

One of the greatest victories in medical history: eradication of smallpox

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“ In virtually every war, far more people — soldiers and civilians alike — have been debilitated and killed by disease than by any combination of arrows, bullets, and bombs.”

– David Koplow, Former Pentagon Advisor

The Eradication of Smallpox: Jenner’s Final Victory

Introduction

In 1977, near the coastal city of Merka in Somalia, Ali Maow Maalin found himself traveling towards a vaccination site with a smallpox victim. The twenty-three year old was a cook at the local hospital in Merka, but on occasion, he volunteered to help the local World Health Organization workers vaccinate the people against smallpox. Shortly after the encounter, Maalin fell ill with the characteristic rash of smallpox. In a later investigation it was determined that Maalin had never received his smallpox vaccination. Luckily, Maalin recovered fully, and the virus was not spread to anyone else. In fact, this incident would be the last natural case of smallpox ever to be recorded. No one else in the future would ever have to worry about naturally contracting smallpox ever again. With the eradication of smallpox in 1977 set a precedent for future disease eradication programs, but also prompted many new concerns about the rights and responsibilities of nations and worldwide organizations to defend against and attempt to destroy diseases.

HISTORICAL CONTEXT – THE DEVASTATION OF SMALLPOX

Smallpox ravaged mankind for thousands of years. In ancient times, it was usually introduced to a new area through merchants and travelers. The variola virus, as the disease was also called, would spread through

populations with alarming speed. After an incubation period of about two weeks after infection, victims come down with a high fever. Shortly after, a rash begins to appear on the skin. The rash soon develops into large bumps filled with thick white liquid. Usually 30% of people who contracted the virus died, but much higher death rates have been documented. After smallpox has passed through a population, the survivors develop immunity to the disease and the area stays free from the disease for many years. As those initial survivors begin to die and the number of immune people begins to fall, however, the area once again becomes susceptible to the disease. The process repeated for centuries. In the 1900s alone, the virus killed 30 million people (Flight, par 2).

Smallpox has been used many times throughout history as a biological weapon, both intentionally and unintentionally. Though biological and chemical weapons were often looked down upon in ancient times as being cowardly or inhumane, they certainly changed the outcomes of many battles. One of the most famous examples is the conquistadors' invasion of Central America. The Spanish conquerors introduced the virus to the Native Aztecs and Incas unknowingly, and for the Europeans, who were either survivors of smallpox or at least direct descendants of survivors, the disease had no effect. But the Natives, to whom the disease was completely foreign, the disease was devastating. Entire tribes were wiped out, bodies piled up by the thousands, and many important leaders who might have been capable of mounting a defense against the invaders were killed. The use of smallpox has also been documented during medieval times and the American Revolutionary War (Koplow, ch. 3).

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EVENT – ERADICATION

Though Edward Jenner's revolutionary smallpox vaccine was developed in 1796 (Koplow 18), it wasn't until 1950 that the world began taking steps towards the goal of eradicating smallpox. Starting around that time, it was decided that investment towards the eradication of smallpox would be financially profitable, so programs to remove the virus from an area began popping up around the world. The movement started in the United States with the Pan American Sanitary Organization, and after eight years the disease began to disappear from the US. In 1958, Victor M. Zhdanov boldly proposed to the World Health Organization (WHO) the idea of global eradication. Put simply, the 10-year plan involved constant vaccinations and revaccinations around an area whenever a smallpox case was reported. The proposal was quickly approved. In 1967, the Intensified Smallpox Eradication Program was initiated and even more countries started being crossed off of the list of infected countries (Koplow 22). By 1972 only six remaining countries were still infected with smallpox, and seven years later the World Health Organization officially declared that smallpox was completely eliminated from the planet – that is, with the exception of a over a hundred samples still retained by the United States and Russia in high-security WHO laboratories.

EFFECT 1 – THE DISEASE ERADICATION MODEL

The eradication of smallpox has such symbolic value that many may even argue that it is more important than its practical value. The variola virus is the first human disease to ever be completely eradicated from the

environment. Because of this, its methods and strategies act as a model for all current and future disease eradication programs (Cochi 1).

One notable contribution of the smallpox eradication program is a method of vaccination called ring vaccination. Ring vaccination is a system of strategic vaccination developed during the smallpox eradication project. With ring vaccination, vaccination teams respond to individual cases rather than simply vaccinate the entire population of an endemic country. When an outbreak is reported, all of the people within a certain distance of the reported case are vaccinated, creating a sort of “ ring” around the infected (Kreston 2). This method proved to be extremely efficient and cost-effective during the smallpox campaign.

