meaning of receiving an injection to prevent against disease.

TRANSMISSION, SYMPTOMS, DEATH TOLLS

Smallpox is an acute contagious disease caused by variola virus, a member of the orthopoxvirus family, and is related to cowpox and monkeypox. It is transmitted from person to person by infected air droplets spread in face-to-face contact with an infected person. The disease can also be transmitted by

contaminated clothes and bedding, though the risk of infection from this source is much lower. There is no animal reservoir and insects play no role in transmission.

The incubation period of smallpox is usually about two weeks. During this period, there are no outward symptoms and the person cannot infect others. The incubation period is followed by the sudden onset of flu-like symptoms including fever, malaise, headache, severe back pain and, less often, abdominal pain and vomiting. Two to three days later, the temperature falls and the patient feels better. Over the next few days, the characteristic rash appears on the face, hands, forearms and abdomen. Lesions also develop in the mucous membranes of the nose and mouth, and ulcerate very soon after their formation, releasing large amounts of virus into the mouth and throat. Lesions progress from macules to papules to vesicles to pustules. About two weeks after the onset of symptoms, if the patient is still alive, the pustules form scabs which leave behind scars.

The possibility of infection is greatest after face-to-face contact with a patient after fever has begun and during the first week of rash. It is then that the virus is released via the respiratory tract and the patient's coughing spreads infected droplets into the air. Although patients remain infectious until the last scabs fall off, the large amounts of virus shed from the skin are not highly infectious. Exposure to patients in the late stages of the disease is much less likely to produce infection.

There is no effective treatment for smallpox. For those who were exposed, a vaccine could be administered within 4 days of exposure to the virus. Sometimes this would grant immunity, prevent infection or lessen the severity of the disease. Otherwise, 30% of those infected by smallpox died.

In the early 1950s – 150 years after the introduction of vaccination – an estimated 50 million cases of smallpox occurred in the world each year, a figure which fell to around 10–15 million by 1967 because of vaccination. Historically, there were major epidemics of smallpox throughout Africa. Along the West African coast, there were epidemics from the 1680s through the nineteenth century. In South Africa, there were smallpox epidemics introduced by foreign ships in 1713, 1755, 1767. On the East Coast, the Portuguese recorded an epidemic in 1589, but it moved into the interior slowly since the trade networks were not as extensive as on the West Coast. Globally, the disease killed between 300 and 500 million in the twentieth century alone.

ERADICATION: THEORY AND TECHNIQUES

There are at least two different strategies for managing disease: control or eradication. Since a version of Jenner's vaccine came into widespread use, smallpox had been managed globally by administering the vaccine to people. But no matter how good a vaccine is, it can never be 100% effective. Vaccines suffer from a few minor problems and one major problem. The minor problems are that there is always a slim chance that a vaccine is ineffective, or that it won't properly work on a person. In a small number of cases, the vaccine will also cause serious side effects and even death. But these aren't the real shortcomings of vaccination.

More importantly, a vaccine's efficacy is limited by where it is actually used. A vaccine cannot help someone if it doesn't reach that person. In rural parts of Africa and Asia, people were not being

vaccinated and were continuing to suffer from a fatal—yet preventable—disease. People were beginning to see the limits of only controlling smallpox. Control meant that while it was virtually eliminated from industrialized nations, but continued to plague poorer countries. In 1967, the "ancient scourge" still threatened 60% of the world's population, killed every fourth victim and scarred or blinded most survivors and eluded any form of treatment. This reality made many ethically uncomfortable and by the late 1950s there was talk of another type of management for smallpox: eradication.

Despite appearing to be quite clear, eradication is a public health term that is actually quite hazy. When the World Health Organization first began discussing smallpox eradication in 1958, then eradication only meant the elimination of the disease within specific nations. By 1967, the term described the elimination of smallpox globally. This was a huge jump in scale. With the backing of the United Nations and the WHO, smallpox became the second disease to be targeted for worldwide eradication. (Malaria was the first disease; and while it was successfully eliminated from the Southern United States and parts of Europe and Latin America, attempts failed in Asia and Africa.)

The blueprint to accomplish global smallpox eradication was to eradicate the disease country by country using the techniques of vaccination and isolation. The plan for eradication called for 100% vaccination. This meant that thousands of public health workers were sent out into millions of villages and cities to go door to door, vaccinating every single person.

This plan of 100% vaccination sounded great to public health workers, but there were two areas where problems arose. The first came when public health workers encountered someone who refused to be vaccinated. The reasons as to why someone would refuse were many. Some people refused on religious grounds, others were doubtful as to the efficacy of the vaccine or felt threatened by foreigners pushing medicine. Regardless of the reasons, there were many people who refused to be vaccinated. In these cases, the WHO plan relied on forcing those individuals to be immunized against their will.

The second scenario that threw a wrench into the public health machine was when workers discovered someone who was infected with smallpox. There was no effective treatment for smallpox so anyone who had the disease had to be isolated to prevent the spread of the disease to other persons. Complete isolation was the only way to be sure that the disease wouldn't spread to others and foil eradication attempts. Isolation in a special ward in a hospital was ideal, but in many rural areas there were no hospitals, and no special wards. In this case, isolation was best done at home. As you may have guessed by now, many patients were less than enthusiastic about the idea of being isolated, especially forced isolation. People were so distraught by this, in fact, that smallpox patients hid from workers and tried to avoid being discovered.

