

The Injection Problem

Five years ago a mysterious disease struck Center City 500 miles away. 45,000 people live in Center City. At first a few people became sick, running a high fever with sores all over their body. After a week, many people of all ages became sick in the same way. One month later, the disease disappeared as suddenly as it began. A total of 4,865 men, women and children caught the disease and 805 people died. All of those who survived were left with scars from the sores. Some scars were very bad on people's arms, legs and faces. A year later the disease broke out again in the same city, in the same way. When it was over 5,246 people caught the disease and 750 people died. The survivors all had scars. Some of the scars were very ugly.

Dr. Martha Stanton, an epidemiologist (one who studies who gets diseases), realized that no one who had caught the disease the first time, and survived, caught the disease the second time. She could tell because no one who had scars from the first outbreak of the disease caught it the second time. She reported the information to the medical doctors in the city. A few doctors and other public health officials proposed the idea that once a person survived the disease, they were immune and could not get it again. Dr. Walters, a children's doctor, noticed that in homes where children got the disease first, many parents and brothers or sisters who lived with them caught the disease afterwards, but very few died. He studied them further and found out that many of the people who caught the disease this way and survived had cuts or other open wounds when the first family member became sick. Dr. Walters' idea was that people can catch the disease by contact with the material in the infected sores of other victims. These people usually did not get a very serious case of the disease.

He reported this to the other doctors in Center City and five of them decided if another epidemic of the disease broke out, they would offer to give people the disease. They explained that this meant taking a bit of the material from the sores of someone who had a slight case of the disease and injecting it under the skin of the healthy person. The further explained that almost all the people so treated would probably get the disease and that some might even die. They said their idea or hypothesis was that very few people die and all the others would then be immune.

In the next three months, the disease broke out in two other countries and 12,500 people caught it and 1,594 died. A few months later people began getting sick again in Center City and Dr. Walters and five other doctors decided they would give the disease to volunteers in an experiment to test their ideas.

869 people volunteered and were injected. 863 of those caught the disease and of those, 22 died. At the same time 4,328 other people in the Center City caught the disease and 652 died. Again, no one who previously had the disease caught it again. There were many arguments in Center City as to whether Dr. Walters and the others who injected people were right. There was another outbreak of the disease in Center City last year and none of the injected people who survived caught the disease. Dr. Walters said this helped prove his idea that injection was a good thing to do.

In the last week, 15 people where you live have caught the disease, one is in your neighborhood. The health department announced yesterday they expect a serious outbreak of the disease in the area including your neighborhood. Three doctors in the community are offering to inject anyone in the area who wants to be injected. They explained injected people will probably get the disease and some may die. They said it is an experiment and everyone should think about the information from Center City before making up their minds. They think injection will cause fewer deaths and those who survive will be immune. You have to make the decision by yourself!

The injection problem you just read is based on the real story of the disease called smallpox. Smallpox was a terrible disease all over the world in the 1700's. Epidemics would break out suddenly and people of all ages would catch it. Everyone who survived would be left with scars which formed when the sores healed. About one in seven people who caught the disease died from it. It was quickly noticed that two things were unusual about smallpox:

1. Then the disease struck a community, very large numbers of people caught it.
2. People who survived the disease never caught it again.

In the early 1700's people in Turkey and England learned that if you inoculated people with pus from the smallpox sores of others, they would get a slight case of the disease. A few might die, but most would recover and then would never get the disease again. Although they didn't understand the concept then, these people had become "immune". For example most of you have been given polio shots that have made you immune to that disease.

The idea of inoculation was brought to North America and was of real interest to Dr. Boylston of Boston. He had caught smallpox as a boy, survived and realized he was now immune. He realized in 1717 that an epidemic of smallpox was starting in Boston brought in by the crew of a visiting ship. Dr. Boylston tried inoculation on his son and two other volunteers. All three caught slight cases of the disease and survived. The smallpox epidemic in Boston grew very large. Dr. Boylston inoculated 247 other people and 6 of them died. Dr. Boylston became very popular, especially with the people who survived. Some of the other doctors in Boston were opposed to Dr. Boylston's revolutionary use of immunization. The fact that 6 people died made things worse and Dr. Boylston was accused of violating the ancient oath of Hippocrates which is supposed to guide all doctors. In part the oath says: "Above all, do no harm to anyone, nor give advice which may cause his death." Dr. Boylston had to face the outrage of other doctors, and part of the community at large.

When the smallpox epidemic of 1717 in Boston ended, careful counting produced the following evidence:

- A. 5,759 people caught smallpox naturally and 844 died. This meant approximately one in seven people who caught the disease naturally died.
- B. None of the previously inoculated by Dr. Boylston caught the disease during the epidemic. Therefore 6 out of 247 who were inoculated died. This meant one in 41 people died from inoculation.

As you might imagine when the epidemiologist proved the data given above, all charges against Dr. Boylston were dropped. In other smallpox epidemics in the 1700's, some doctors used the inoculation procedure. The use was always limited and of course, when anyone died there were usually arguments about whether it should be done. In 1792, Dr. Edward Jenner, an English physician, recognized that people who contracted cowpox became immune to smallpox. As the story goes, Jenner was examining a young woman with a number of broken out areas on her skin. When Jenner said that one possibility was that she had smallpox the woman replied that was impossible because she had already had cowpox and people who had cowpox did not get smallpox. Jenner collected more evidence and found out this was true. Further it was known that cowpox produced a slight infection. Jenner's genius was putting together the information about cowpox and Boylston's risky method of inoculating people against smallpox. He reasoned if you inoculated people with cowpox, you would produce the immunity without the risk of life of Boylston's method. Jenner's method, called vaccination, was soon used around the world. It was combined with identifying and isolating smallpox victims whenever the disease struck. Many years after Jenner's discovery careful application of epidemiology proved there was a risk of death involved in Jenner's method. One person in 100,000 who were vaccinated contracted smallpox and died. When the risk was realized and smallpox had been absent from America and Britain for a number of years, both countries gave up vaccination. They decided at the time, the danger of being vaccinated was greater than the danger of dying from smallpox.

History of Smallpox Vaccination

1. List some of the effects of smallpox infection as described in the article.
2. What did people in Turkey and England learn about smallpox in the early 1700's?
3. When was the idea of inoculation introduced in the United States?
4. What role did Dr. Boylston of Boston play in beginning inoculation for smallpox in the United States?
5. How many people did he inoculate? How many of those people died as a result?
Calculate the percentage of people that died as a result of his inoculation.
6. In the same epidemic, how many people caught the disease naturally?
How many of those people died as a result?
Calculate the percentage of people that died as a result of naturally contracting smallpox.
7. When and where did Dr. Edward Jenner live?
8. What did he learn from the young woman he examined for areas that were broken-out on her skin?
9. How is cowpox different than smallpox?
10. What hypothesis did Dr. Jenner develop?
11. He carried out an experiment, did his experimental data support his hypothesis?
12. When was the last documented case of smallpox?
13. Why did many countries stop vaccinating for smallpox?