While smallpox was the only disease to be successfully eradicated, it certainly was not the only one to be attempted. In the late 1900s a total of five disease eradication programs were initiated: yaws, malaria, smallpox, guinea worm, and polio (Cochi 2). Each one of these programs faced unique sets of obstacles. First, eradication programs were greatly affected by political factors. Because of their differences in time period, some programs were forced to try to vaccinate populations in the midst of political upheavals, armed conflict, and mass migrations (Cochi 2-3). This made cooperation and funding from the endemic country, which are crucial to the success of a worldwide eradication program, exceedingly difficult to obtain. Second, the fight against a disease is heavily influenced by social factors, or the public view of the disease. The more dangerous a disease is perceived to be, the more support the eradication program receives from developed

countries (Cochi 3). It also helps if, during the campaign, there are no other competing disease eradication programs. Economic factors also affect disease campaigns. If a developed country believes that the cost of eradicating the disease is much less than the cost of treating the disease for decades to come, it will be more likely to donate funds to the eradication effort (Cochi 3). Any gaps in funding can cause enormous setbacks in the treatment process. Finally, there are many technical factors that affect the outcome of eradication campaigns. The more efficient a vaccine is, the easier it is to immunize large groups of people.

Smallpox acts as a model because it demonstrates the political, social, economic, and technical factors needed to successfully eradicate a disease. While the initial infected population was relatively large (Cochi 2), the smallpox campaign started out with many hidden advantages over other disease campaigns. First, the project was initiated during a time of relative political peace. This meant that there was sufficient personnel support from the public health systems of endemic countries. Former US Surgeon General Dr. C. Everett Koop once pointed out that “ the smallpox campaign would not have worked were it not a grassroots campaign, it was essential that indigenous public health workers be involved in the campaign if it was to gain the cooperation of local people necessary for success.” (Kreston 2). At the time of the program’s start, it was well known that smallpox was extremely deadly, which meant that developed countries were eager to make sure it never again plagued mankind. There were also very few competing disease programs in place during the campaign. In terms of money, the smallpox campaign was relatively inexpensive. The program

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received sufficient funding and is estimated to only have expended \$300 million. This is not much, compared to the \$1.7 billion already spent towards the eradication of polio. Finally, the smallpox campaign experienced a wealth of technical advantages. At the beginning of the program, smallpox was restricted to a relatively small area, which made it much easier to control. Smallpox also could not be spread to humans through animals, air, or water. “Transmission required contact with the respiratory secretions and the skin rash of a patient” (Steinbrook 2; see appendix Figure 1), which meant that even the transmission of the disease could be easily controlled. The smallpox vaccine was also extremely effective. One dose usually immunized a person for many years. It was this plethora of advantages that allowed smallpox to succeed, and it is these conditions that future disease control programs must strive for. With the eradication of smallpox as a guide, the world may someday be free of many of the horrible diseases that plague humans today.

This, however, raises an important moral question in itself. Do humans have the right to control nature in this way? While most would argue that, yes, humans indeed have both the right to defend themselves from predators and the responsibility of protecting their progeny, a vocal minority argue that technology has gone too far. Some argue that it is immoral for humans to “play God” in this way, and that nature should be allowed to run its course in keeping the human population under control. Some environmentalists, religious extremists, and philosophers believe that humans have the right to continue tampering with the natural order of the world. (Koplow, ch. 6) These views, however, make up a minority, and the fight against disease continues.

EFFECT 2 – BIOLOGICAL WEAPON THREAT

On April 10, 1972, a convention was brought forth by the British called the Biological Weapons Convention (BWC). The document acted as an extension of the Geneva Convention, which only prohibited the use of biological weapons. The BWC went one step further, and limiting the right of nations to produce or store biological weapons. As of April 2013, 170 countries have signed and ratified the treaty. Nine years after the proposal of this convention, the World Health Organization proudly announced to the world that the variola virus was completely eradicated from the environment. Despite both of these massive steps, smallpox continues to be a major concern in national defense (Koplow 81).

