Polio Eradication

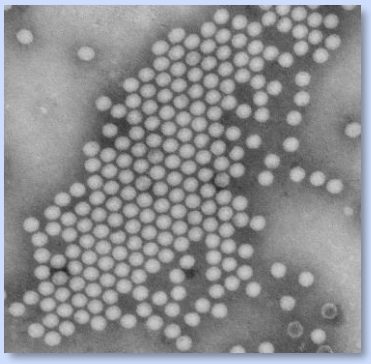
Poliomyelitis, or polio, is a disabling and life-threatening disease caused by poliovirus infection. Since **vaccination** efforts began in the 1950s, the number of global cases has been reduced by 99.9%. Public health workers have collaborated worldwide to **eradicate** polio, but the task is not finished yet.

Terms to Know

Vaccine/ Vaccination	a substance used to stimulate the production of antibodies and provide immunity against disease
Virus	type of microbe (organisms too small to be visible to the naked eye) that causes infectious diseases; has a core of genetic material but no way to reproduce on its own; uses infected cells' reproductive machinery
Paralysis/ Paralyzed	the loss of the ability to move (and sometimes to feel anything) part or most of the body; caused by illness, poison, or injury
Endemic	the regular presence of a disease or infectious agent in a population
Eradicate/ Eradication	the reduction to zero of an infectious disease's presence in the global host population

Understanding Polio

Polio is a crippling and potentially fatal infectious disease caused by the poliovirus. Poliovirus is very contagious and spreads through person-to-person contact. The **virus** enters the human body through the mouth and exits via the digestive system. For most, this **virus** passes through undetected, but for others the **virus** can cause nerve damage, resulting in **paralysis**. Poliovirus only infects people. It enters the body through the mouth and spreads through contact with the feces of an infected person or droplets from a sneeze or cough of an infected person. Polio can contaminate food and water in unsanitary conditions where access to proper sanitation is unavailable.



Think About It

1. How does the poliovirus's choice of host make it an easy target for **eradication**?
2. What jobs and skills would be needed to stop a disease from spreading?
3. Polio mainly affects children. How does that affect the public's interest in stopping the spread of the poliovirus?

Polio and the Centers for Disease Control and Prevention (CDC)

Dr. Jonas Salk created the first polio **vaccine** in the early 1950s. Children who participated in the first polio **vaccine** trials in 1954 received polio Pioneer Pins from the National Foundation for Infantile Paralysis. The highly successful **vaccine** trial led to the **vaccine's** implementation the following year. One of CDC's greatest disease detectives, the late Dr. Steve Thacker, was part of the **vaccine** trial and remembered receiving his polio pioneer pin.

Today, the U.S. Food and Drug Administration (FDA) oversees **vaccine** licensing, a process that requires significant funding and years to complete. In 1955, no such agency existed. A small federal agency, the Laboratory of Biologics Control, had the power to approve production of **vaccine**. Eager to meet public demand, the polio **vaccine** was licensed in just two hours, and state and local health departments began campaigns to **vaccinate** millions. Shortly after the program was implemented in the U.S., 40,000 cases of **paralytic** polio in children who were recently **vaccinated** were detected by health departments and reported the numbers to CDC. In the subsequent weeks, 260 children were **paralyzed**, and 10 children died. Epidemic Intelligence Service Officers (EIS)at CDC used epidemiology to trace the outbreak to a few batches of **vaccines** from California's Cutter Laboratories that used poliovirus which was not properly killed. The **vaccine** therefore caused polio instead of protecting against it. The investigation resulted in the establishment of rigid production controls to ensure the **vaccine's** safety and the public's confidence in the **vaccine** was restored in a matter of weeks. The Cutter Incident, as it came to be called, also put CDC and the EIS disease detectives in the national spotlight as a valuable disease-investigating program.

