TEACHING GUIDE

LESSON: POLIO—*The Last Child: The Global Race To End Polio*

Grades 8-12

Subjects: Science, Social Studies, Language Arts, International Public Health, Contemporary World Problems, African Studies

Classroom Activity

Time: Three classroom periods

Part 1: *Before viewing discussion*
Part 2: *View the film*
Part 3: *After viewing activities*

Part 1: BEFORE VIEWING

Time: one class period

1. Have students study the basics about viruses:

(a) What are they made of?
(b) How do they replicate?

2. Have students research the poliovirus:

(a) How is it transmitted?
(b) What part of the body does it attack?
(c) Why is there no cure or treatment?

3. Discuss how a vaccine works to prevent disease.

Part 2: VIEW THE FILM

Time: one hour

Objective: Students gain an understanding of polio, its continuing effects and what's needed to eradicate the disease.

- Learn about current events in the battle to wipe out polio.
- Gain an understanding and appreciation of the collaborative role played by nongovernmental organizations (NGOs) in helping to complete the largest public health initiative in history.

- See the dangers and challenges volunteer vaccinators around the world face dangers and other challenges in their efforts to immunize every child. Learn how they educate people about their goal of eradication.

Part 3: AFTER VIEWING ACTIVITIES:
Time: one class period

1. Seminar:

Place students in a circle; ask questions "round robin" style.

Possible questions:

(a) Do you think it is important to wipe out polio globally? Why or why not?
(b) As seen in the video, there are many obstacles the volunteers face as they attempt to vaccinate children in different parts of the world. What do you think would be an effective way to counteract the misconceptions/misinformation?
(c) Who do you think should be financially responsible for the eradication efforts? All governments? Only the governments of at-risk countries? Nonprofit agencies? Why?

2. Role play:

Make sets of numbered note cards with a different scenario printed on each.

Examples:

(a) You are the parent of an Indian or African child who contracted polio from the vaccine itself. Your child has no use of his legs. Volunteers come into your community to vaccinate. Will you allow your other children to receive the vaccination?
(b) You are the CEO of a pharmaceutical company that makes the polio vaccine. You know that each dose of the vaccine costs only 11 cents. If your company donates free vaccines toward the global effort, it will lose money. What will you do?
(c)You are a volunteer administering vaccines in India (or Africa). You encounter much resistance from the villagers. This is due mainly to illiteracy and misinformation. What will you do to try to get 100 percent participation?
(d) You are the president of one of the at-risk nations. You are facing an election and your opponent claims that your support of the vaccination efforts against polio is an attempt to "sterilize" the poor. How will you counter these attacks?

Each group reads their card. Give them 10 minutes to discuss, then ask a spokesperson from each group to read the card to the class and describe how they would respond. It is essential that students try to put themselves in their chosen position. It is not essential that all members of a group agree. After each individual group presents their responses, the class is invited to respond.

FACTS ABOUT POLIO

What is polio?
Poliomyelitis (polio) is a highly infectious disease caused by a virus. It invades the nervous system, and can cause total paralysis in a matter of hours. It can strike at any age, but affects mainly children under three (over 50 percent of all cases). The virus enters the body through the mouth and multiplies in the intestine. Initial symptoms are fever, fatigue, headache, vomiting, stiffness in the neck and pain in the limbs. One in 200 infections leads to irreversible paralysis (usually in the legs). Among those paralyzed, 5 to 10 percent die when their breathing muscles become immobilized. Although polio paralysis is the most visible sign of polio infection, fewer than 1 percent of polio infections ever result in paralysis. Poliovirus can spread widely before cases of paralysis are seen. As most people infected with poliovirus have no signs of illness, they are never aware they have been infected. After initial infection with poliovirus, the virus is shed intermittently in the feces (excrement) for several weeks. During that time, polio can spread rapidly through the community.

How is polio spread?
In the remaining polio endemic countries, poliovirus is spread from person to person through fecal-oral contact. Where hygiene and sanitation are poor, young children are especially at risk. Young children who are not yet toilet-trained are a ready source of transmission, regardless of their environment. Polio can be spread when food or drink is contaminated by feces. There is also evidence that flies can passively transfer poliovirus from feces to food.

