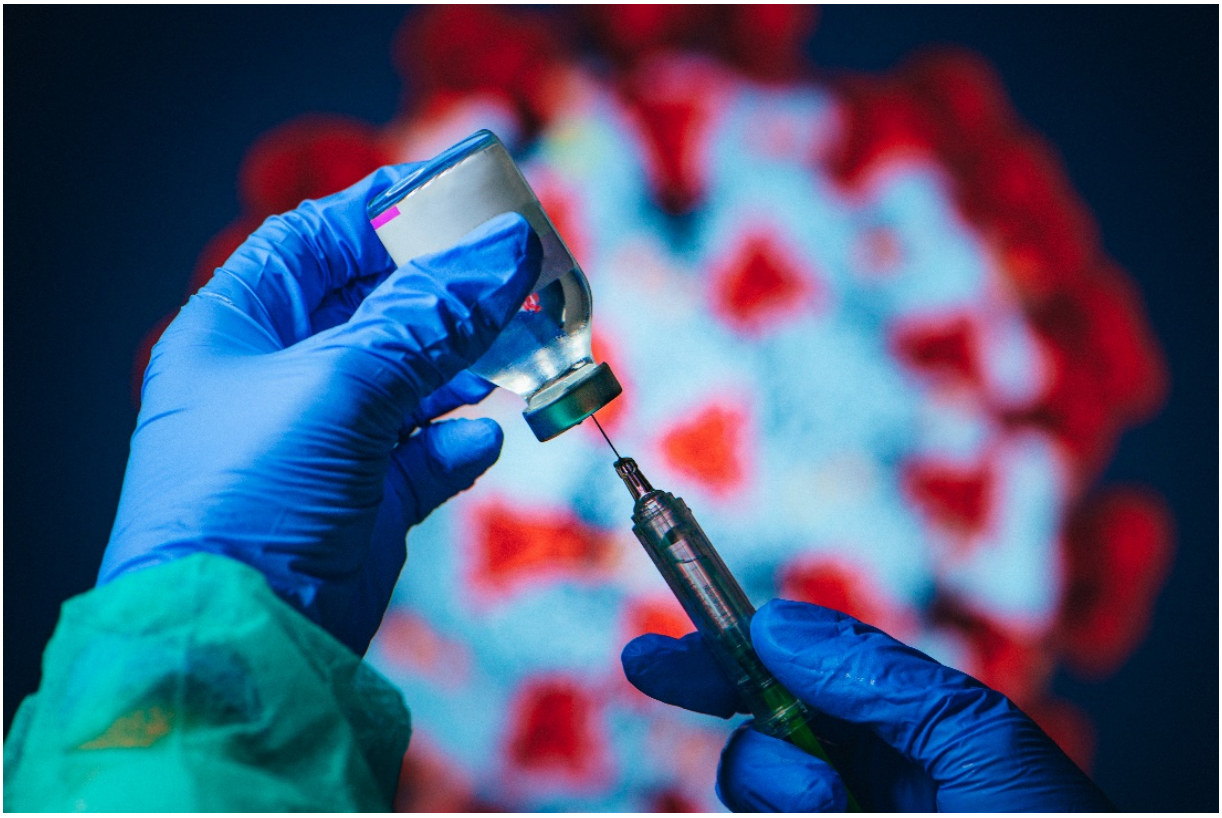
Smithsonian | SCIENCE for Global Goals

Vaccines!

How can we use science to help our community make decisions about vaccines?



SUSTAINABLE DEVELOPMENT GOALS

developed by

Smithsonian Science Education Center

in collaboration with

iap SCIENCE HEALTH POLICY
the interacademy partnership

Smithsonian Science Education Center greatly appreciates the efforts of all the individuals listed below and in the acknowledgments section in the development of *Vaccines! How can we use science to help our community make decisions about vaccines?* Each contributed his or her expertise to ensure this project is of the highest quality.

Smithsonian Science Education Center Module Development Staff

Executive Director - Dr. Carol O'Donnell

Assistant Division Director for Curriculum - Dr. Katya Vines

Division Director of Professional Services - Dr. Amy D'Amico

Science Curriculum Developer - Heidi Gibson

Science Curriculum Developer - Logan Schmidt

Lead Product Specialist - Hannah Osborn

Senior Program Manager for Leadership Development and International Programs - Katherine Blanchard

Technical Reviewers

Dr. Toni Gabaldón, PhD Dr. Melvenia Martin, PhD Dr. Sabrina Sholts, PhD

The contributions of the Smithsonian Science Education Center: Module Support Staff and Technical Reviewers are found in the acknowledgments section.

Image Credits
Cover - kovop58/iStock/Getty Images Plus
All figures - Smithsonian Science Education Center

Dear Parents, Caregivers, and Educators,

As we face the spread of disease as a global community, it can be difficult to put into words what we as adults are feeling and even more challenging to discuss these feelings with young people. As the young people in your care work through this guide with you, some difficult questions may come up: How does my community think and feel about vaccines? How do vaccines work? How do we know vaccines are safe and effective? How should we make decisions about vaccines? How do I get information about vaccines? You do not need to have the answers to any of these questions. The most important thing you can offer to young people is honesty and security.

This material is based in science. One of the best ways to become comfortable with the changing state of the world is by arming yourself with knowledge, and then using that knowledge to make a difference in the world. This is true for young people as well. As youth around the globe engage with the activities in this guide, they will gain an understanding of the science that underlies vaccines. They will be able to share their knowledge with their community, create tangible ways to help their community make informed decisions in this challenging time, and understand the best places to find additional information on the topic.

But this new knowledge may also be scary and overwhelming for people who are young. They may require support and guidance from you to put their new knowledge into context. Ask the young people around you how they are feeling and what they are thinking about as they learn about vaccines. Validate the questions they ask you, even if they ask them over and over again.

These tasks are designed to be completed in collaboration with the young people in your care. Each task is driven by a question that young people may ask you about vaccines. Each task is structured in a way to help young people (and you) to: (1) discover the answers to the questions in your own community; (2) understand the science that underlies the questions; and then (3) provide guidance to help you and the young people you care for act on your new scientific knowledge.

What can young people do to use science to help their community make decisions about vaccines? Task 1 should help you and each young person you care for understand who they are so that they are better prepared to understand the concerns of others. Tasks 2–6 will help young people learn about the history of vaccines, how vaccines work, how we know vaccines are safe and effective, and how to support others in making decisions about vaccines. Tasks 7–8 will help young people combat misinformation and create an integrated action plan to help their community make decisions about vaccines.

As a parent, caregiver, or educator, you may decide to skip certain questions, activities, or an entire task because it may be of concern to you. This is okay! Please personalize the interactions so that your health and safety and the health and safety of the young people in your care are of utmost concern.

At the Smithsonian Institution, we are not first responders or public health specialists, but we are experts in helping young people understand science and how it affects the world around them. We also deeply believe in the importance of using the United Nations Sustainable Development Goals (SDGs) as a framework to focus on sustainable actions that are defined and implemented by youth. As part of the Smithsonian Science for Global Goals project, this guide addresses SDG Goal 3 (Good Health and Well-Being), Goal 4 (Quality Education), and Goal 10 (Reduced Inequalities). We also recognize the incredible power of collaboration and working closely with others, even at a distance. We are immensely grateful to the InterAcademy Partnership (IAP), the World Health Organization (WHO), and our colleagues at the Smithsonian for their perspectives and for their technical support in ensuring the science in this guide is accurate.

> *"It is so important for children—wherever they are in the world—to develop their scientific understanding and rational thinking. Only by being able to make rational decisions based on the best science and evidence can any of us adjust our behaviour to keep ourselves and our families safe from infections." —Professor Volker ter Meulen, InterAcademy Partnership President*

> *"The Smithsonian Science Education Center makes science exciting and approachable for children and youth all over the world and encourages them to explore the how and the why of things around them. The Smithsonian Science for Global Goals project uses an innovative methodology where children and youth learn by doing and have to discover the answers themselves. Understanding the relationship between human beings and the environment will help us live in harmony and also prepare for future pandemics. With all the myths and misconceptions out there, it is important for children and youth to understand the nature of this pandemic and what can be done to prevent future pandemics from happening." —Dr. Soumya Swaminathan, Chief Scientist, World Health Organization*

The spread of infectious disease is frightening. It upends our lives. But the development of vaccines gives us hope. We may live across geographic boundaries, but we are all in this fight together. And science—and action—can help us win this battle together.

Stay safe. Stay healthy. Stay informed.

Best,

Dr. Carol O'Donnell, Director

Smithsonian Science Education Center

Table of Contents

Dear Student,

Think back to a time when you had to make a decision. What did you need to know to help you decide? You may have needed to find out information and think about what would happen because of your decision.

Decisions about health can be especially important. Many people are making important decisions about vaccines. But understanding vaccines can be difficult. This guide is designed to help you discover and understand the science behind vaccines. Then you can act to help build understanding in your community.

Each community has different concerns about vaccines. You will learn more about your community's concerns. Then you can share information to help people in your community make good and safe decisions about vaccines. Throughout this guide you will work to find out information and get ready to share it with others.

How to use this guide

This guide is here to help you. This means you can always adapt how you use it to fit your needs and the needs of your community.

Adapting the Guide

You will notice that in this guide there are often suggestions of different ways to share your ideas or do investigations. This is because different people think and work best in different ways. For example, some people like to draw. Some people like to talk out loud. Some people prefer to write to express their ideas. This guide has suggestions, but you can always do what works best for you. You can share your ideas using discussions, acting, signing, telling stories, recording your voice, writing by hand, typing on a computer, drawing, or any other way you choose. If you are working with others, think about the best ways to learn together. Including everyone is important.

Safety Tips

This guide asks you to do and think about things that may seem unfamiliar. You will notice physical and emotional safety tips in the guide. These will help you stay safe and supported during the activities. Make sure you follow any safety guidelines from your teacher or other trusted adult.

Guide Structure

There are eight tasks in this guide. Each task has three activities. The activities are called ***Discover***, ***Understand***, and ***Act***. In the ***Discover*** activities you will focus on thinking about information and feelings that you and your team already have. In the ***Understand*** activities you will use scientific investigations or data to find out more about vaccines. In the ***Act*** activities you will put your existing and new knowledge into action by applying and sharing it. At the end of the guide there is a glossary of words used that may be unfamiliar to you. These words will appear in bold when they are first used in the guide.

Keeping Organized

In this guide you will have information that you will need to keep. We suggest you use a digital document, phone, notebook, or binder as a journal to help you stay organized and keep your ideas together.

Working with a Team

You may be working by yourself. Or you may be working as a team with a group of people. In that case, your team will conduct investigations and make decisions together. There will not always be a clear right and wrong answer. Sometimes the team might not agree. This is okay. Just make sure to respect the people you are working with. There is no one right answer to the problems faced by your community. There is just the answer that's right for you and your team.

More Information

In the guide you will notice quotes about vaccines from experts around the world. These quotes can help you understand new perspectives. You can also find more information about vaccines from experts, additional activities, and historical stories on the Vaccines Story Map at bit.ly/3n9QHxv.

Your Role

You will be thinking about complex problems. Sometimes this can feel difficult. Be patient. You will be guided to consider different parts of the science and feelings behind vaccines. By the time you are ready to share with your community, you

should have lots of information. Always remember, your work is important. Decisions you make can change your community. You are an important part of making your local and global communities better.

Thank you for working to make your community better.

The Smithsonian Science for Global Goals team

Task 1: How does my community think and feel about vaccines?

People have been using vaccines for centuries, but not everyone understands how they work and why they are important. A **vaccine** is something that helps your body protect itself against disease. Individuals and communities may have many thoughts and feelings about vaccines. But sometimes people do not have enough information to make good decisions. You can help share the information they need.

Before you can understand the thoughts and feelings of others, you first need to ***discover*** your own identity and opinions. Then you will survey others in your community to start to ***understand*** their opinions and concerns. You can use this information when you ***act*** to help others in your community. In this task you will think about the concerns about vaccines in your community and how you can help.

Discover: *How does my identity relate to what I think and feel, and how I make decisions about vaccines?*

Our different experiences, backgrounds, and ideas give each of us a unique identity. Our identities are always changing as we grow and experience life. Our different identities often lead to different perspectives. **Perspectives** are the way we think about the world around us. Understanding your own identity and perspectives can help you understand other people's perspectives. This activity will help you think about your own identity and how it relates to your perspectives on vaccines.

1. Open your journal. A journal can be a notebook or folder where you keep loose pieces of paper together. A journal can also be a digital document that you add to. You will use this journal throughout the guide.
2. At the top of the first page in your journal write My Identity Map. Or if you prefer, you can make an identity map using objects. There are more details about how to do that in step 6.
3. On the paper, write your name in the center of the page. Or draw a small picture of yourself.
4. Draw a circle around your name or picture.

5. Answer the question, “Who am I?” or, “What describes me?” You can think about the following categories and write down your answers if they are important to who you are. You can also include things that are not on this list.
    - Age
    - School or class
    - Race and/or ethnicity
    - Gender
    - Country or place where you live
    - Country or place that is important to you or your family
    - Topics or subjects that interest you
    - Hobbies or things you like to do for fun
    - Physical traits (such as tall, black hair, blue eyes, wears glasses)
    - Personality traits (such as loud, funny, sad, kind)
    - Roles you have in your household (such as big sister, helper, cousin)
    - Groups you belong to

> When you’re talking about identity, it’s a lot about what are the different labels and pieces that you consider part of you.
>
> —Dr. Angela Mashford-Pringle, PhD

6. Write each answer on the page around your name. Draw a line between your name and each answer. If you don’t have paper available, you can use objects around your home to create your map. To keep that kind of map, you can take a picture or just remember it. There are examples of both types of identity maps in Figure 1.