There is no cure for polio. Infection prevention through the polio **vaccine** is the only protection available. Two main types exist. The oral polio **vaccine** (OPV) contains weakened live **virus** and is administered by mouth. The inactivated polio **vaccine** (IPV) is given by injection and needs to be administered by a trained health worker. While OPV is much easier to administer, particularly in remote locations, it does carry a very small risk of developing **vaccine** derived poliovirus if the weakened **virus** is reactivated by the digestive system. These cases are closely tracked by CDC and other global health organizations.

The last **endemic** case of polio in the United States occurred in 1979. Today, CDC is partnering with other agencies through the Global Polio Eradication Initiative (GPEI) across the world to **eradicate** polio globally. Organizations like GPEI carry out disease surveillance activities in countries around the world by going door-to-door to identify polio cases and **vaccinate** children. Polio has three main strands: poliovirus type 1, type 2, and type 3. Globally, wild types 2 and 3 were declared **eradicated** in 2015 and 2019. As of 2021, wild type 1 poliovirus remains **endemic** in only two countries: Pakistan and Afghanistan. Though cases of **vaccine** derived polioviruses still occur in many countries, the world is close to fully **eradicating** polio through the concentrated efforts of public health officials.

Think About It

1. Why might people be reluctant to be **vaccinated**?
2. How many years have passed since the disease was **endemic** in the U.S.?
3. How does **vaccination** help limit the spread of polio?

From the Expert

Listen to Dr. Stephen L. Cochi, part of the Global Immunization Division of CDC, speak about the strategy to eliminate **endemic** polio in India through **vaccination** and surveillance. Find out how this strategy has been applied globally to reduce polio cases. https://youtu.be/uPGhmLzUGec

Call to Action

In order to fully **eradicate** polio, it is essential that children get fully **vaccinated**, even in remote areas of the world. You can help the **eradication** efforts by following these three steps:

1. Design and build a polio vaccine carrier. One of the big challenges with the polio **vaccine** is that it must be kept between 35-46°F (2-8°C) to remain effective. This can be difficult to do in remote areas. Design a cost-effective portable carrier that will allow healthcare workers to preserve the **vaccine's** safety in the field.

2. Test your prototype. Use the design you developed to build a prototype. Conduct field tests to see how effective your device is at maintaining a consistent temperature.

3. Share your designs. One of the ways CDC communicates information is through social media. Your designs can help CDC communicate the work they have done and are doing to improve access to polio **vaccinations** across the globe.

Why Participate? A Message from CDC

The **eradication** of polio is an important priority for CDC. On December 2, 2011, CDC activated its Emergency Operations Center (EOC) to strengthen the agency's partnership engagement through the Global Polio Eradication Initiative (GPEI), which is committed to completing the **eradication** of polio. On December 14, 2011, the support of the entire CDC community was enlisted to become active participants in an intensified effort to **eradicate** polio worldwide. Efforts to **eradicate** polio over the last few decades means that over 18 million cases of **paralysis** have been averted.

Success in **eradicating** polio will mean that no child will have to experience the devastating effects of the disease again. Failure to **eradicate** polio could cause poliovirus to reappear around the world with up to 200,000 new cases expected every year within 10 years. We are so close to **eradicating** the **virus**, but we need to finish the job now, once and for all.

Think About It

1. What role does global politics play in public health?
2. Explain the important role communication plays in **vaccination** initiatives.
3. How can your efforts support the efforts of CDC and GPEI?

Design a Polio Vaccine Carrier

The engineering design process allows engineers to develop and test solutions to problems. You can use the process to help determine the best way to make a portable **vaccine** carrier that is capable of maintaining low temperatures for long time periods.

Define the problem

Describe the problem you are trying to solve. There are several questions you could use to guide your investigation:

- How can you get the temperature down to 35-46°F?
- How can you keep the temperature constant?

Do background research

Find information about the problem.

- What is required to transport a **vaccine** safely?
- What are some easy cooling methods?

Specify requirements

Determine what your solution needs to have to succeed.

- What are the specific temperature, time, and portability requirements?