The disease circulates "silently" at first, and may infect hundreds of people before the first case of polio paralysis emerges. Because of this silent transmission and the rapid spread of the disease, a single confirmed case of polio paralysis is evidence of an epidemic — particularly in countries where very few cases occur.

The poliovirus can also infect persons who have been vaccinated and can be carried by them. Such individuals will not develop polio, but can carry the virus in their intestines and can pass it to others in conditions of sub-standard hygiene. The disease may infect thousands of people, depending on the level of sanitation, before the first case of polio paralysis emerges. Individuals can carry the virus in their intestines just long enough to transmit to others.

Polio paralysis
Once established in the intestines, poliovirus can enter the blood stream and invade the central nervous system, spreading along nerve fibers. As it multiplies, the virus destroys nerve cells (motor neurons), which activate muscles. These nerve cells cannot be regenerated and the affected muscles no longer function. The muscles of the legs are affected more often than the arm muscles. The limb becomes floppy and lifeless — a condition known as acute flaccid paralysis (AFP). More extensive paralysis, involving the trunk and muscles of the thorax and abdomen, can result in quadriplegia. In the most

severe cases (bulbar polio), poliovirus attacks the motor neurons of the brain stem, reducing breathing capacity and causing difficulty in swallowing and speaking. Without respiratory support, bulbar polio can result in death.

Who is most at risk of polio?
Polio mainly affects children under 5 years of age. However, immune and or partially immune adults and children can still be infected with poliovirus and carry the virus for long enough to take the virus from one country to another, infecting close contacts and contaminating sanitation systems. This could facilitate transmission especially in countries where sanitation systems are sub-standard.

Although polio paralysis is the most visible sign of polio infection, fewer than 1percent of polio infections ever result in paralysis. Most cases (90 percent) produce very mild or no symptoms and usually go unrecognized. A further 5 to 10 percent of polio infections result in aseptic meningitis, a viral inflammation of the outer covering (meninges) of the brain. The rest involve mild flu-like symptoms common to other viral infections: mild fever, sore throat, abdominal pain and vomiting.

How can polio be prevented?
There is no cure for polio; it can only be prevented through immunization. Polio vaccine, given multiple times, almost always protects a child for life. Full immunization will markedly reduce an individual's risk of developing paralytic polio. While full immunization will protect most people, individuals can still contract the disease due to the failure of some individuals to respond to the vaccine.

Have other diseases been eradicated?
Smallpox has been the only other disease ever eradicated worldwide. It is hoped that polio will be the second.

What is the cold chain?
The cold chain is the system for preserving vaccines. A cool temperature must be maintained for vaccines such as the oral polio vaccine, in order for it to remain potent.

Polio Vaccines
The development of effective vaccines to prevent paralytic polio was one of the major medical breakthroughs of the 20th century.

Two different kinds of vaccine are available:

- A live attenuated (weakened) oral polio vaccine (OPV) developed by Dr. Albert Sabin in 1961. OPV is given orally.
- An inactivated (killed) polio vaccine (IPV), developed in 1955 by Dr. Jonas Salk; unlike OPV, IPV has to be injected by a trained health worker.

Both vaccines are highly effective against all three types of poliovirus. There are, however, significant differences in the way each vaccine works.

1. Oral Polio Vaccine (OPV)
The action of oral polio vaccine (OPV) is two-pronged: OPV produces antibodies in the blood ('humoral' or serum immunity) to all three types of poliovirus. In the event of infection, this will protect the individual against polio paralysis by preventing the spread of poliovirus to the nervous system. OPV also produces a local immune response in the lining ('mucous membrane') of the intestines — the primary site for poliovirus multiplication. The antibodies limit the multiplication of 'wild' (naturally occurring) virus inside the gut, preventing effective infection. This intestinal immune response to OPV is probably the main reason why mass campaigns with OPV can rapidly stop person-to-person transmission of wild poliovirus.

Advantages of Oral Polio Vaccine:
OPV is an orally applicable vaccine. It does not have to be administered by a trained health worker, can be given by volunteers, and — unlike most other vaccines — does not require sterile injection equipment. The vaccine is relatively inexpensive (current price for public health program in developing countries is 8 U.S. cents a dose), a major consideration when governments have to purchase massive quantities of vaccine for use during National Immunization Days.