Figure 1: An example of a written identity map (left) and an identity map using objects (right)

7. Your identity can play an important part in determining what you think and feel. In this guide you will be focusing on vaccines. First start by considering what you already think and feel about vaccines. Rate each of the following statements in your journal on whether you think it is:

   (1) not true; (2) somewhat not true; (3) not sure; (4) somewhat true; (5) true

   a. Vaccines help protect my family from disease.
   b. Vaccines help my immune system recognize harmful pathogens.
   c. I can trust vaccines because they are tested to make sure they are safe.
   d. Vaccines that I have gotten have been proven to work.
   e. Some people want vaccines but can't get them.
   f. There is true and false information about vaccines, and I can tell the difference.
8. If you are working with a team on this guide, you can share your answers with one another. Consider:
   a. Are there some statements that everyone answered the same way?
   b. Are there some that people answered differently?
   c. Why do you think other people might have different ideas?
9. Think about your answers from step 7 and your identity map. Then answer the questions below. Record your ideas in your journal.
   a. Are there things about your identity that affect your ideas about vaccines? For example, maybe you have a family member who works in health care, so you have been told a lot about vaccines.
   b. If you had a different identity, how might your answers be different?

Understand: *What do others think and feel about vaccines?*

If you want to help your community make good decisions about vaccines, you need to find out more about their concerns. Helping your community starts by considering who is in the community and how they feel. You can investigate this using a survey.

"If a vaccine for COVID-19 were available to me, I would get it."

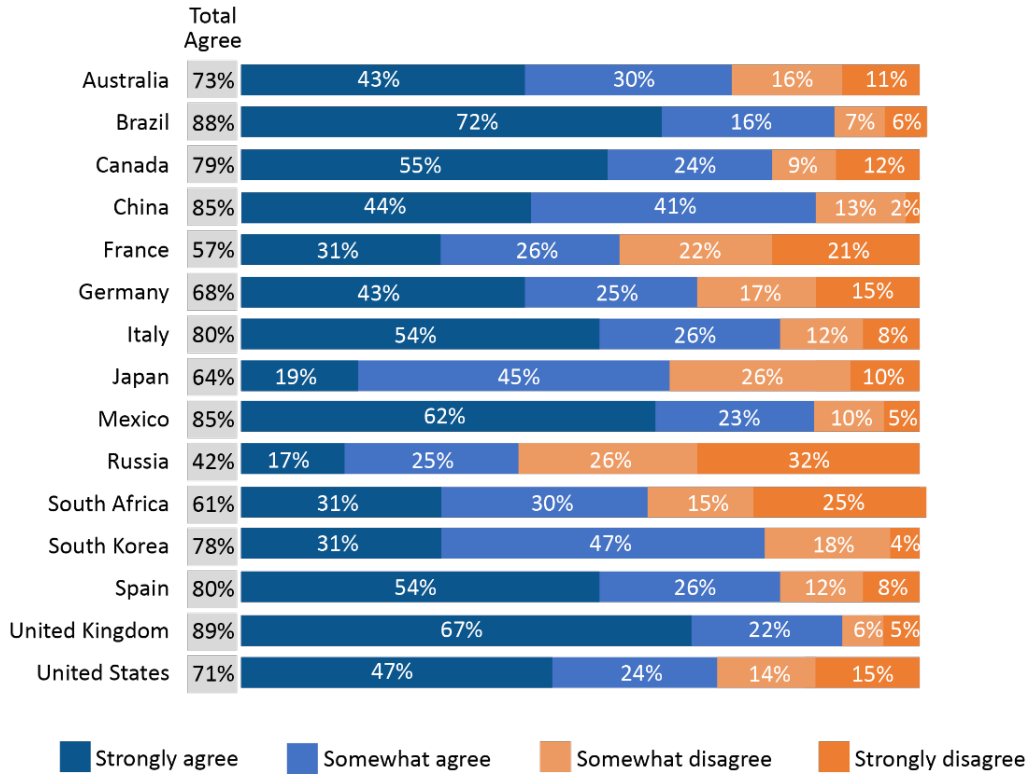


Figure 2: Poll of Global Attitudes, January 2021[1]

1. Examine Figure 2 by yourself or with a team. The graph shows how people surveyed in different countries felt about the sentence: "If a vaccine for COVID-19 were available to me, I would get it." Consider the survey results and record your answers to the questions below in your journal.
    a. Write the word <u>Notice</u> and list everything you notice about the graph. For example, are there differences between the countries listed on the graph?
    b. Write the word <u>Think</u> and list everything you think about the information you noticed on the graph. For example, why do you think people in some countries feel more positive about getting a vaccine?
    c. Write the word <u>Wonder</u> and list everything you wonder about the information you noticed. For example, maybe you wonder why some people would get vaccines and some wouldn't.
2. Surveys like this one can help researchers understand the ideas of people they are working to help. If you were designing a survey to understand people's opinions and concerns about vaccines, what questions might you

ask? Write them down or find another way to record them to help you remember. Consider:

a. Are there things you listed under Think or Wonder that you could find out if you asked the people you survey?
b. What do you think would be most important to find out? You can use the statements from the Discover activity to give you some ideas.
c. Are there parts of someone's identity that you think it would be important to ask about? For example, maybe you think it would be important to know someone's age or the type of work they do.
d. Read Dr. Galiatsatos's quote below. Are there any questions you would want to ask your community after reading his ideas?

> Growing up in a community, the community molds us. If you want to change people's behavior, you need to be aware of where people are coming from, from a cultural standpoint. The first thing you have to ask is, "What is the concern?" Talk to the community to understand what the concern is. Don't make an assumption. First hear the community. Then align the communication to the concerns of the community.
>
> —Dr. Panagis Galiatsatos, MD, MHS

3. You can learn more from this expert and others at the Vaccines Story Map at bit.ly/3n9QHxv.
4. In this guide you will be working to help a community you are a part of. Now you will think about which community you would like to help. A **community** is a group of people who share something, for example, your family, your classmates, your teachers, or your neighbors. A community can share space, like a local, national, or global community. Or a community can share an identity, like a religion, ethnicity, or common interest. If you think back to your identity map, you will probably realize you are part of many communities. Which community would you like to share information about vaccines with? Sharing can help them make good decisions.
5. If you are using this guide by yourself, you can decide now which community you will help. If you are working with a team, discuss this together and decide.

6. First you will give a survey to your community to understand what they think and feel about vaccines. You can work with a team or by yourself. Read the Survey Instructions below for more information about how to give a survey and pick your questions.

Survey Instructions

You can use a survey to understand the people in your community better. A survey is a list of simple questions you can ask of a group of people.

Choosing People to Survey

a. Think about the categories in your identity map. Use those categories to try to pick a diverse group of people to survey to get a more accurate idea of what your community thinks and feels. For example, you may want to survey people of many different ages or of more than one gender.

Ways You Could Give a Survey

a. Talk to people in person, on the phone, or using a virtual meeting.
b. Have people answer questions using paper, email, or an online survey.

Tips for Giving a Survey

a. Make sure your questions are easy to understand and specific, such as, “What worries you about vaccines?” instead of, “What worries you?”
b. Think about how you should give the survey. Is there a safe and easy way to reach people?
c. Think about the best way to survey your community. For example, does everyone have access to the Internet if you want to do an online survey?

Safety Tips for Giving a Survey

Talk to your teacher or a trusted adult for guidelines. They will know what is safest in your community.

Physical Safety Tip: Never go out alone and always be aware of your surroundings. Pay attention to local guidance on whether it is safe to interact with people outside of your home.

Emotional Safety Tip: It can be hard to talk to other people in the community. You may feel shy or nervous. Someone may tell you they don't want to talk. That's okay! It doesn't have anything to do with you. It just means they don't want to share. You can show them respect by thanking them and moving on to another community member.

7. Use the list of your own questions from step 2 to help you choose which questions would be best to ask your community. You probably want to ask between five and ten questions in your survey. When you choose your questions, make sure you consider:
    a. How can you find out the concerns people have about vaccines?
    b. Are there reasons people have been unable to get vaccines?
8. Remember, including everyone is important. If you are working with a team, you may need to adjust the way you do your survey so that everyone feels safe, comfortable, and able to help. Those changes are okay! They are part of including everyone. Make sure to consider:
    a. Time: If the survey happens after school, does everyone in the team have time to do it?
    b. Comfort: If you decide to move around the community to do your survey, make sure everyone on your team feels safe and able to do this. If not, what is another way team members could help with the survey?
    c. Location: If the survey is going to happen in a specific place, how easy is it for team members to get to that place?
9. Next, plan how you will collect information. If you are working with a team, assign different jobs to people. For example, if you decide to do an online survey, decide who will type the survey, who will share it, and who will collect the results.
10. Finally, conduct your survey by yourself or with your team.

Act: *How should I make decisions about vaccines?*

You now know more about your identity. You also found out information about how people in your community think and feel about vaccines. How can you use this information to help yourself and your community?

1. Read the quote below. Are there ideas you want to remember? Record them in your journal.

> The most important thing is understanding and listening to people's reasons. There are several different reasons why they might be hesitant to vaccinate. Whatever their reason is, that's a valid reason. If someone is afraid, beating them with facts is not going to help. If they are information-starved, those facts are like food. If they are afraid, they need to have people hear that fear. Respecting people where they come from, what their ideas are, why they are the way they are, answering those questions, validating that experience is very important work.
>
> —Dr. Anne McDonough, MD, MPH, MA

2. Examine the results of your survey by yourself or with your team. Record your ideas in your journal.
    a. How did the people you surveyed feel about vaccines?
    b. Did anyone feel like they needed more information?
    c. What were some of the concerns people shared?
3. In your journal create a list with two columns and title it <u>Community Concerns</u>. Title one column <u>Concerns</u>. List the concerns of the people you surveyed. Include any worries they shared or information they needed. Title the second column <u>Information</u>. This will be a place where you can list information or ideas that might help with the concerns people shared. You will fill in this column as you use this guide.
4. This guide will help you decide how you want to share information with your community. This can help them make decisions about vaccines. Record your answers to the questions below in your journal.
    a. Who do you trust to help you make decisions?

b. Have you ever helped anyone else make an important decision?
c. What do you think you can do to help your community make decisions about vaccines?

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 2: Why are vaccines important?

In this task you will learn about the history of vaccines and why they are important. You will ***discover*** the experiences you and adults you know have had with diseases that have vaccines. Then you will do an investigation to ***understand*** how vaccines affect how common diseases are. Finally, you will ***act*** by sharing information about how vaccines can decrease diseases in communities.

Discover: *What do I know about diseases that now have vaccines?*

This activity will help you think about what diseases and vaccines you already know about. You will also think about how people in different generations have had different experiences with diseases.

1. Read the quote below. What do you think may have made John sick?
    a. "I'm in second grade. I'd got sick, just like my brothers and sisters and friends. I spent a month in the hospital." —John, age eight[2]
2. Read more about John's story: John lived in the United States in 1959. He got a disease called measles. Many children got measles at that time. John survived and became a doctor who studied diseases.
3. Think to yourself, do you also have brothers and sisters and friends who have had measles? Record your ideas in your journal or discuss with your team.
    a. Your answer is probably no, because measles now has a vaccine to prevent it. Vaccines help prevent disease. They are different from medicines that help treat disease.
4. Examine the list of diseases below. Write in your journal the names of the diseases you have had or recognize. If you want, you can ask a trusted adult for more information about which diseases you have had.
    a. Measles, mumps, rubella (German measles), varicella (chicken pox), polio, tetanus, diphtheria, pertussis (whooping cough), cholera, smallpox
5. Share the list of diseases in step 4 with the adults in your household or older adults you know. Ask them to list the diseases they have had or have heard of. Compare your lists.
    a. Are your lists the same? Or did the adults have a longer list than you?

b. The adults may have had or know about more diseases than you. This is because those diseases were more common when they were younger. You can ask them about their experience. Did they know a lot of people who got sick?
c. Why do you think fewer people get sick with these diseases now?
d. These diseases are not common anymore because there are vaccines to prevent them. This is why you might have not had any of these diseases. Ask the adults if they remember vaccines being developed for these diseases.

Emotional Safety Tip: Discussing health information is often very personal. Some people may not be comfortable discussing diseases or vaccines they may have had. You should respect people's wishes if they do not want to discuss health information.

6. Ask the adults if they would feel comfortable with you recording their stories. You could record their stories about diseases that used to be common and the effect of vaccines. Later you could share these stories with others to help them understand more about vaccines.

Understand: *In the past, how did vaccines affect diseases?*

Some diseases used to be really common. Now you will investigate how vaccines have helped prevent these common diseases. You will examine **data** about diseases in the past. Data are information and observations collected by researchers. You will investigate how vaccines have helped stop the spread of disease.

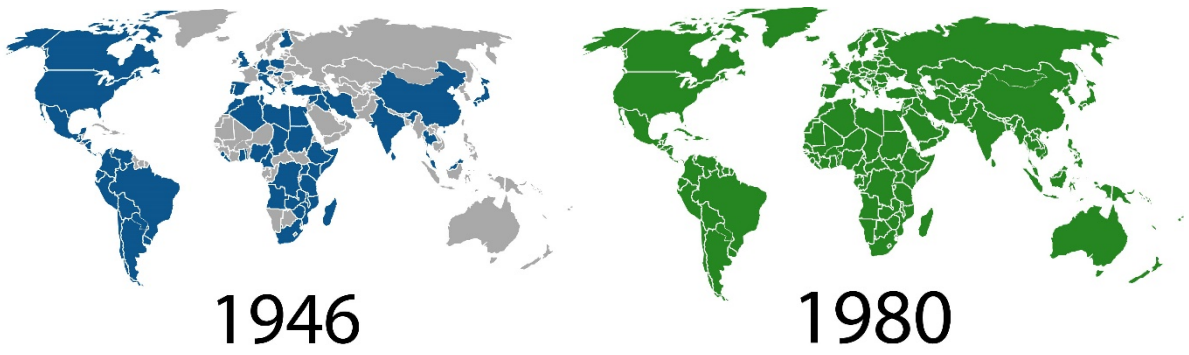


Figure 3: These maps show which countries had a disease in 1946 and 1980. Countries with the disease are in blue. Countries without the disease are in green. Countries with no data are in gray.[3]

1. Examine the two maps in Figure 3 by yourself or with your team. Consider the following questions and record your ideas in your journal.
    a. Write the word Notice and list everything you notice about the changes on the maps between 1946 and 1980.
    b. Write the word Think and list what you think might have caused the changes on the maps between 1946 and 1980.
    c. Write the word Wonder and list everything you wonder about what caused the changes.
2. The disease on the maps was called smallpox. In 1946 many countries had cases of smallpox. But by 1980 no countries had cases of smallpox. To understand how vaccines changed where smallpox was found, read the Smallpox Vaccine box. Think quietly to yourself as you read, how do the maps show the story of the smallpox vaccine?