Brainstorm, choose and develop solutions

For each part of your design, ask yourself:

- Which solution seems to be the best one for the problem?
- What steps do I need to take to create my solution?

Build a prototype

Design and build your prototype **vaccine** carrier.

- Gather materials and construct a working prototype **vaccine** carrier that meets your requirements.

Test and redesign

Test the prototype **vaccine** carrier you made.

- Collect data about the performance of your carrier.
- Redesign and retest your carrier to improve results.

Communicate results

Sharing the information you collect is key!

- Share your information using social media with the accounts listed.

Design and Build the Vaccine Carrier

One of the big challenges with the polio **vaccine** is that it must be kept between 35-46°F (2-8°C) to remain effective. This can be particularly difficult to do in remote areas. Design a cost-effective portable carrier that will allow healthcare workers to maintain the polio **vaccine's** safety in the field. Start by researching the storage and handling concerns of the polio vaccine.

Suggested Materials

You may use any materials to build your cooler. Here are some suggestions:

- **Container: box, bag, storage container, etc.**
- **Insulation: towels, cardboard, bubble wrap, cotton, foam insulation, etc.**
- **Cooling: ice, dry ice, gel packs, etc.**
- **Temperature monitoring: thermometer or digital temperature probe**

Draw a diagram of your design in the box below. Make sure to include materials and measurements.

Test the Vaccine Carrier

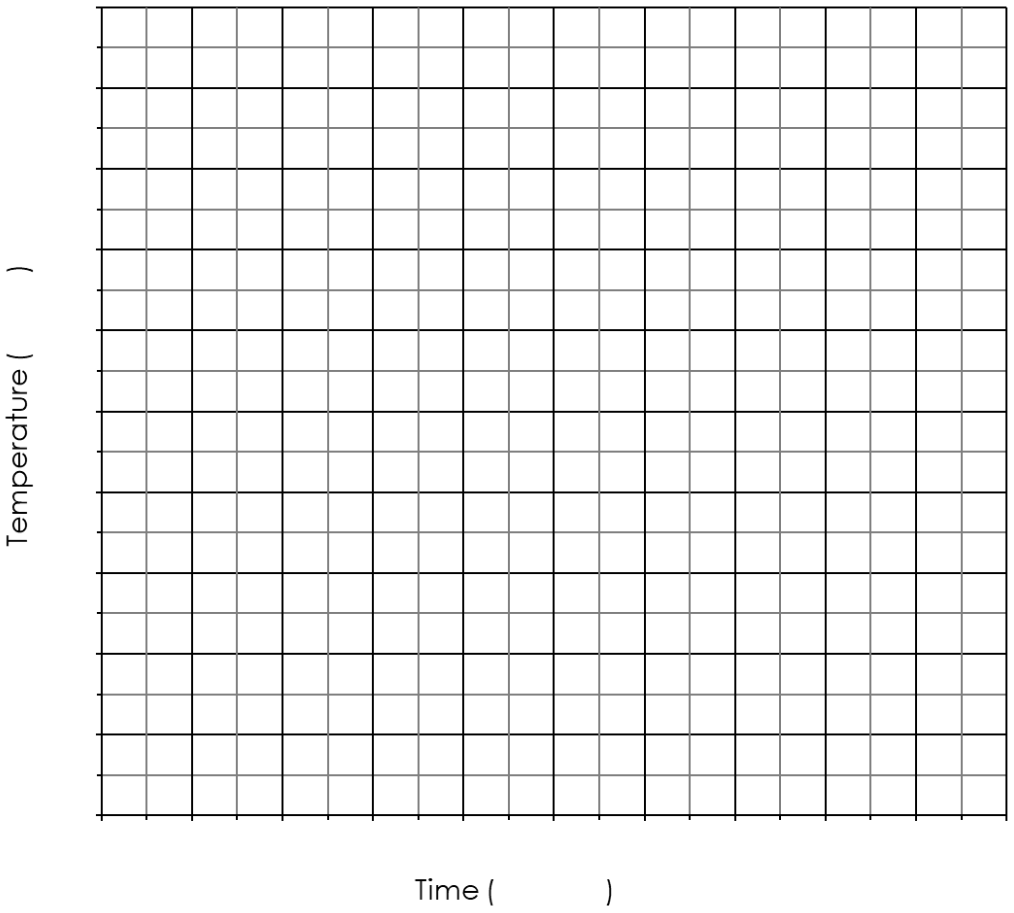
Use the design you developed to build a prototype. Conduct field tests to see how effective your device is at maintaining a consistent temperature.