Two important events caused the United States' sudden interest in the smallpox weapon. The first was the terrorist attacks of September 11th. The devastating attacks caused major increases in security all over the country in all areas. The attacks also made the United States very wary of all other potential terrorist threats, smallpox being one of these potential threats. However, smallpox may never have been brought forth as a concern if not for a man named Ken Alibek. Ken Alibek defected from the Soviet Union to the United States in 1992. He had been a high-ranking official in a Soviet bioweapons research program. He testified to Congress, saying that the Soviet Union had been illegally stockpiling “ hundreds of tons of anthrax weapon... along with dozens of tons of smallpox and plague” (Brown, par 17). Alibek even claimed that the Soviet Union was manipulating genes in order to create much more powerful variations of viruses that vaccines would not be able to fight. Although Alibek's claims have never been verified

by other sources, his testimony raises concerns with potentially devastating repercussions.

Because of this concern, the United States military has taken steps to try to defend against such an attack. Although the general population has stopped receiving the smallpox vaccine many years ago, the United States military continues to vaccinate its troops against the virus. The United States Department of Defense spends hundreds of thousands of dollars every year buying and administering the smallpox vaccine for its troops. Many argue that this seemingly unnecessary expenditure could be put to better use funding international efforts to combat diseases like malaria or HIV (Russell, col 4; see appendix Figure 2). The smallpox vaccines also raise several health concerns. The injections have often been found to cause serious and occasionally even lethal side effects in vaccinees. Symptoms have included rashes, lesions, infections, fevers, and ulcers (Russell, col 3). Family, friends, or other people close to vaccinees have also been known to contract vaccinia, a weakened form of the smallpox virus. These and several other factors have caused much controversy over the military's steadfast decision to continue vaccinations.

A smallpox attack on the United States would no doubt be devastating. While the devastation could be of varying degrees depending on the method of attack, any attempt would nevertheless be an incredible effort to contain (Foster 1). The United States public health system is simply not prepared for such an attack. The notoriety of the smallpox virus coupled with the shortage of smallpox vaccines would no doubt lead to much panic.

Once again, important questions are raised. Should the remaining stocks of smallpox be destroyed? Some would argue that it is the responsibility of the developed nations to take every possible step towards ensuring that smallpox never again attacks mankind. Others argue that the scientists have the right to keep the samples and continue studying them, in case they are needed in the future. As of 2013, the debate has reached a stalemate, and no action has been taken (Koplow, ch. 3)

CONNECTION TO TODAY – DEALING WITH DISEASES

The success of the campaign to eradicate smallpox is the reason no one has naturally contracted the disease in over forty years. It is thanks to this success that no civilian on the planet has to worry about smallpox anymore. It introduced the idea of complete eradication as a possibility; permanently changing the way the world viewed the fight against disease. The responsibility of extinguishing diseases has now fallen to the WHO. The ongoing debate on what to do with the remaining samples has also raised the question, whose responsibility is it to ensure smallpox is never again used as a weapon? These types of questions are the legacy that the eradication of smallpox has left behind.

Conclusion

The eradication of smallpox was a blessing to the world, a freeing of future generations from a horrible disease, and symbolic display of mankind's dominance over nature (Koplow, ch. 4). However, as the world progresses into an increasingly chaotic and complicated era of political unrest, it is time for the developed nations of the world to reevaluate the rights and

responsibilities involved with that act of dominance. Is it the responsibility of
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man to continue extinguishing diseases? Do the United States and Russia have the right to continue keeping and studying the remaining samples? Does smallpox have a right to live? These questions will likely take the world many years to answer, but when they are answered, the world will take one massive step towards to world peace.

Appendix

Figure 1 – A newspaper article about the eradication of polio

Figure 2 – Newspaper article about the vaccination of military personnel against smallpox.

Annotated List of Works Consulted

Primary Sources

Russell, Christine. Washington Post, Staff Writer. “ Military’s Insistence on Smallpox Vaccinations is Attacked.” The Washington Post (1974-Current file) May 13 1985: 1. ProQuest. 8 Nov. 2013 This primary source newspaper article describes the debate over whether or not the United States should continue to immunize its military against smallpox even though the disease was eradicated in 1977. The United States and the Soviet Union also signed an agreement in 1972 that outlawed any forms of biological warfare. A major concern is that the immunizations often cause side effects in the immunized people and those around them. Many also argue that the money spent on vaccinations could be devoted towards eradicating deadly diseases in third world countries instead. The information in this article will be used to help

describe the effect the eradication of smallpox has had on the world of bio warfare.