Smallpox Vaccine

Smallpox was a serious disease. It caused fever and a skin rash. People who lived usually had bad scars. About three out of every ten people who got smallpox died. Smallpox killed between 300 and 500 million people.[4]

In 1796 English doctor Edward Jenner made the world's first vaccine. This vaccine prevented smallpox infections. Countries around the world began to use the vaccine to try to prevent the spread of smallpox. And in 1959 an international organization called the World Health Organization (WHO) came up with a plan to **eradicate,** or completely get rid of, smallpox around the world. Their goal was to get at least 80 percent of the world's population vaccinated, and they were successful. By 1980, there were no new smallpox infections anywhere in the world. Smallpox is the only human disease to be eradicated. Eradication has saved 150 to 200 million lives since 1980.[5]

Find out more information about Edward Jenner and other people who contributed and are contributing to vaccines by going to the Vaccines Story Map at bit.ly/3n9QHxv.

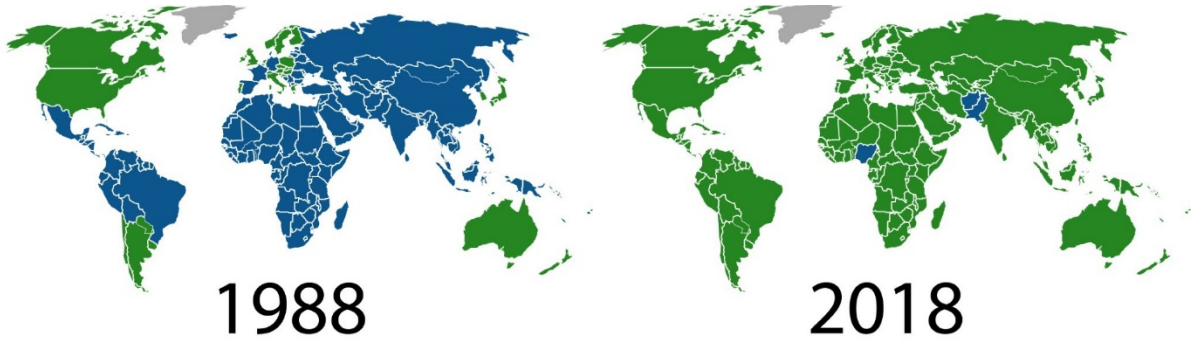


Figure 4: These maps show which countries had a disease in 1988 and 2018. Countries with the disease are in blue. Countries without the disease are in green. Countries with no data are in gray.[6]

3. Examine the two maps in Figure 4. Record your thoughts or questions in your journal.
    a. Write the word Notice and list everything you notice that changed between 1988 and 2018 on the maps.
    b. Write the word Think and list why you think so many places no longer have the disease.
    c. Write the word Wonder and list everything you wonder about why some places still have the disease.
4. The disease on these maps is called polio. By 2018, polio was no longer spreading in most countries. This is because of something called **herd immunity**. You may have heard people talking about herd immunity. You can read the Polio Vaccine and Herd Immunity box to understand it better. Herd immunity shows how vaccines can protect everyone in the community. Think quietly to yourself as you read, how do vaccinated people stop the spread of disease?

Polio Vaccine and Herd Immunity

Polio is a life-threatening disease that spreads easily. It can cause paralysis, which means a person cannot move their muscles. Polio can also kill people who are infected.

In 1955, people in the United States began to use a vaccine to prevent polio. This vaccine was developed by an American doctor named Jonas Salk. In 1988, the WHO decided to try to eradicate polio around the world using the

polio vaccine. Since 1988 cases of polio have decreased by 99 percent. In 2018 only three countries still had polio infections. Vaccination has saved more than 18 million people from paralysis. It has also prevented 1.5 million childhood deaths.[7]

Vaccines can make you **immune** to the disease. Being immune means you can no longer be infected. It also means you are very unlikely to infect others. As more and more people get vaccinated, fewer people can be infected and the disease spreads less and less. If enough people are immune, the disease stops spreading completely. When the disease is not spreading anymore, a community has reached herd immunity or community immunity. **Herd immunity** or community immunity is when a large part of the community (the herd) can no longer be infected or spread a disease.

Did you notice how many countries in the world no longer have polio? This is thanks to herd immunity from vaccination. After a community reaches herd immunity, the disease is stopped from spreading in the community. This protects the whole community. Some people who are too young or have certain other health problems cannot be vaccinated. Herd immunity protects these people too. The disease is no longer spreading, so these people are less likely to be exposed.

5. You are going to create a model to help you better understand how herd immunity works. You will model herd immunity with a disease called measles. This model will help you think about and share how vaccines can keep the people in your community healthy.
6. You will need these materials: 8.5-inch X 11-inch or A4 paper, a pencil or pen, and a ruler or straight edge.
7. Take the piece of paper and draw 9 evenly spaced vertical lines to create 10 columns that cover the entire paper. Then draw 9 evenly spaced horizontal lines to create 10 rows that cover the entire paper. Your paper should now have 100 boxes on it, as in Figure 5.

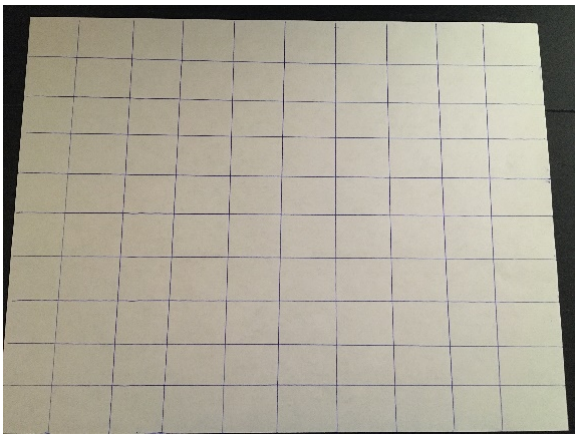


Figure 5: Sample paper with 100 boxes

8. First you will model 95 percent herd immunity. This means 95 out of 100 people in the community are immune to the disease. Each box represents one person. Take your pencil or pen and color in five boxes scattered around the paper. These colored-in boxes represent the 5 out of 100 people in the community who are not vaccinated. These people are not immune.
9. Take your hand and make a fist. Close your eyes and place your fist on your paper. If you are doing this activity with others, you can use someone else's paper. Your fist represents one infected person who comes into the community. Trace around your fist. Remove your hand from the paper and examine the outline. Each box inside or touching the outline of your fist represents a person living in the community who came into contact with an infected person. These people have now been exposed to measles.
10. Are there colored boxes inside or touching the tracing of your fist? Remember that the colored boxes represent people who are not immune to measles. If these people are exposed to measles, they will get infected. Count how many colored boxes are inside or touching the outline. This number shows how many people have now been infected with measles.

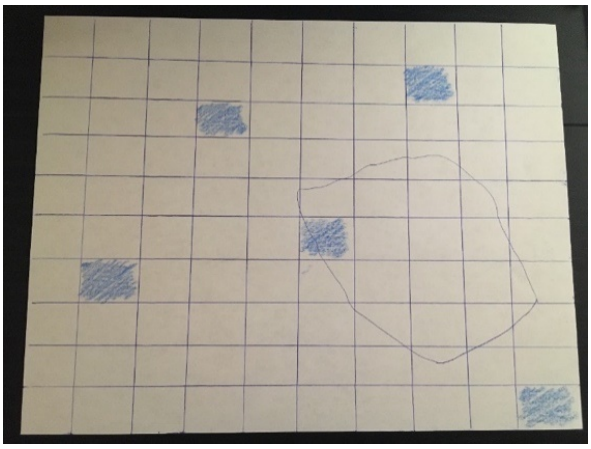


Figure 6: In this model of 95 percent herd immunity, one person (represented by the colored box within the outline) is newly infected after being exposed to measles by an infected person (who came into the community.

11. Measles can spread very easily from person to person in a community. Scientists know that 95 percent herd immunity can help keep measles from spreading. All the empty boxes in your model are immune people who can't spread the disease. Maybe someone in your community was infected with measles. But if they are surrounded by people who are immune, the spread stops. What happens when a community does not reach 95 percent herd immunity?
12. Take out a new piece of paper and repeat step 7. This time you will be modeling 80 percent herd immunity. This means only 80 out of 100 people in the community are immune. To create the model, color in 20 random boxes. These represent the 20 people in the community who are not immune to measles.
13. Place your fist on the paper and trace it as you did before in step 9.
14. Count how many colored boxes are inside or touching the outline of your fist. This number shows how many people have now been infected with measles.
15. Compare the number of new infections in your 80 percent herd immunity model to the number in your 95 percent model.
    a. Are there more infections with 95 percent or 80 percent herd immunity?
    b. Do you think measles would be more likely to keep spreading in a community with 95 percent or 80 percent herd immunity?

16. If you have time, model herd immunity of 40 percent, 50 percent, or 60 percent and compare them to your models of 80 percent and 95 percent. To model these percentages, you will need to:
    a. 40 percent model: color 60 boxes
    b. 50 percent model: color 50 boxes
    c. 60 percent model: color 40 boxes

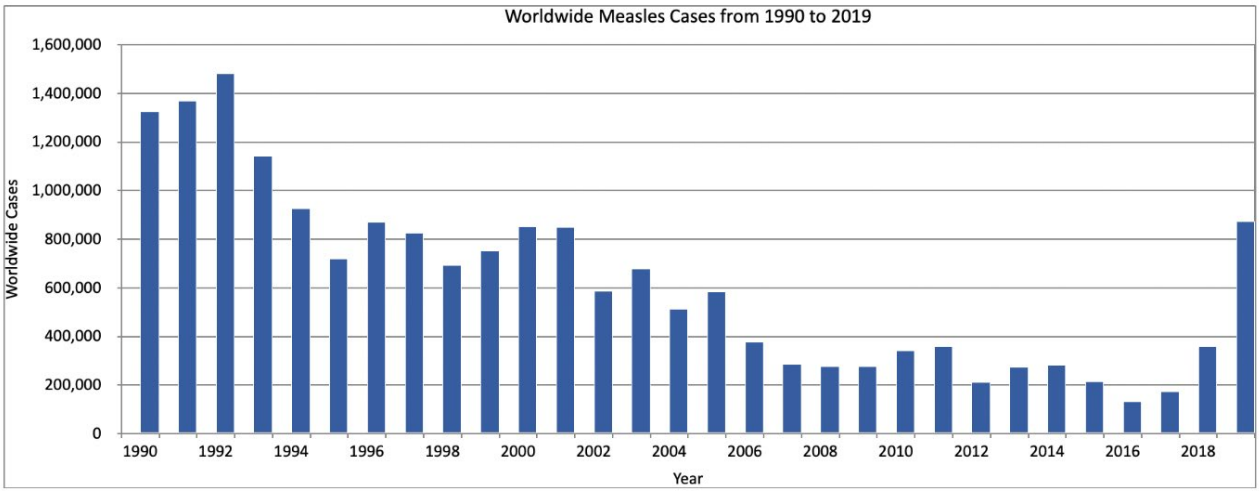


Figure 7: Worldwide measles cases from 1990 to 2019[8]

17. Examine the graph of measles cases in Figure 7. Notice that recently there have been more cases. Consider the questions below and record your thoughts in your journal.
    a. Would you expect the number of cases to rise if a community had herd immunity?
    b. Do you think more people are being vaccinated for measles now or 15 years ago?
18. Read the Measles Vaccine box to see if your ideas about the graph were correct.

Measles Vaccine

Measles causes fever, cough, runny nose, inflamed eyes, and a rash. It can also cause more serious effects. Before a vaccine was available, more than 90 percent of people had measles by the time they were 15 years old. Later, vaccination programs around the world decreased the number of cases of measles. Many communities reached herd immunity, which for measles is 95 percent. But since 2016, fewer people have been getting vaccinated for

measles. In some communities, immunity has fallen below 95 percent. This means more measles cases because fewer people are immune and the disease can spread more easily. In 2019, the world had the most cases since 1992.[9]

Act: *What is my responsibility to myself and others?*

You have just examined data on how vaccines affect the global community. Now you will use that information to think about your own community.

1. Take out your journal. Record your thoughts about the following questions.
    a. Do you think vaccines could help protect you from diseases?
    b. How do the decisions of each person affect how common diseases are in the community? Read the quote from the expert below and record your ideas in your journal.

> Even with all this historical success, there is a decrease in vaccination rates. In part, the program suffers from its own success, because the population understands that the diseases are not a problem anymore and stops vaccinating. This is aggravated by the people's lack of information about the diseases and the many factors that play a role in controlling a disease, resulting in the risk of reemerging diseases.
>
> —Dr. Luiz A C Galvão, MD, MPH, DSc

2. Take out your Community Concerns list from Task 1. Is there any information you found out during this task that would be useful to share with your community? Write down the information next to those concerns.
3. Pick one person and share the information you learned about vaccines and why they are important. For example, you could:
    a. Go back to the adults you spoke to in the ***Discover*** activity of this task. Share with them what you learned about eradicating disease and herd immunity. Do they remember smallpox, polio, or having measles?

b. Share the stories you recorded with people who are unfamiliar with what life was like when smallpox, polio, or measles were common.