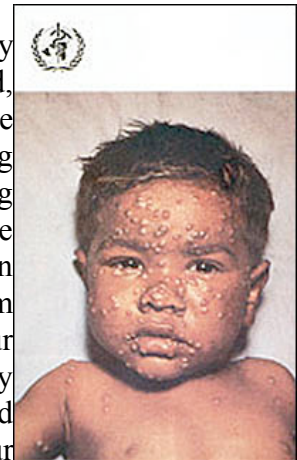
Ultimately, the WHO strategies of mass vaccination and isolation were effective at eliminating the disease from the globe. In 1980 the WHO announced the total eradication of smallpox. Some have argued that the eradication of smallpox was the biggest public health accomplishment in history, remarkable both for its logistical difficulty and the outcome.

ERADICATION: ETHICAL QUESTIONS

The tactics used to eradicate smallpox are worth considering from an ethical perspective, rather than just a pragmatic one. The campaign was based on the notion of 100% vaccination in locations where the disease was still present. It was also dependent on finding every case of smallpox so the individual could be isolated. Each of these practices raises serious ethical questions about the rights of individuals to choose what happens to their own bodies versus the rights of public health workers to go against an individual's wishes and do what they believe is best both for the individual and larger society. In this section, we'll evaluate the practice of forced vaccination.

As was mentioned in the prior section, public health workers occasionally ran into people who refused to be vaccinated. Sometimes these people made sophisticated arguments about why they wanted to opt out, and other times they were just obstinate. From an ethical perspective, we could say that these people—regardless of whether they had a good reason or not—were exercising their autonomy. It is their choice as an individual to decide what will and will not be done to their body. The ethical principle of autonomy is also sometimes referred to as the right to self-determination. In the United States, we recognize respect for autonomy as one three key ethical principles guiding medical practice. (The other two principles are “non-maleficance and beneficence” and “distributive justice.”) In practice the major way medical researchers and doctors respect autonomy is by always asking for informed consent. The process of informed consent is meant to share information with the patient so she can decide what she would like to be done.

In medical and public health situations, when a health worker knowingly disrespects someone else's autonomy, one of two things are afoot. On one hand, the health worker is just knowingly and egregiously breaking the law. On the other hand, the person may defend herself by claiming that she is in fact acting in the person's best interest. In this case, the person is said to be acting paternalistically. Paternalistic behavior is grounded in the belief that there are times when someone may not act in his best interest, and that an outside person can do a better job of deciding what is best. An obvious example of paternalism is when your parents forced you to go to the dentist, get a shot, or eat your vegetables when you were little. Although as a ten year old you probably objected to all of these things, your parents acted in your best interest, ruled against you and made you go to the dentist and the doctor and to finish your peas. This type of paternalistic behavior is tolerated when a parent is acting in the best interest of the child.



The WHO card used in the eradication campaign

The concept of paternalism becomes murky when we have adults acting on behalf of other adults. For the smallpox eradication campaign, global health workers would determine that although a competent adult might state their opposition to being vaccinated, it was actually better for that person to be forcibly vaccinated. This type of paternalistic behavior was justified by claiming that it was better for the individual to be vaccinated. The logic was that smallpox was a terrible disease and that the vaccine was safe and effective, and it would protect this adult from future infection really a question of individual rights to autonomy vs community interest in good health. Better frame e.g. stopping at red lights benefits community over individuals.

You may or may not agree with the health worker's justification on paternalistic grounds. An alternative justification is based on the concept of utilitarianism. Briefly, a utilitarian is in support of actions that will bring the greatest good to the greatest number of people, even if that means that the rights of an individual are infringed upon. In this case, one person's forced vaccination would bring great benefit to that person's family and whole community, now protected from smallpox. However, a supporter of rule-based ethics would argue that it is always wrong to disrespect someone's autonomy since there are certain ethical rules and principles that must always be adhered to. If respect for persons through respect for autonomy is a fundamental ethical principle, any action that conflicts with this principle must be wrong.

Discussion Questions

- What techniques did Africans use to treat smallpox? How do you think they learned those things?
- Discuss the differences between controlling a disease and eradicating a disease. Although eradication may always be desired, can mere control also be successful or desirable?
- Is eradication only possible when there is no vector involved, and the disease is only tangentially linked to the environment? [easier to discuss when compared to sleeping sickness]

Activity Ideas

- Consider the practices used during the smallpox eradication campaign. Outline the different ethical arguments to be made in support of, and against, the practice of forced isolation. What is your conclusion about the health workers' actions?

After you've discussed the practice of forced isolation related to smallpox, reconsider your argument in light of a recent story about an American infected with tuberculosis. This man knew he was infected with tuberculosis yet chose to travel to Europe and visit multiple countries before returning to the United States. Ethically, he was expressing his autonomy in choosing to be out in society. But as soon as he arrived back to the United States he was legally forced to be isolated and treated. Do you think this was fair? Are there ever situations when individual rights ought to be ignored if it means society, as a whole will benefit? Does the fact that tuberculosis is a contagious disease that can quickly spread amongst the public make a difference? Can you identify the ethical principle behind your argument?

Additional Materials



The last victim of smallpox



A particularly bad case of smallpox