Steinbrook, Robert. "Can World Eradicate Polio by the Year 2000?" *Los Angeles Times* (1923-Current File): 2. May 02 1988. ProQuest. Web. 26 Oct. 2013. This short primary source newspaper article discusses the polio eradication effort and its original plan to be completed by the year 2000. The article briefly summarizes the techniques employed to eradicate smallpox and Polio, like National Vaccination Day. The article also analyzes factors that have made polio eradication much harder than smallpox eradication, like transmission methods and vaccine efficiency. The information in this article will be used to supplement the argument on how the eradication of smallpox has influenced the eradication of other diseases in the world.

Secondary Sources

Post, 15 Mar. 1999. Web. 5 Nov. 2013. . This secondary source web source focuses on the debate over smallpox's potential threat as a biological weapon. It describes some of the stances on the topic and some of the reasoning behind arguments. The purpose of the article was to announce an upcoming expert panel by the National Academy of Sciences Institute of Medicine, but it gives quite a bit of background information regarding smallpox as well. The information in this article will be used to describe the current state of the world in regards to its stance on whether or not smallpox is a threat to humanity.

And Constraining Factors." *Journal Of Infectious Diseases* 204. (2011): S54-S61. Academic Search Premier. Web. 21 Oct. 2013. This secondary journal

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article compares the five disease eradication programs initiated in the latter half of the twentieth century. The five programs, which targeted smallpox, yaws, malaria, polio, and guinea worm, are each analyzed in terms of the political, social, and economic factors that affected them. They are compared and contrasted in how each one was affected by factors such as population movement, funding, and media perception. For each one of these factors, a prediction is also made on how these factors would affect an initiative to eradicate measles, if one were to be started in the near future. The information in this article will be used to compare the eradication of smallpox to past, present, and potential programs to eradicate other diseases.

This secondary source article provides basic background information on the smallpox disease and the process of eradication. It gives a concise summary of all of the important facts including the history of its travels around the globe, Jenner's work, containment, and a Yugoslavian Incident. The information in this article will be used to supplement the research in each of the other areas.

This secondary source journal article approaches the threat of smallpox as a biological weapon from the perspective of a critical care nurse. It begins by giving an exhaustive summary of the background of smallpox, including its history, transmission, and symptoms. It then describes some of the responsibilities that a critical care nurse has in response to the many effects of a theoretical smallpox outbreak. This information will be used to describe some of the effects that a smallpox attack would have on the American Public Health Care System.

This secondary source interview was conducted with Dr. Sadik Khuder, the director of the Epidemiology Department at the University of Toledo. In this short E-mail interview, Dr. Khuder gives brief answers to several important questions regarding the eradication of smallpox, biological warfare threats, and future disease eradication programs.. The information will be used as additional information for each section of the paper.

Koplow, David A. *Smallpox: The Fight to Eradicate a Global Scourge*.

Berkeley: U of California P, 2003. Print. This secondary source book focuses on the ongoing debate on whether or not the remaining samples of the variola virus should be destroyed. Many different aspects of the debate are explored such as the potential of variola as a biological weapon, the conflicts of eradication with international law, and the moral and ethical dilemmas involved with the deliberate extinction of a species. This book will be used to provide perspectives on the current state of the controversy in each section of the paper. A sentence from this book is also used as the introductory quote.

This secondary source website gives a brief overview of the current Polio eradication efforts, as well as how this effort has been affected by the eradication of smallpox in the 1970s. The smallpox was the first disease to ever be completely eradicated from the general public. Its symbolic message inspired health workers and governments around the world with the idea that diseases could be conquered and even destroyed. The strategies employed to eradicate smallpox are also being studied and implemented, particularly a method of vaccination known as ring vaccination. The

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information on this site will be used to describe the impact of the eradication of smallpox on the fight against diseases in the world today.

Miller, Debra A. *Pandemics*. Detroit: Lucent, 2007. Print. Hot Topics. The first half of this secondary source book describes the effects of and the reactions to some of the major pandemics in history while the second half of the book also describes modern efforts to prevent, fight, and prepare for diseases and pandemics. The book describes in lucid detail many of the dangers that still affect people today, and even those that might affect the world in the future. There are even several specific mentions of smallpox. This book will be used to provide background information what diseases are capable of doing and the potential devastation of diseases that threaten the world today.