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 3: How do vaccines work?

Vaccines help you by working with your body's existing defenses against disease. In this task you will ***discover*** the many ways your body protects you against disease. You will use models to ***understand*** how vaccines help your body protect you. Then you will ***act*** by sharing this information with others.

Discover: *How does my body protect me?*

Imagine your job is to keep a factory safe. Protecting this factory is very important because it is the only place that makes something you need to live. How would you protect it? Your first idea might be to build a barrier, like a wall, all the way around it. But you cannot have a completely enclosed barrier because people and things need to get in and out of the factory. How do you balance the need to protect with the need to interact with the outside world?

Living things face the same challenge. Living things need air, water, and food from the outside world. But living things also need to protect their bodies against disease. Different living things try to solve this problem in different ways. In this activity you will be thinking about the ways the human body solves this problem.

1. First read the paragraphs above and think about the challenge of keeping something safe. Record your ideas by writing or drawing in your journal, or discussing them with your team.
    a. First, think about protecting your factory. Why would it be useful to build a barrier to separate your factory from other places?
    b. Now, think about protecting your body.
        - Why would it be useful to have a barrier around your body like you have for your factory?
        - Which part or parts of your body act as a barrier to keep things out?
2. Now, remember why it might be difficult to have a barrier. Factories and living things need things to come in and go out of them. Record your ideas about the questions below in your journal or discuss them with your team.
    a. First, think about your factory.
        - What kind of things need to come in and go out of it?
        - How could that happen with a barrier around the factory?
        - Are there ways you could protect any opening in the barrier?

b. Now, think about your body.
    - What kinds of things need to come in and go out of it?
    - How does that happen with the barrier of your skin?
    - Are there ways your body protects any openings?

3. Read the text in the Natural Barriers box. Are there any ideas you didn't already think of?

> ***Natural Barriers***
>
> The human body uses barriers to protect itself against disease. The biggest barrier is the skin. Your skin provides a barrier between you and everything outside your body. This stops many **pathogens**, or things that cause disease, from entering the body. However, humans need to breathe air in and out, eat food, drink water, and notice things. Openings in the skin like your mouth, nose, eyes, and ears are part of the way you do this. Each opening has ways to stop pathogens from entering the body. For example, your nose has both nose hairs and sticky mucus (snot). Your eyes have tears, eyelashes, and eyelids. Your ears have earwax. Your mouth has saliva (spit).

4. No system is perfect. If your job is to protect something, you need to think about what happens if a harmful intruder gets through the barriers. Would you want another way of defending your factory or your body if something got inside? What would that additional defense need to do?
    a. First, think about your factory. Imagine a group of intruders snuck into your factory and were stealing things.
        - What are the some of the ways the intruders might have gotten through the barrier?
        - How could you protect your factory once intruders got inside?
        - Probably, you want to figure out some way to find the intruders and get them out of your factory.
    b. Now, think about your body. Imagine a group of intruders that cause disease snuck into your body. In your body these intruders are called pathogens.
        - What are some ways pathogens could get through your natural barriers?

- How does your body protect itself when pathogens get inside? It is okay if you are not sure. You can just make your best guess and go on to the next step.

5. Can you think of times when pathogens got through your natural barriers and made you sick? Maybe you had an infected cut or got a cold. Record in your journal a list of the ways you felt when you had an infection or disease.
6. Read the General Immune Response box. Examine your list of the ways you felt when you had an infection or disease. Which ones do you think might be because your immune system was fighting pathogens?

General Immune Response

Sometimes when you feel sick or hurt, some of the ways you feel are actually signs that your body's defenses are fighting pathogens. Your body's defenses are called the immune system. Your immune system is like a 24-hour guard in your body trying to find pathogens and prevent disease.

Your body responds to pathogens by first using a general response. This general immune response is designed to destroy any pathogen it finds. You may recognize some of the signs that your general immune response is activated. Here are a few examples.

- Cuts or other breaks in the skin may become hot, red, or swollen.
- You may have a fever.
- You may feel tired.
- You may have muscle aches and pains.

Although they may make you uncomfortable, these symptoms are encouraging signs that your immune system is defending your body against pathogens.

7. Imagine you got rid of the intruders in your factory or your body. You want to make sure they never come in again. Is there a way you could recognize the intruders if they tried to come back?
    a. First, think about how this would work when guarding your factory.

- If someone snuck into your factory before, what would you do so that you could recognize them quickly if they tried to come back?
- Perhaps you would post a picture of the person at the front gate or show it to any guards who were moving around the factory.

b. Now, think about your body.

- If you had a disease before, do you think your body would be able to recognize it if the pathogen came back?
- How do you think your immune system could remember?

8. Read the Immune Memory box. Did you find out any new information about how your immune system remembers pathogens? Record your ideas in your journal.

Immune Memory

When your immune system meets a pathogen for the first time, it forms **memory cells**. These cells usually form in about four to seven days. Each memory cell specifically remembers one pathogen. Once these cells are formed, your immune system can better fight the pathogen. It can also react much more quickly if the pathogen comes into your body again.

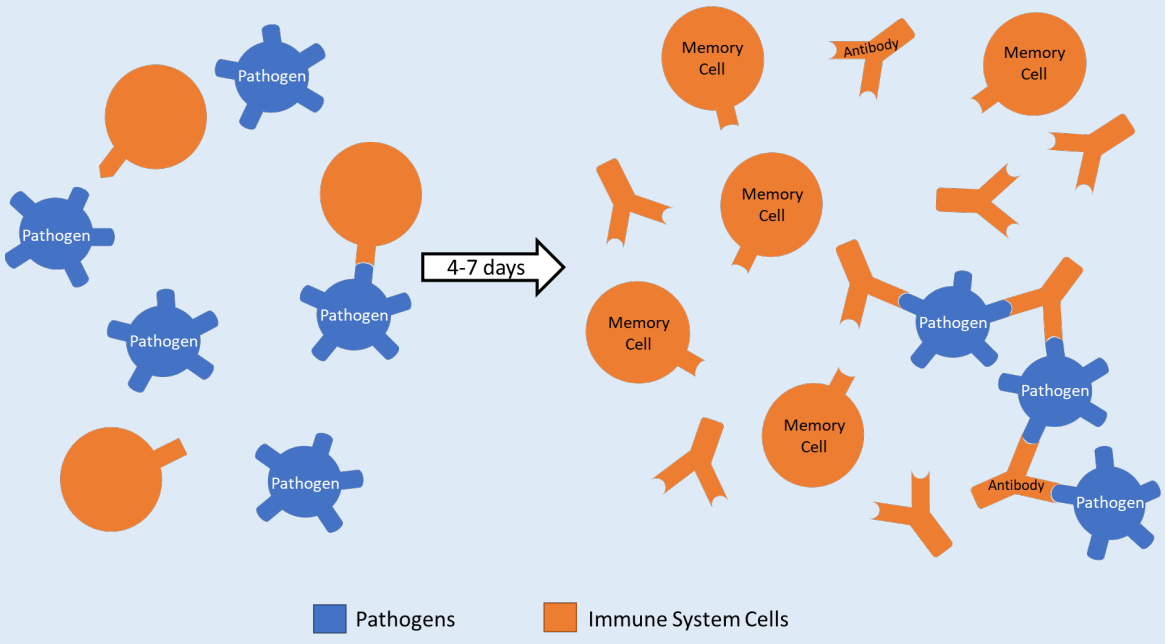


Figure 8: Formation of memory cells and antibodies after meeting a pathogen

The memory cells release small proteins called **antibodies** that fit into specific parts of the pathogen, like a key fits into a lock. If the pathogen comes back, these antibodies can now quickly identify it. The memory cells for that pathogen will immediately leap into action to help get rid of the pathogen before it has a chance to make you seriously sick. Memory cells and antibodies can last in your body for a very long time, sometimes decades.

9. In the next activity you will learn about how vaccines work with your immune memory to prepare you to fight pathogens.

Understand: *How do vaccines teach my body to recognize threats?*

From the time you are born, you learn about things that are dangerous. You may learn to recognize fire or speeding cars as things that could hurt you. Your immune system has also been learning since you were born and building your immune memory.

In this activity you will model four different ways your immune system builds memory. You will use the pathogen and antibody models below to recognize shapes and patterns. This will help you understand how your immune system learns to identify pathogens. These shapes do not look like real pathogens and antibodies; they are just a model to help you understand.

1. First you will model what happens in your body when you are infected by a pathogen. When your body meets a pathogen for the first time, it starts to build memory cells and then antibodies. After they are built, if you get infected again antibodies can help get rid of the pathogen quickly.
2. To model an infection in your body, first imagine you are infected by a pathogen that looks like this.

Figure 9: Pathogen model

3. Your immune system uses matching memory cells and antibodies to quickly identify this pathogen. Use the symbol in Figure 9 to make a model antibody shape that will help you identify this model pathogen, the way a real antibody identifies a real pathogen. The antibody model you make can be drawn or cut out of a piece of paper. Remember, antibodies fit into distinct parts of a pathogen like a key fits into a lock. Make an antibody model that fits any distinctive part of the pathogen model. For example, here is an antibody model that could fit the pathogen model in Figure 9.

Figure 10: Antibody model

Here is how this antibody model would match with the pathogen model.

Figure 11: Antibody model and matching pathogen model

> Vaccines protect your body from getting very sick. Vaccines cause your body to respond to the shot. Then if your body sees the actual disease itself, it remembers and is better prepared to fight the disease.
>
> —Dr. Stephanie Marton, MD, MPH

4. You have learned how your body builds its own immune memory. Now you will model three different ways in which vaccines help build your immune memory.
5. One way is a vaccine that uses a weakened or inactivated whole pathogen, like the measles vaccine. This type of vaccine exposes your body to a

pathogen that has been weakened or killed. This means your body will respond to the vaccine as if it has been infected, but the pathogen in the vaccine won't make you sick with the disease. Make an antibody model that fits the weakened pathogen model in Figure 12.

Figure 12: Weakened pathogen model

6. Another way is a vaccine that is made from part of a pathogen, like a pertussis vaccine. This type of vaccine uses just a part of the pathogen, so it can't make you sick with the disease. Make an antibody model that fits the model of the part of the pathogen in Figure 13.

Figure 13: Partial pathogen model

7. A third way is using a **genetic** vaccine, like some of the COVID-19 vaccines. Genetic means related to the instructions that cells use. The material in a genetic vaccine gives instructions to a few of your cells. The instructions tell your cells to make small parts of the pathogen. These small parts of the pathogen cannot make you sick with the disease, but they do help you build immune memory. When your cells make these small pathogen parts, your immune system notices them and makes antibodies that are ready to fight the pathogen. The genetic material is a temporary instruction and does not change your own genetic code in any way. Your body gets rid of the instructions after they have been used. Here's a model of a genetic vaccine. The instructions might say:

"Draw a diagonal line from the bottom left corner of the box to the middle of the top line. Then draw a line from the middle of the top to the bottom right corner."

Figure 14: Box for modeling a genetic vaccine

Make an antibody model that fits the shape you drew inside the box.

8. You should now have four antibody models to help you remember four different pathogens. One model was formed through infection. The other three models were formed using a vaccine. After you form your immune memory, the vaccines and pathogens will no longer be in your body. Your immune system will have gotten rid of them. But your antibodies remain. Now that you know this, imagine your body is exposed to the pathogens below. Which ones can your body immediately get rid of because you have antibodies ready? Fit your antibody models to the matching pathogens.

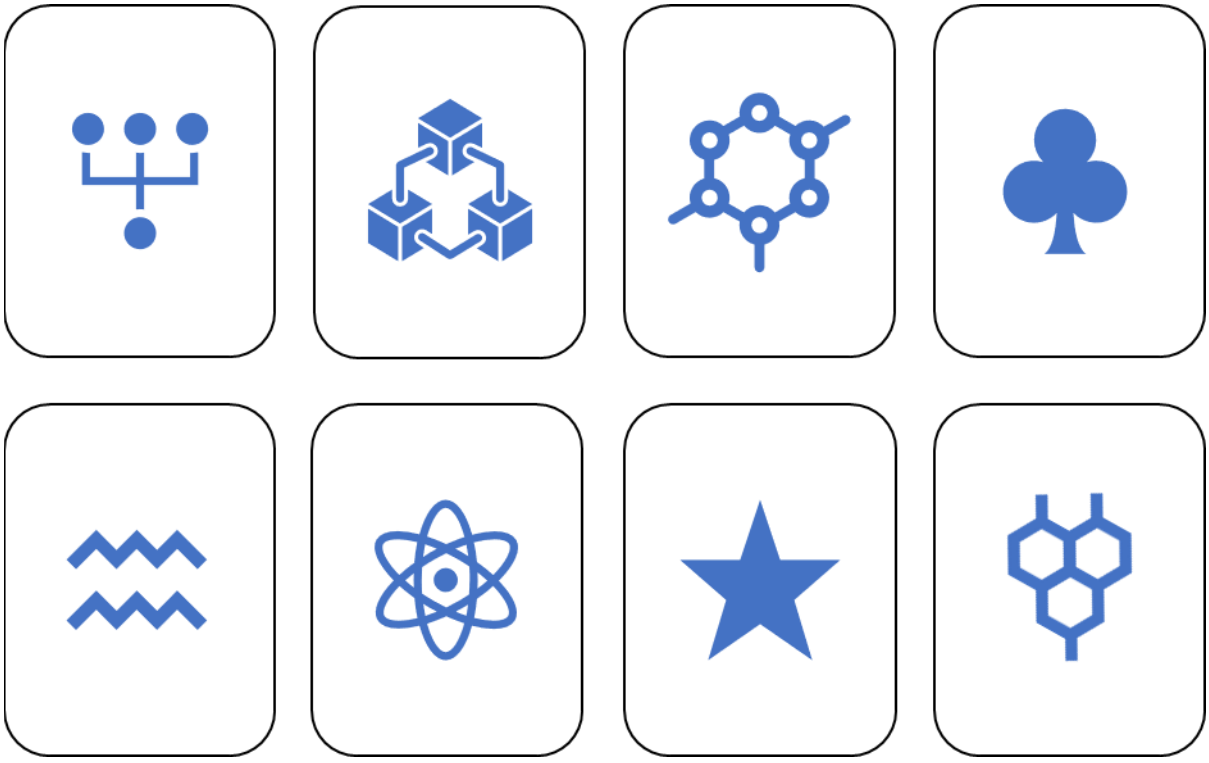


Figure 15: Pathogen models

9. Think about what you just modeled. Record your answers to the following questions in your journal.
    a. Did you notice that your antibodies would immediately recognize four of the pathogens? Why is that important?
    b. What were the different ways you made antibodies to form immune memories?
    c. Why would using a vaccine be better than being infected with a pathogen?