The short-term shedding of vaccine virus in the stools of recently immunized children means that in areas where hygiene and sanitation are poor — and the incidence of polio is likely to be highest — immunization with OPV can result in the 'passive' immunization of persons within close contact. Due to these advantages, OPV remains the vaccine of choice for the eradication of polio, which would not be feasible with inactivated polio vaccine (IPV).

Disadvantages of Oral Polio Vaccine
Although OPV is safe and effective, in extremely rare cases (approximately 1 in every 2.5 million doses of the vaccine) the live attenuated vaccine virus in OPV can cause paralysis — either in the vaccinated child, or in a close contact. Immune deficiency of the recipient may be among the causes. This extremely low risk of vaccine-associated polio (VAPP) is accepted by most public health programs in the world because without OPV, hundreds of thousands of children would be crippled every year.

2. Inactivated Polio Vaccine (IPV)
Inactivated polio vaccine (IPV) needs to be injected and works by producing protective antibodies in the blood (serum immunity), thus preventing the spread of poliovirus to the central nervous system. However, it induces only very low levels of immunity to poliovirus locally, inside the gut. As a result, it provides individual protection against polio paralysis but, unlike OPV, cannot prevent the spread of wild poliovirus.

Advantages of Inactivated Polio Vaccine
IPV is not a 'live' vaccine — the poliovirus is inactivated — and immunization with IPV carries no risk of vaccine-associated polio paralysis. Immunization with IPV triggers an excellent response of the immune system in most IPV recipients.

Disadvantages of Inactivated Polio Vaccine
Unlike the oral vaccine, IPV confers only very little immunity in the intestinal tract. When a person immunized with IPV is infected with wild poliovirus, the virus can still multiply inside the intestines and be shed in stools, risking continued circulation.

Other disadvantages of IPV include the price (over five times that of OPV), the cost of the syringe, and the need for trained health workers to administer the vaccine using sterile injection procedures.

Polio in industrialized and developing countries
Until the 1950s, polio crippled thousands of children every year in industrialized countries. Soon after the introduction of effective vaccines in the late 1950s (IPV) and early 1960s (OPV), polio was brought under control, and practically eliminated as a public health problem in industrialized countries.

It took somewhat longer for polio to be recognized as a major problem in developing countries. However, surveys during the 1970s revealed that the disease was also frequent in developing countries, crippling thousands of children every year. As a result, during the 1970s routine immunization with oral polio vaccine (OPV) — as part of national immunization programs (Expanded Program on Immunization, or EPI programs) — was introduced worldwide, helping to control the disease in many developing countries.

Today, the disease has been eliminated from most of the world. While the lowest number of countries ever are circulating wild poliovirus, the areas of transmission are more concentrated than ever – 98 percent of all global cases are found in India, Nigeria and Pakistan.

For the latest updates on polio cases around the world, visit www.lastchild.org.

What are the taping rights for *The Last Child*?
Off-air taping rights for classroom use have been extended from within seven days to within one year of the broadcast date of the program.

Can I use the information from your web site in my classroom?
Reproduction of any information contained on ***The Last Child*** web site is granted for educational use to schools and libraries. You may also print and distribute a classroom set of any articles on this web site.

Please visit www.lastchild.org for an extensive list of frequently asked questions, the status of eradication, more polio facts, and an interactive historical timeline of polio.

Can I purchase a DVD and/or VHS of *The Last Child*?
To order a VHS or DVD copy, visit www.bullfrogfilms.com or call Bullfrog Films at 1-800-543-3764 or 1-610-779-8226. For broadcasters interested in airing this program outside of the United States, call CS Associates at 617-923-0077.

How can I access a closed-captioned version of *The Last Child*?
The Last Child: The Global Race to The Polio is closed captioned for viewers who are hearing impaired. Turn the closed captioning option on your television "on" in order to access the closed-captioning.

We encourage educators to share ideas about how you put resources together in a compelling classroom presentation that included materials from "The Last Child." Please email us with your suggestions at info@lastchild.org and feel free to pass your ideas along to others.

Sources: WHO's polioeradication.org; LastChild.org

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