As you prepare to test your **vaccine** carrier, consider the following:

- When you open your carrier, heat will enter. Can you measure temperature without opening it?
- How often will you collect temperature data? *(Every minute? Every 15 minutes? Every hour?)*
- How does the temperature of the environment surrounding your cooler affect your data?

Time ( )	Temperature ( )

Polio Vaccine Carrier Temperature Changes



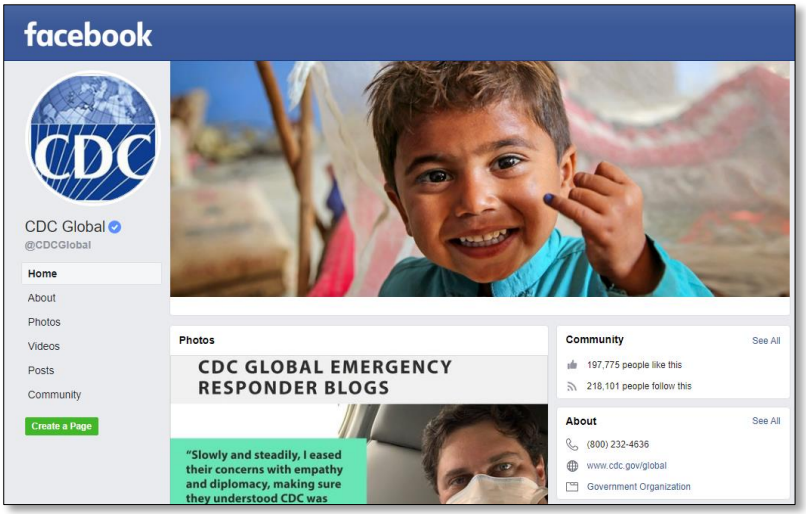
How did your **vaccine** carrier perform? Would it work as a **vaccine** carrier in the field? If not, what changes would you recommend to improve its performance?

Share Your Designs and Results

CDC plays a critical role in **eradicating** polio by providing scientific leadership and guidance at the global, regional, and country level to implement evidence-based strategies. Since 1988, CDC, ministries of health, and Global Polio Eradication Initiative (GPEI) partners have worked together across these areas to reach every community and **vaccinate** every last child.

CDC's Center for Global Health (CGH) works 24/7 around the globe to stop health threats at their source. As a citizen scientist, you can help CDC's CGH by sharing your design on their Twitter or Facebook pages to show the importance of polio **vaccination** using **@CDCGlobal**.

The David J. Sencer CDC Museum uses award-winning exhibits and innovative programming to educate visitors about the value of public health and presents the rich heritage and vast accomplishments of CDC. Your design could be a valuable contribution! Share your demonstration with the CDC Museum on Instagram using **@CDCMuseum**.



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Reflections

Now that you have built a model and shared your findings, think about what you learned about polio. Answer the questions below.

1. What are some of the effects of polio on communities?

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2. What is the role of **vaccines** in **eradicating** diseases?

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3. The last **endemic** case of polio in the United States was recorded in 1979. Should the U.S. continue to **vaccinate** children against polio? Why or why not?

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4. What are some of the reasons that global health organizations continue to administer the oral polio **vaccine** (OPV) if there is a small chance of developing polio?

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5. Should money from the United States be used to support polio **eradication** efforts in other countries? Why or why not?

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6. Should international health organizations focus only on countries with polio outbreaks? Why or why not?

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