> A vaccine is a way to get your immune system ready for something to attack you. Your body is ready to defend you. It is like having bodyguards.
>
> —Dr. Carlos del Rio, MD

Act: *How can I share information about how vaccines work?*

It can be hard for people to make decisions about something they do not understand well. You now know more about how vaccines work with your immune system to fight pathogens. How could you share this information with others to help them understand vaccines better?

1. Consider how you would explain the immune system and vaccines to someone who did not understand them. Record in your journal ways you think will work well.
    a. Was the comparison from the ***Discover*** activity about protecting the factory useful to you when you were learning about the immune system?
    b. Can you think of another comparison that might help someone else understand the immune system or vaccines? Draw, write, or find another way to record and share your comparison.
2. Read the quote from Dr. Galiatsatos. Do you agree that vaccines are a great advancement?

One of the greatest advancements as human beings is the ability to prevent disease by using nature. That's what vaccines are. We get immunity without ever having to go through a disease.

—Dr. Panagis Galiatsatos, MD, MHS

3. Take out your Community Concerns list. Some concerns about vaccines may be because people do not understand how vaccines work with your body. Is there any information you found out during this task that would be useful to share with your community? Write down the information next to those concerns. For example:
    a. One common concern about vaccines is **side effects**. Side effects are unwanted things that happen when you take a vaccine or some medicine. There are some common vaccine side effects. Sometimes the spot where the vaccine was injected may look red, swell, or feel hot or sore. Sometimes people may have a day or two when they have a fever or feel achy or tired. Based on what you learned about the immune system in the ***Discover*** activity:
        - What do you think is happening in your body to cause these symptoms? If you get stuck, you can look at the General Immune Response box for ideas.
    b. Another common concern is whether vaccines stay in the body and cause long-term effects. Remember what you learned about the way vaccines work in the Understand activity. Based on what you know:
        - Do vaccines stay in the body for long?
4. Pick one question or concern from your Community Concerns list that you could now help explain.
5. Think about how you learned about vaccines in Tasks 2 and 3. Graphs, figures, comparisons, and models were all shared as ways to help you learn.
    a. Which of these ways helped you the most?
    b. Are there other ways you could help teach people? For example, could you use a creative method like drama, music, or dance?
6. Use the concern you picked and decide how you will share that information with someone you care about who has that concern.
    a. Who will you share this information with?

b. What method or methods do you think would be most helpful for sharing?

7. Now put your ideas into action.

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 4: How do we know vaccines are safe?

You know that vaccines can keep your body safe by helping it prevent disease. But how do we know that vaccines are safe to put in our bodies? In this task you will ***discover*** how you feel about the safety of vaccines. You will use real-world data to ***understand*** how clinical trials help create safe vaccines. Then you will think about how you and your community feel about the safety of vaccines so that you can ***act*** to share this information with others.

Discover: *How do I decide if something is safe?*

Using something new can sometimes make you feel unsure or unsafe. In this activity, you will think about what helps you feel safe about using something new. You will also think about how your identity influences your decision to use something new. Finally, you will think about what steps you would take to make sure a new product is safe to use.

1. Imagine someone asked you to try a product that was brand new, like a kind of snack or a hand lotion. Now consider the list below. Which of these would make you feel safe using the new product?
    a. Your best friend said it was safe.
    b. The government in your country or town said it was safe.
    c. Your doctor said it was safe.
    d. Your religious leader said it was safe.
    e. The people who make the product described how they tested it to make sure it was safe.
    f. You watched a TikTok® video that said it was safe.
    g. Ten people tried it and nothing bad happened to them.
    h. Ten thousand people tried it and nothing bad happened to them.
2. List the statements from step 1 in order from what would make you feel least safe to most safe. Use the letter of each statement to record your list in your journal.

Least Safe **Most Safe**

Figure 16: An example of how to record the order of statements from step 1

3. Take out your identity map from Task 1.
    a. Are there parts of your identity that helped you decide how to order these statements?
    b. For example, if your friends are really important to you, you might have listed "Your best friend said it was safe" as the statement that made you feel the safest.
4. If you can, ask other people to do the activity in steps 1 and 2. You could ask the people in your household, your classmates, or your team.
5. Compare how you and other people put the statements in order.
    a. Did anyone put their statements in a different order than you? What were their reasons?
    b. How did their identity affect the way they ordered the statements?

Emotional Safety Tip: There are no wrong or right answers. Different people can have different opinions. Considering different opinions helps people think better. It may feel difficult to disagree with someone or have them disagree with you. Remember, disagree with ideas, not with people.

6. Now imagine you were asked to make a new product. You need it to be safe for everyone to use. Answer the following questions by yourself or with others.
    a. What steps would you take to make sure the product was safe?
    b. How would you convince other people that it was safe?

Understand: *How do we make sure vaccines are safe?*

The vaccines that protect people from COVID-19 are new products. But the people who developed these vaccines followed very specific steps to make sure that each vaccine is safe for people to use. These steps are called clinical trials. A **clinical trial** is a process to make sure that a medical drug, procedure, vaccine, or new product is safe and that it does what it is supposed to do. A clinical trial has very specific steps. These steps are called phases. These phases always happen in the same order. In this activity, you will learn about the phases of a clinical trial.

1. Read the paragraph above. Then think quietly to yourself about the following question: Why might you feel safe using a new product if you knew it had been through a clinical trial?

There are many smart, ethical, honest doctors, scientists, and others that work to develop medications to help with various illnesses and health problems. In order to know that they are safe, they ask for volunteers to help with their research in clinical trials.

—Dr. Valerie Montgomery Rice, MD, FACOG

2. Record your answer in your journal. You will think about it again in the Act activity.
3. Read the information in the Phases of a Clinical Trial for a Vaccine box. It describes how researchers make sure a vaccine is safe to use and that the vaccine works. This section will help you understand some real-world data about COVID-19 vaccines that you will find in step 4.

Phases of a Clinical Trial for a Vaccine

Each clinical trial for a vaccine has four phases. Different things happen in each phase, but every phase of a clinical trial has:

- **Participants:** These are the people who are part of a clinical trial. They are always volunteers, meaning that they choose to be a part of the clinical trial.
- **Researchers:** These are the people who plan and carry out the clinical trial.
- **Informed consent:** In each phase, the researchers explain the risks of being in a clinical trial to the participants. Then, the participants sign a form saying that they understand the risks. This is called informed consent. Participants can leave the trial at any time if they change their mind.

Vaccine Safety

It's important to know that any phase of a clinical trial will stop if the vaccine causes a serious side effect, death, or does not help prevent the disease. Think of this like moving through four different gates in a row. You have to

get through the first gate before you can move through the next three.

Before Phase 1 even begins, a vaccine is tested on animals. If the vaccine is safe in animals, Phase 1 can begin.

In Phase 1, the vaccine is tested on 10 to 100 participants. Researchers check whether there are serious side effects or deaths. If the vaccine is safe to use, Phase 2 can begin.

In Phase 2, several hundred participants try the vaccine. The researchers may try to find the right amount of the vaccine (the dose) that prevents disease. They may observe whether the vaccine works to prevent disease. If the vaccine is still safe to use, Phase 3 can begin.

In Phase 3, thousands or tens of thousands of participants try the vaccine. These participants must be similar to the people who will eventually use the finished vaccine. For example, the COVID-19 vaccine is meant to be used around the world. So Phase 3 participants for this vaccine are all different ages, races, genders, and have different medical conditions. Researchers make sure the vaccine is safe, that they are using the right dose, and that the vaccine prevents disease.

Government Approval

If Phases 1, 2, and 3 are successful, then the vaccine might be given to people outside of the trial. But the researchers or companies that run the clinical trials for vaccines do not make this decision. This decision is made by governments agencies and scientists. They review the clinical trials and decide whether to approve the vaccine.
It is important to know that a vaccine may never be safe for certain people. For example, people who have a weakened immune system cannot get a vaccine. The vaccine will not work the way it should and the risk is too high.

After a vaccine is approved, the researchers continue to keep track of any problems caused by the vaccine. If the researchers notice serious problems, the government might stop using the vaccine until the problems are solved. This is sometimes called Phase 4 of a clinical trial.

4. Examine Figure 17. It describes the participants in Phase 3 of three actual COVID-19 vaccine clinical trials. Remember, the vaccines tested in these trials are meant to be used by people around the world. Answer the following questions in your journal or discuss them with your team.
    a. Write the word Notice and list everything you notice about the data in Figure 17.
    b. Write the word Think and describe whether you think Figure 17 includes the participants you would want for a COVID-19 vaccine trial. Why or why not?
    c. Write the word Wonder and list everything you still wonder about these clinical trials.

Clinical trial	**Number of participants**	**Race of participants**	**Age range of participants**
A	More than 40,000	American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, Multiracial	18 to 100 years old
B	More than 40,000	American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, Multiracial	16 to 91 years old
C	More than 30,000	American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White, Multiracial	18 to 95 years old

Figure 17: Data from Phase 3 of three actual COVID-19 vaccine clinical trials[10, 11, 12]

5. You just learned about how important it is to have many different kinds of people as participants. It is also important to include many different kinds of people as researchers. Read what one expert says below.

The development of one of the COVID-19 vaccines was led by a Black woman scientist, Dr. Kizzmekia Corbett. A diverse group of scientists and researchers had seats at the table as the vaccine was developed.

—Dr. Valerie Montgomery Rice, MD, FACOG

6. Now imagine you are in charge of a clinical trial for a new vaccine. Your job is to make sure the vaccine is safe and that it works. Figure 18 lists information about several imaginary clinical trials. The column on the left has information that could affect each clinical trial. Examine each piece of information and decide if you would stop that clinical trial. Then record why you made that decision in your journal or discuss it with your group.

Information about the clinical trial	**Would you stop this clinical trial? Why or why not?**
The participants signed an informed consent form.	
In Phase 1 of the clinical trial almost all the participants get very sick and have to go to the hospital.	
A clinical trial is testing a vaccine that will be used by people around the world; 95 percent of the participants are White.	
Before Phase 1 the vaccine is tested on animals. None of the animals got sick or died.	
Phase 3 of the clinical trial has 10 participants.	

In Phase 2 the researchers try several different doses of the vaccine with the participants.	

Figure 18: Information about several imaginary clinical trials

7. If you are working in a team, compare your answers with other people. What helped you make your decisions? Did anyone decide something different?
8. How do clinical trials make sure that vaccines are safe to put in your body? Record the answer to this question in your journal.

Act: *How can I help my community understand the safety of vaccines?*

One of the main goals of clinical trials is to find out whether vaccines are safe. In this activity, you will think about how you and your community feel about the safety of new vaccines. Then you will act to share this information with others.

1. Think about what you learned about clinical trials for vaccines. Record your ideas in your journal or discuss with your team.
    a. How do clinical trials help keep people safe?
    b. What do you think are the most important parts of a clinical trial?
2. In the Understand activity you answered the following question: Would you feel safe getting a vaccine if you knew it had been through a clinical trial?
    a. Has your answer changed? If so, how?
3. Take out your Community Concerns list. Is there any information you found out during this task that would be useful to share with your community? Write down the information next to those concerns. For example:
    a. One common concern about vaccine clinical trials might be that clinical trials do not include participants who share the health concerns, age, gender, or race of people in your community. Answer the following questions based on what you know.
        - Did the three COVID-19 vaccine clinical trials in the Understand activity have many different types of participants?
        - Why is that important?
    b. Maybe people in your community are worried that vaccines may not be safe to put in their bodies. Based on what you know:

    - How do clinical trials help make sure vaccines are safe to use?
4. Pick one question or concern from your Community Concerns list that you could share information about.
5. Decide how you will share that information.
    a. Who in your community will you share this information with?
    b. What method or methods do you think would be most helpful?
        - For example, if several people answered that they would feel safest after watching a TikTok® video about a new product, you could make a TikTok® video for your community that explains how clinical trials work.
6. Now put your ideas into action.

> I believe, particularly for the COVID-19 vaccine, that hearing from trusted members of a community is so important. This might be church members, neighborhood leaders, or even celebrities who need to come forward and say why they got the vaccine and how they feel now. Individuals want to hear that people who look or think like them got the vaccine and are safe.
>
> —Dr. Stephanie Marton, MD, MPH

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 5: How do we know vaccines work?

You know how vaccines work in your body. And you know how clinical trials make sure that vaccines are safe. Now you are going to learn how researchers make sure that vaccines prevent disease. In this task you will ***discover*** how people figure out whether vaccines work. You will ***understand*** more about how vaccines can lower the risk from a disease. You will ***act*** by sharing information with your community about how we know vaccines work.

Discover: *How do we know a vaccine is working?*

Imagine a friend or family member told you their story about getting a vaccine and said, "I got a vaccine and now I feel sick. I don't think it's working."

1. Think about the experience shared in the paragraph above. Record your answer to the following question in your journal or discuss it with your team.
    a. Do you think hearing one person's story is enough to tell whether a vaccine is working?
2. You started learning about clinical trials in Task 4. Now you will find out more about how clinical trials show a vaccine works. Read the Does the Vaccine Work? box. Record in your journal or discuss with your team: Why might the data from a clinical trial be a better way to tell whether a vaccine is working?

Does the Vaccine Work?

In Phase 3 of a clinical trial, a large group of participants is divided into two smaller groups which are the same size. One group gets the vaccine. The other gets a **placebo**. The placebo in a vaccine trial is a harmless shot that does not contain any vaccine. Participants are not sure if they are getting a placebo or a vaccine. The participants and researchers do not find out if a participant's shot was a placebo or the vaccine until the trial is over. This helps keep the clinical trial data accurate. Researchers closely track which people in both groups get infected with the disease. If a person does develop the disease, the researchers record how sick the person becomes.

After the trial is over, researchers compare the vaccine group and the placebo group. They examine which group had fewer people get sick, the group that got the placebo or the group that got the vaccine? If the same number of people got sick in both groups, researchers know that the vaccine is not helping to prevent the disease. If fewer people in the vaccine group got sick, researchers know that the vaccine helped to prevent the disease.

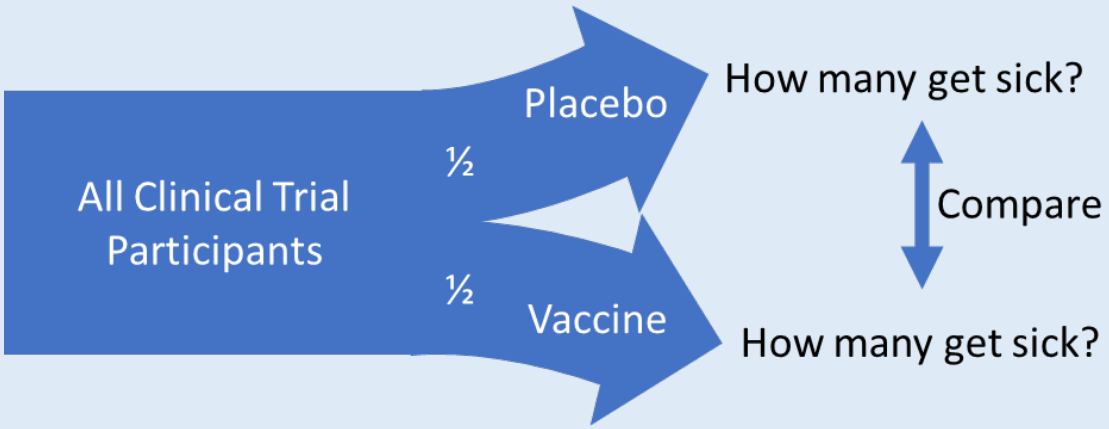


Figure 19: Example of how a clinical trial splits into a placebo group and a vaccine group

3. The results of the clinical trial are shared with government agencies and scientists. They decide whether the data show that the vaccine works and is safe. Examine the data from an actual COVID-19 clinical trial in Figure 20. Do you think it shows the vaccine worked?

	Placebo group	**Vaccine group**
COVID-19 cases	185	11
COVID-19 severe sickness	30	0

Figure 20: COVID-19 cases in the placebo and vaccine group of an actual clinical trial [13]

4. Think about the following questions and record your answers in your journal or discuss them with your team.
    a. Think back to the story in step 1. Each person's story is important, but why are clinical trials a better way of figuring out whether a vaccine is working?
    b. Do you think COVID-19 vaccines could protect people you care about?
    c. How did the data from the clinical trials help you decide?

Emotional Safety Tip: You may know people who have gotten sick or died of COVID-19. You might be worried for people you care about. You might be worried about your own health. These feelings are normal. If you find the topics in this activity difficult to discuss, you can pause and return later or speak to a trusted adult.

Understand: *How do we know vaccines work?*

You know a vaccine is working if it reduces the risk of people becoming infected or getting seriously sick with a disease. We can use data from a clinical trial to calculate **vaccine efficacy,** which shows how well the vaccine works in a clinical trial.

1. For this activity you will need these materials: one six-sided die and your journal. If you do not have a die, you can access a virtual die by using a computer search engine and the search term "virtual dice."
2. For round 1, you will use data from around the world that shows what can happen when someone is infected with COVID-19. Some people have mild cases that do not lead to hospitalization. Some people have severe cases that do lead to hospitalization or even death. You can model the chances of these different outcomes using a die and Figure 21.
3. Roll the die four times and write down the four numbers you get.
4. Add the four numbers together. This is your score.
5. Find your score on Figure 21. Read the type of COVID-19 sickness this number stands for and record it in your journal. Mild sickness is having symptoms that do not lead to hospitalization. Severe sickness is having symptoms that lead to hospitalization.

Score	Type of COVID-19 sickness	Score	Type of COVID-19 sickness	Score	Type of COVID-19 sickness
4	Mild	11	Mild	18	Mild
5	Mild	12	Mild	19	Death
6	Mild	13	Severe	20	Mild
7	Mild	14	Mild	21	Severe
8	Mild	15	Mild	22	Mild
9	Severe	16	Mild	23	Mild
10	Severe	17	Mild	24	Mild

Figure 21: Table with types of COVID-19 sickness based on global rates of mild, severe, and fatal COVID-19 sickness [14]

6. If you are working with a team, compare your results. If you are working alone, repeat round 1 five times. Getting many sets of results can help you better understand the risks of COVID-19 infections.
7. In round 2, you will model a person who received a vaccine in a clinical trial and is exposed to COVID-19. This model uses data from a clinical trial with 65 percent efficacy. Efficacy is a calculation to show how well vaccines work in a clinical trial. With a vaccine with 65 percent efficacy, it does not mean you have a 35 percent chance of getting the virus. It means that in a clinical trial the vaccinated group was 65 percent less likely of getting the disease.
8. Roll the die four times and write down the four numbers you get.
9. Add the four numbers. This is your score.
10. Find your score on Figure 22. Read the type of COVID-19 sickness this number stands for and record it in your journal.

Score	Type of COVID-19 sickness	Score	Type of COVID-19 sickness	Score	Type of COVID-19 sickness
4	Not Sick	11	Mild	18	Not Sick
5	Not Sick	12	Not Sick	19	Not Sick
6	Not Sick	13	Mild	20	Not Sick
7	Not Sick	14	Not Sick	21	Not Sick
8	Not Sick	15	Not Sick	22	Not Sick
9	Not Sick	16	Mild	23	Not Sick
10	Mild	17	Not Sick	24	Not Sick

Figure 22: Table with types of COVID-19 sickness based on rates of mild, severe, and fatal COVID-19 sickness in a person vaccinated with a vaccine with 65 percent efficacy who is exposed to COVID-19[15]

11. If you are working with a team, compare your results. If you are working alone repeat round 2 five times. Getting many sets of results can help you better understand the risks of COVID-19 for someone in the vaccine group.
12. Now think quietly to yourself and answer these questions in your journal.
    a. How do the results from round 1 compare to round 2?
    b. What surprised you about the results from round 2?
    c. Were you worried that with a 65 percent efficacy rate the person in the model would be likely to get very sick?
13. Read the quote below. Consider:
    a. Why does Dr. Laborde believe people should get vaccinated even if it is not a vaccine with the highest efficacy?

b. The model you used of 65 percent efficacy is on the low end for COVID-19 vaccines. Remember the results of your modeling. What could you tell someone about whether it was useful to get a vaccine that is at 65 percent efficacy or higher?

> All of the three vaccines that are currently available in the United States have very high efficacy at preventing the really bad outcomes that we can see with COVID-19, such as severe disease, hospitalization, and death.
>
> —Dr. Yvens Laborde, MD

Act: *How can I explain to others about how we know vaccines work?*

You examined data that compares a vaccine group and a placebo group. You also modeled COVID-19 sickness in people around the world and in a vaccine group. Now you will think about ways to communicate with your community about how we know vaccines work.

1. Take out your journal. Record your thoughts about these questions.
    a. What do you think will be difficult for people to understand about how we know vaccines work?
    b. How can you help answers people's questions?
2. Think about the importance of vaccines as you read the following quote from Dr. Fransen.

> It may be difficult to accept, but the risk of having COVID-19 is much higher than the risk of getting a vaccine. I've seen some people getting a little bit sick with a pain in their arm or feeling a little bit like the flu after getting the vaccine. The choice is between feeling a little bit like the flu for a day and getting COVID-19. Even when you're young or even in good health, you don't know what can happen if you are infected with COVID-19. There can be a lot of long-term impacts.
>
> —Dr. Lieve Fransen, MD, PhD

3. Take out your Community Concerns list from Task 1. Is there any information you found out during this task that would be useful to share with your community? Write down the information next to those concerns. Consider:
    a. Are there concerns that are based around one person's experience? What information could you share to help people in your community understand why it is better to examine many people's experiences to find out if something is working?
    b. Are there concerns about whether vaccines work? What information could you share about vaccine efficacy?
4. Pick one question or concern from your Community Concerns list that you could now help explain with the information you have learned.
5. Decide how you will share that information with a friend or family member who has that concern.
    a. Stories can be valuable tools to communicate information. Rather than sharing information about one person's experience, is there a way to use the story of the clinical trial to share information about how well vaccines work?
    b. Are there other ways you could help teach people? You can use a graph, figure, comparison, model, song, game, dance, or other form of communication.
6. Now put your ideas into action.

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 6: How should we make decisions about vaccines?

Decisions about vaccines affect people in important ways. Thinking about the reasons for our decisions can help us make better choices. In this task you will ***discover*** more about what influences the decisions we make. Then you will ***understand*** more about personal, local, national, and global decision-making about vaccines. You will ***act*** on this information by thinking about how you could help others access information and vaccines.

Discover: *What affects the health decisions we make?*

Everyone makes decisions about their health every day. The reasons for those decisions can vary. In Task 5 you learned about why it may be more helpful to make decisions using data. But that can be hard to do when you or someone close to you has had an experience that influences how you feel. Understanding why experiences may affect people and their decision-making is an important part of helping your community.

1. By yourself, think about who you trust to help you make decisions about your health.
    a. Do you use your own experience? For example, maybe if something made you sick in the past, you will avoid it in the future.
    b. Do you use an expert or data to make the decision? For example, maybe you ask a doctor or nurse about a concern you have.
    c. Do you ask for opinions from others? For example, maybe you ask your friends about decisions they made in the past.
2. Examine your identity map from Task 1. Think quietly to yourself, are there parts of your identity that help determine the way you make health decisions?
3. Now consider how your decisions might be different if you had a different identity or experience. Examine the identities in the Person 1, 2, 3, and 4 boxes. If you are working in a team, split up into four smaller teams or individuals and examine one identity each. If you are by yourself, you can examine one or more of the identities and experiences below.

Person 1

A few years ago, I felt really sick and went to the hospital. The doctor didn't seem to believe what I was telling him about how I felt. He sent me home. A few days later I had to have an emergency surgery because he didn't listen to me. I'm not sure whether doctors really care about people who look like me.

Person 2

I would like to think that the government is looking out for me and keeping me safe, but it is hard to believe. Not too long ago, people in my community were used for medical research without their knowledge or consent. If that kind of thing happened to my grandparents, what would stop it from happening now?

Person 3

My friend's son was diagnosed with autism when he was about two and a half years old. He started showing signs of autism just a few weeks after having some vaccines. My friend believes that the vaccines caused it. It seems possible, and it makes me nervous about taking vaccines.

Person 4

I would like to get a vaccine, but it seems impossible. I tried to use the system to sign up, but there were no available times. Also, the nearest clinic is only open when I am at my job. If I don't go to my job, I don't get paid. My friends and family have the same problem. It feels like no one really cares about the needs of people like me.

Emotional Safety Tip: People are sometimes treated unequally because of different parts of their identity, such as race. This might make you feel angry, sad, or frustrated. These feelings are okay when you notice things that are unfair. You can ask to pause or move away from a discussion if you are uncomfortable or upset.

4. You are going to use empathy to try to imagine the experience of the person you or your team examined. **Empathy** means trying to understand the perspective of another person. It is impossible to entirely understand someone else's experience. But when you become empathetic, you do your best to imagine what another person would think and feel. Think by yourself or discuss with your team:
    a. What health concerns might this person have?
    b. Do you think their experience is related to those concerns?
    c. Who might a person with that experience trust to help them make decisions about their health?
    d. Who might they be reluctant to trust?
5. Some groups of people have had difficult experiences with health care in the past. Read the quotes below. Why is it important to understand different people's experiences?

I think what we're seeing, at least in North America on Turtle Island is this idea that there's a lot of people that haven't trusted biomedicine because of what has been done to people in their ethnic group or their racial groups. Henrietta Lacks is a good example of why you might find Black people not wanting to buy into a vaccine and for Indigenous people you handed us off blankets with smallpox in them.

—Dr. Angela Mashford-Pringle, PhD

Trust is easy to lose, and it is difficult to build. Distrust is a product of years of abuse, neglect, and differential treatment: racism, basically. Communities that have been abused and neglected for years have lost trust in the health care system. This is not something new and you can't rebuild trust overnight. I think we need to start caring for communities and dealing with racism. It is

hard to build trust when you are continuously abusing people.

—Dr. Carlos del Rio, MD

Sometimes we are afraid of things because they are new, and we don't understand them. Sometimes we are afraid of things because we've heard from someone we love that something is scary and we're taking that on. Sometimes we've heard about side effects. There have been groups of people around the world who have had governments or medicine experiment on them in a way that's not in their best interest. It's totally understandable that they wouldn't trust. That has to be addressed and looked at from a space of compassion.

—Dr. Anne McDonough, MD, MPH, MA

6. Think about the people you just discussed. What might happen if each person was given the opportunity to be vaccinated? Record your ideas in your journal or share them with your team.
    a. Is there information about vaccines in this guide that you think would be useful for them to know?
    b. How do you think you might share that information with them, using empathy?
    c. Are there other things you could do to help?

Understand: *What is important to consider when making decisions about vaccines?*

You just explored some personal reasons people may be more or less willing to get a vaccine. Vaccines are an important tool to fight disease. However, even if a person wants a vaccine, they may have trouble getting one. Vaccines are not always distributed equally within and between different countries. When there are fewer vaccines than people who want them, decisions must be made about who will have access to those vaccines. In this activity you will think about how you would decide to distribute vaccines. We will use an example from the United States.

1. Read the paragraph above. Then imagine you are a community official deciding who should have the first opportunity to be vaccinated in a community within the United States. Record in your journal how you would order the following people from 1 (first to be vaccinated) to 5 (last to be vaccinated):
    - A 40-year-old Latinx high school teacher who needs to be vaccinated before in-person school restarts.
    - A 29-year-old Asian nurse who works with cancer patients.
    - An 85-year-old white retiree who lives in a care home.
    - A 59-year-old Indigenous (American Indian) grocery worker who cares for her elderly parent.
    - A 34-year-old Black accountant working from home with a preexisting medical condition that puts him at high risk for COVID-19.

Emotional Safety Tip: The people listed above may be similar to your friends or family. This can make it difficult to think or talk about vaccination order without feeling emotional. That is okay. It is natural to be concerned for people you know. If you need to take a break from the activity, that is fine.

2. Now write, draw, or use another way to show your ideas about:
    a. Why did you choose this order?
    b. What helped you decide?
3. If you are working with others, pick a partner. Between you and your partner, choose a speaker and a listener. For the next two minutes, the speaker should share their thoughts about the best way to decide who should be vaccinated first. The listener's job is to actively listen but not say anything. Active listening means paying close attention to what the other person is sharing, not just thinking about your own response. When the two minutes are up, switch roles.

Emotional Safety Tip: There are no wrong or right answers. Different people can have different opinions. Considering different opinions helps people think better. It may feel difficult to disagree with someone or have them disagree with you. Remember, disagree with ideas, not with people.

4. When you have finished listening to each other, discuss with your partner:
    a. Did you agree on the order in which people should be vaccinated?
    b. Why might it be good to talk to someone who has a different opinion than you?
    c. Do you wish you had more information?
5. One way to make decisions is based on data. Scientists gather information to help them make better decisions. Examine Figure 23 and read the Understanding the Figure box.

Risk for COVID-19 Infection, Hospitalization, and Death by Age Group							
Rate compared to 5-to-17-year-olds	**18–29 years old**	**30–39 years old**	**40–49 years old**	**50–64 years old**	**65–74 years old**	**75–85 years old**	**85+ years old**
Cases	2x	2x	2x	2x	1x	1x	2x
Hospitalization	6x	10x	15x	25x	40x	65x	95x
Death	10x	45x	130x	440x	1,300x	3,200x	8,700x

Figure 23: Risk for COVID-19 Infection, Hospitalization, and Death by Age Group, from U.S. Centers for Disease Control and Protection[16]

Understanding the Figure

The figure shows rates of infection, hospitalization, and death from COVID-19 in the United States. The risks of COVID-19 increase as people get older. People between the ages of 5 and 17 have the lowest chance of being hospitalized or dying of COVID-19. Compared to those people, someone who is 85 years old or older is 95 times more likely to be hospitalized and 8,700 times more likely to die of COVID-19.

Emotional Safety Tip: You may know people who have gotten sick or died of COVID-19. You may be worried for people you care about. You might be worried about your own health. These feelings are normal. If you find the topics in this activity difficult to discuss, you can pause and return later or speak to a trusted adult.

6. Think about who you decided should be vaccinated first. Examine the data in this figure. Then record your ideas in your journal or discuss them with your partner. Remember that when you're with a partner, first one person talks for two minutes and the other person listens, then you switch roles.
    a. Would you change any of your decisions?
    b. Is there other data you would like to have?
7. Read the Inequality and COVID-19 box. How do existing inequalities within the United States affect the health of people in certain racial or ethnic groups?

Inequality and COVID-19

There are lots of things that affect what makes a person more at risk from COVID-19. Age is just one example. A person's health conditions might also make them more at risk of severe sickness or death.

You may know that there are different rates of cases, hospitalizations, and deaths from COVID-19 between different racial and ethnic groups in the United States. A history of inequality and racism has put some groups more at risk of getting COVID-19. Because of racism and inequality, some people are more likely to have essential worker jobs where they must go to work in-person and face exposure to COVID-19. Some people live in places or situations where they are more likely to be exposed to COVID-19. Some people have health conditions that make them vulnerable because they have not had access in the past to high-quality healthcare. Some people may have trouble getting the healthcare they need now to treat COVID-19 or other sicknesses. All of these things can contribute to higher rates of COVID-19 in some communities compared to others.

Emotional Safety Tip: People are sometimes treated unequally because of different parts of their identity, such as race. This might make you feel angry, sad, or frustrated. These feelings are okay when you notice things that are unfair. You can ask to pause or move away from a discussion if you are uncomfortable or upset.

8. Examine the data in Figure 24 on race and ethnicity and risk. This data is about groups of people around the United States. This is different than the risk of an individual person. Still, this data might affect who you think should get the vaccine first. Does this data change any of your ordering decisions? Discuss your ideas with your partner.

Risk for COVID-19 Infection, Hospitalization, and Death by Race/Ethnicity				
Rate compared to White, Non-Hispanic persons	**American Indian or Alaska Native, Non-Hispanic persons**	**Asian, Non-Hispanic persons**	**Black or African American, Non-Hispanic persons**	**Hispanic or Latino persons**
Cases	1.7x	0.7x	1.1x	1.3x
Hospitalization	3.7x	1.0x	2.9x	3.1x
Death	2.4x	1.0x	1.9x	2.3x

Figure 24: Risk for COVID-19 Infection, Hospitalization, and Death by Race/Ethnicity, from U.S. Centers for Disease Control and Protection[17]

9. Decisions can be made based on many different perspectives. Examine the following questions and think about which perspectives you just used. Share your ideas with your partner, if you have one. As before, switch who

is speaking and who is listening after two minutes. Consider, when you made your ordering decisions, did you use:

a. A social perspective? For example, ordering based on what is needed to allow important community interactions to take place, like education or religious worship.
b. A health perspective? For example, ordering based on who is most at risk of getting seriously sick.
c. An economic perspective? For example, ordering based on what is needed to make sure the economy works and people have jobs.
d. An ethical perspective? Ethical means what you think is morally right or wrong. For example, ordering based on who is most at risk or what is most fair.
e. Another perspective?

10. Now think about a global perspective. The people in step 1 were all in one country. But disease does not stop at a country's borders. During a pandemic a disease spreads around the whole world. By yourself or with a partner, consider:
    a. Would you change your order if some of the people listed were inside your country and some were outside?
    b. What should determine who in the world is vaccinated first?
        - Should we think about individual people? For example, all elderly people or medical professionals go first.
        - Should it be managed by country? For example, countries with more money can buy all the vaccines they need to protect their citizens.
        - Should it be evenly distributed, so every country has enough vaccines to give to the same percentage of its population?
11. Read the quote below from Dr. O'Brien from the World Health Organization. Record in your journal:
    a. How do you feel about this quote?
    b. If you were in charge of deciding how vaccines should be distributed globally, what would you do?

No person is safe unless all the people around them are safe. That also means that no country is safe until every country is safe. Pathogens don't recognize borders.

—Dr. Katherine O'Brien, MDCM, MPH, FRCPC

Act: *How can we make good decisions about vaccines?*

Different communities have different concerns and different perspectives. To communicate effectively with people, you must consider their perspectives.

1. Take out your journal. Record your thoughts about these questions.
    a. How did you feel at the beginning of the COVID-19 pandemic before there was a vaccine?
    b. Did your feelings change when a vaccine became available?
    c. Do you know anyone who wants to be vaccinated but can't be?
    d. How do you feel about that?
2. Take out your Community Concerns list from task 1. Is there any information you found out during this task that would be useful to share with your community? Write down the information next to those concerns.
3. Think quietly to yourself:
    a. What were some of the concerns your community felt about vaccines?
    b. What experiences might they have had that influenced their ideas about vaccines?
    c. How can you show empathy toward your community when communicating with them?

The main and best way I have found to help patients with their concerns is to completely listen to their question or concern, empathize with them about their story, and then present the facts to them very matter-of-factly.

—Dr. Stephanie Marton, MD, MPH

4. Think back to your survey results from Task 1. Did anyone tell you they wanted a vaccine but it was difficult to get? By yourself or with your team, decide how you can help people get vaccines if they want them. For example:
    a. Can you find out and share information on how and where to get a vaccine in your community with people who do not know?
    b. If someone in your survey said they were having trouble getting access to a vaccine, is there anything you can do? For example, if they were confused by an online appointment system, could you help the person make an appointment?
    c. Can you encourage government officials or others to help make vaccines available for everyone?
5. Plan how you will help. For example, maybe you decide you need to research the places in your community where someone can get a vaccine. After you find out, you will share this information with others or create a flyer to put up.
6. Now put your ideas into action.

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 7: How do I get information about vaccines?

This guide helps you communicate information about vaccines to other people. One important part of being a good communicator is using information that is accurate, or correct. Where can you find accurate information about vaccines? How can you tell if information is accurate or not? This task will help you answer those questions.

In this task, you will ***discover*** how you and others in your community get information about vaccines. You will carry out an investigation that helps you ***understand*** whether your sources of information are accurate. Then you will ***act*** to teach people in your community about how to find accurate information and communicate it to others.

Discover: *Where do I get my information?*

Because of the COVID-19 pandemic, right now people all around the world are sharing information about vaccines. Some of the information is accurate. Some of the information is not. With so many people sharing information, it can be hard to figure out what is accurate. But it is really important that you help stop the spread of misinformation. Misinformation is incorrect and false information. Misinformation about vaccines can lead to people making unsafe decisions about their health.

You can help your community by learning how to tell if something is misinformation. In this activity, you will take the first step. You will think about where you and others in your community get your information about vaccines.

1. Read the paragraph above. Then answer the following questions by yourself. Record your answers in your journal.
    a. Where do you get information about what is going on in the world?
        - For example, someone in your household, a friend, your doctor, WhatsApp®, TikTok®, YouTube™, Twitter™, Snapchat®, podcasts, television, newspaper articles, radio, pamphlets or posters, or other sources.
    b. Where do you get information about the COVID-19 vaccine?

2. The place where you get information is called a **source**. Think about the following questions and record your answers in your journal or discuss them with your team.
    a. Which of your sources of information do you use the most? Why?
    b. Do you think your sources of information are accurate? Why or why not?
3. Interview several other people from your community using the questions in step 1 and record their answers in your journal. You will need these answers for the ***Understand*** activity.
    a. You can interview people in your household, classmates, friends, team members, or other people you know.
    b. Think about the categories in your identity map. Use those categories to try to pick a diverse group of people to interview, to get a more accurate idea of where different people get their information.

Understand: *How can I tell what information is accurate?*

This activity will help you figure out if the sources of information you listed in the ***Discover*** activity are accurate. This process is called evaluating a source. To evaluate means to figure out the value of something. You are going to figure out if the sources you use are valuable because they have correct information.

1. Read the paragraph above before starting the activity.
2. You can do this activity by yourself, work with the people in your household, or work with your team.
3. Remember the sources that you and others listed in the ***Discover*** activity.
4. Collect several pieces of information about the COVID-19 vaccines from these sources.
    a. These pieces of information could be in the form of articles, conversations with people, podcasts, videos, photos, or any other format.
5. Use the How to Evaluate a Source guide to help you or your team evaluate your sources. Record your answers to each question in your journal.

How to Evaluate a Source

Consider one piece of information at a time. You and everyone on the team should read, listen to, or view the piece of information you are evaluating. Answer the following questions on your own or with your team.

Age

- Does this information list the date it was created?
- Was this information created recently?

Style

- Does the information seem neat and organized?
- Is the spelling and grammar correct?

Author

- Who created this information?
- Is the author's name in a place where you can easily find it?
- Is there information about the author?
- Does the author know a lot about this subject, or did they include information from people who do?

Data

- Does this piece of information include data?
- Where does the data come from? Is that source listed?
- Can you check the data yourself?

How does the information make you feel?

- Does this information have words, images, or sounds that make you feel intense emotions, such as angry, scared, or upset?
- Does it use loud voices, capital letters, or exclamation points?
- Does it feel like the information is trying to get you to take a side?

6. Consider the answers you recorded. Use the information here to help you evaluate your sources.
    a. Age: A good piece of information clearly states when it was created. Our information about vaccines changes each day, so you may want to use information that was created recently. It is okay if the source you are using has been around a long time (such as a newspaper that has been in business for many years). You just want to make sure you are using the most recent information from that source.

    - For example, an article that was written on March 29, 2020, may not be a good source of information about COVID-19 vaccines anymore. March 29, 2020, was close to the beginning of the COVID-19 pandemic. What we know about COVID-19 vaccines has changed since then.

b. Style: A good piece of information has correct grammar and spelling. It is neat and organized. It seems professional.
    - For example, a website with spelling errors, broken links to other websites, and a poor design may not be a good source.

c. Author: You should be able to tell who created a piece of information. They should be experts in the topic. Or the author should use information from other people who have more knowledge than they do.
    - For example, the host of a podcast should tell you their name. You should be able to contact them or their company to ask questions about the information they discuss. If the host is talking about vaccines, they should be a vaccines expert or have education related to vaccines. Or they should include guests who know about vaccines.

d. Data: A good piece of information has data that comes from a trusted source, such as a hospital or university, the U.S. Centers for Disease Control and Prevention (CDC), or the World Health Organization (WHO).
    - For example, an article should not say, “A lot of people have been infected with COVID-19.” Instead, it should list the current number of people who have been infected with COVID-19 and tell you where the data came from. You should be able to go to that same place and find the same data.

Young people are able to access information easily. They can help their communities by accessing information from reputable sites such as the Centers for Disease Control, government websites, or universities in order to inform themselves and their communities.

—Dr. Atiya Mosam, MBBCh, FCPHM, MPH, MMed

e. How does the information make you feel? A good source gives you facts. It delivers information in a calm and clear way. A good source does not try to make you angry or scared, try to convince you it is the only source that is right, or use photos, fonts, or voices that try to make you upset.
    - For example, a post on social media that reads, "I heard about a woman who was YOUNG AND HEALTHY and she felt REALLY sick after her COVID-19 vaccine!!! The vaccine is NOT SAFE!" is using certain words to make you feel scared and angry. It uses capital letters and exclamation points. It is not delivering information in a calm and clear way. This is not an accurate source of information.

7. Think to yourself or talk to your team about the following questions.
    a. Do you think the sources you considered are accurate?
    b. Do you want to change where you get information?
    c. Did you notice that people in your community are using sources that you think are not accurate? Read the quote below and think about how you can help them find accurate information.

> I think that social media is a big reason for the misinformation about vaccines today. I see this with my patients who have concerns about specific side effects or bring up stories of family members or friends. I have had patients pull up blog sites from the Internet that discuss people who have had serious reactions to vaccines. My patients then tell me this is the reason they do not want to get the vaccine. I talk to them about the story of their friend, family member, or blog acquaintance and help them see why that story may not apply to their child.
>
> —Dr. Stephanie Marton, MD, MPH

8. What can you do if someone in your community is sharing misinformation? Some suggestions from experts are listed below. You can read other suggestions in the Vaccines Story Map at bit.ly/3n9QHxv.
    a. Show empathy and respect. Show people that you are listening. That will help them stay open to a conversation with you.

b. Do not repeat their misinformation. Present accurate information instead.

Act: *How can I help my community get accurate information?*

Now that you have learned how to evaluate an information source, you can pass that skill along to other members of your community. You can help people get correct information about vaccines that helps them to stay safe and protect others. Having a plan to stop the spread of incorrect information is something we can all take action on.

1. Remember that you are an important member of your community. As a member of your community, you can help share information about vaccines that people can trust. You can also teach people how to evaluate sources of information. Think about the following questions and record your thoughts in your journal or discuss them with your team.
    a. What do you want to teach your community about evaluating sources?
    b. Read the quote from the expert below. What kind of power do you think you have to influence your community?

> Young people have a lot of power. They can influence and educate less-informed community members. Young people can break the chain of false information on vaccines by verifying vaccine information on social media and not sharing false information. They can use technology as a tool to promote behavior change communication.
>
> —Dr. Mary Ashinyo, MD, MPH

2. Take out your Community Concerns list from Task 1. Is there any information you found out during this task that would be useful to share with your community? Write down the information next to those concerns.
3. Think back to your identity map from Task 1. What things define you and your community? Use this information when you think about the following questions.
    a. How can you teach your community about evaluating sources?

b. What sources of information could you encourage your community to use to find out more about vaccines?

4. Share the sources you evaluated with someone you know. Can you teach them what to notice when evaluating a source?

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Task 8: How can I share the science of vaccines with others?

As you have worked through this guide, you have been thinking about how to share information about vaccines with your community. Your next task is to plan exactly how to take action. You will ***discover*** the steps you think are most important. Then you will ***understand*** the steps you would like to take. Finally, you will ***act*** to carry out your plan.

Discover: *What have I learned about vaccines that I can share?*

Remember that you are an important and trusted member of your community. You can help yourself and your community stay safe and make good decisions by making an action plan to share information about vaccines. In this activity, you will think about what you have learned in this guide and what you want to include in your action plan.

1. Think back to the answers you recorded in your journal in Task 1, in step 7 of the ***Discover*** section. You rated each statement using the scale below. Record your answers to these statements now and then compare to the way you answered in Task 1. How have your answers changed since using this guide?

   (1) not true; (2) somewhat not true; (3) not sure; (4) somewhat true; (5) true

   a. Vaccines help protect my family from disease.
   b. Vaccines help my immune system recognize harmful pathogens.
   c. I can trust vaccines because they are tested to make sure they are safe.
   d. Vaccines that I have gotten have been proven to work.
   e. Some people want vaccines but can't get them.
   f. There is true and false information about vaccines, and I can tell the difference.
2. Take out your Community Concerns list. If you are working with a team, combine all of your lists.
   a. Which pieces of information are the most important to communicate to your community right now? Star, circle, or find another way to mark those pieces of information.

b. Are there other pieces of information that need to be shared with your community?
c. Are there any concerns that you have not found information about?

Understand: *How can I make a plan to share information with my community?*

You have thought about what information will best help your community stay safe and make good decisions about vaccines. Your next task is to plan exactly how to communicate that information. You will list the steps you think are most important and build an action plan to carry out in the ***Act*** activity.

1. Think about the information you marked in your Community Concerns list.
    a. What are some ways you already shared this information in the Act activities of this guide?
    b. Are there other ways you could share this information?
    c. Knowing what you do about your community, what ways of communicating might be best? For example, you could use social media, create a podcast or visual art piece, interview people, perform a play or dance, design a poster, or use another method.

> You have to be able to present your information to a variety of audiences. You have to know how to speak to different audiences. If you are speaking to your faith congregation, the information stays the same, but how do you present it and connect to the members of your faith community? If you are speaking to your peers, how do you present to that group? You really are an expert and you have a right to be civically engaged. The community can look to you as an expert. How do you wear that kind of responsibility?
>
> This is a chance to document the histories of your community. You are now a community historian.
>
> —Katrina Lashley, MA

2. Make a list of what you need to do to share information with your community.

    a. If you are working in a team, think about who in your team will help share each piece of information. Decide on what each person would like to do and record their name next to it.
    b. Make a list of materials you might need.
    c. Think about how much time you might need.
    d. Think about whether you will need help from any adults.
3. Create your plan. Include:
    a. The steps your team would like to take
    b. The order of those steps
    c. Which person or people will help with each step
    d. When and where you will take these steps
    e. What you will do if your plan doesn't work or you run into a problem

Physical Safety Tip: If your plan includes interacting with people in person, never go out alone and always be aware of your surroundings. Pay attention to local guidance on whether it is safe to interact with people outside of your home.

4. Record your action plan. You could:
    a. Write it
    b. Draw it
    c. Create a storyboard that shows the steps in order
    d. Type the plan on a computer, phone, or other device
    e. Record yourself or your team saying the steps
5. Remember to create an inclusive action plan. That means everyone on your team or in your community can participate in some way. You may need to make changes to the plan so that everyone feels safe, comfortable, and able to help.

> I always, always say to people if you can spread the virus, you can also spread information. Everyone can do just that. So sit down with your parents, grandparents, aunts, uncles, coaches, in a physically distant appropriate manner, and talk to them. You have their trust. It's one thing no doctors or scientists will have. You have it already, so go in and share this information. You are technically our frontline staff.
>
> —Dr. Panagis Galiatsatos, MD, MHS

Act: *How can I continue to help others in my community?*

You have finally arrived at the most exciting part. In this activity you will carry out your plan to share information with your community! After you take action, you will reflect on the action you took. Reflecting means thinking carefully about something. Why should you do this? Because reflecting helps you figure out what worked and what didn't work about your action. It helps you take even better action in the future.

1. Put the plan you created in the ***Understand*** activity into action.
2. After you have carried out the plan, pause to reflect.
3. Find a place to rest that is quiet and comfortable. Start by closing your eyes, if that feels comfortable for you. Breathe in slowly through your nose. Let your belly and chest expand with air. Breathe out slowly through your mouth. Push out all of the air that was in your belly and chest. This exercise helps your brain get ready to reflect. Repeat it as many times as you would like, until you feel ready.
4. Think about the following questions by yourself or with others.
    a. What parts of your action plan went well?
    b. What parts could have been better?
    c. Did your action plan help your community stay safe and make good decisions about vaccines?
5. If you are working with others, ask them to share their answers. Notice what you agree on. Notice what surprises you.
6. Think about the following questions by yourself or with others.
    a. What would you do differently if your team planned another action?
    b. What did you do in this guide that surprised you?
    c. What was hard for you to do?
    d. What are the most important things you learned?
    e. What makes you the proudest?
    f. How have you changed?

Additional Resources

Find out more information at the Vaccines Story Map at bit.ly/3n9QHxv.

Congratulations! You have finished the *Vaccines!* Community Response Guide.

All of us should be trying to do what we can to change ourselves and our world for the better. You are an important part of your community. Your actions can help people around you. In this guide, maybe you took a big action. Maybe you took a smaller action. Maybe it had a big impact. Maybe it had a small impact. The most important thing is that you did something. When you use scientific information to take action to make your community better, you create the world you want to live in. You and your team can use science to change the world, one step at a time!

Glossary

This glossary can help you understand words you may not know. You can add drawings, your own definitions, or anything else that will help.

Antibodies: Small proteins that identify and fit into specific bits of a pathogen

Clinical trial: Specific steps to make sure that each vaccine is safe for people to use

Community: A group of people who share something

Data: Information and observations collected by researchers

Empathy: Trying to understand the perspective of another person

Eradicate: Completely get rid of

Genetic: Related to the instructions that cells use

Herd immunity: When a large part of a community (the herd) can no longer be infected or spread a disease

Immune: When you are unable to be infected with a disease

Informed consent: A form signed by participants saying that they agree to the risks of the clinical trial that the researchers explained to them

Memory cell: An **i**mmune system cell that remembers one specific pathogen

Participants: Volunteers who are part of a clinical trial

Pathogens: Things that cause disease

Perspective: The way we think about the world around us

Placebo: A harmless shot that makes a person think they are getting a vaccine in a clinical trial

Researchers: People who plan and carry out clinical trials

Side effects: Unwanted things that happen when you take a vaccine

Source: A place where you get information

Vaccine: Something that helps your body protect itself against disease

Vaccine efficacy: A calculation that shows how well a vaccine works in a clinical trial

References

1. Ipsos, in Partnership with World Economic Forum. February 9, 2021. Global attitudes: COVID-19 vaccines. https://www.ipsos.com/en-ro/global-attitudes-covid-19-vaccine-january-2021
2. Kiely, John. October 9, 2008. Measles Not Worth the Risk. *Atlanta Journal-Constitution.*
3. World Health Organization. October 15, 2020. Measles reported cases. https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencemeasles.html
4. Thèves, C., P. Biagini, and E. Crubézy. March 2014. The rediscovery of smallpox. *Clinical Microbiology and Infection* 20 (3): 210-218.
5. Center for Global Development. n.d. Case Study 1: Eradicating Smallpox. https://www.cgdev.org/sites/default/files/archive/doc/millions/MS_case_1.pdf
6. World Health Organization. October 15, 2020. Measles reported cases. https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencemeasles.html
7. World Health Organization. July 22, 2019. Poliomyelitis. World Health Organization Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/poliomyelitis
8. World Health Organization. October 15, 2020. Measles reported cases. https://apps.who.int/immunization_monitoring/globalsummary/timeseries/tsincidencemeasles.html
9. Centers for Disease Control and Prevention. March 8, 2021. Measles Cases and Outbreaks. https://www.cdc.gov/measles/cases-outbreaks.html
10. United States Food and Drug Administration. February 26, 2021. Vaccines and Related Biological Products Advisory Committee Meeting: FDA Briefing Document Janssen Ad26.COV2.S Vaccine for the Prevention of COVID-19. https://www.fda.gov/media/146217/download
11. United States Food and Drug Administration. December 17, 2020. Vaccines and Related Biological Products Advisory Committee Meeting: FDA Briefing Document Moderna COVID-19 Vaccine. https://www.fda.gov/media/144434/download
12. United States Food and Drug Administration. December 10, 2020. Vaccines and Related Biological Products Advisory Committee Meeting: FDA Briefing Document Pfizer-BioNTech COVID-19 Vaccine. https://www.fda.gov/media/144245/download
13. United States Food and Drug Administration (December 17, 2020) Vaccines and Related Biological Products Advisory Committee Meeting FDA Briefing Document Moderna COVID-19 Vaccine. https://www.fda.gov/media/144434/download.
14. Johns Hopkins Coronavirus Resource Center. April 23, 2021. Tracking: Follow Global Cases and Trends. https://coronavirus.jhu.edu/data
15. Voysey, M., S.A.C. Clemens, S.A. Madhi, L.Y. Weckx, P.M. Folegatti, P.K., et al., on behalf of the Oxford COVID Vaccine Trial Group. January 9, 2021. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: An interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *The Lancet* 397(10269): 99-111. doi: 10.1016/S0140-6736(20)32661-1

16. Centers for Disease Control and Prevention. February 18, 2021. Risk for COVID-19 Infection, Hospitalization, and Death By Age Group. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html
17. Centers for Disease Control and Prevention. April 23, 2021. Risk for COVID-19 Infection, Hospitalization, and Death By Race/Ethnicity. https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html

Vaccines!

How can we use science to help our community make decisions about vaccines?

Smithsonian Science Education Center (SSEC): Module Development Staff

Lead Authors
Heidi Gibson, Hannah Osborn, Logan Schmidt

SSEC Director
Dr. Carol O'Donnell

Assistant Division Director, Curriculum
Dr. Katya Vines

Smithsonian Science Education Center: Module Support Staff

Executive Office
Kate Echevarria
Angela Pritchett

Advancement & Partnerships
Cole Johnson, Division Director
Kayla Powitz
Inola Walston

Professional Services
Dr. Amy D'Amico, Division Director
Katherine Blanchard
Kat Fancher
Katie Gainsback
Dr. Hyunju Lee
Sherrell Lewis
Tami McDonald
Nejra Malanovic
Alexa Mogck
Eva Muszynski

Finance & Administration
Lisa Rogers, Division Director
Anne-Marie Kom

Curriculum & Communications Division - Curriculum
Dr. Katya Vines
Heidi Gibson
Dr. Sarah Glassman
Melissa Rogers
Logan Schmidt
Beth Short

Curriculum & Communications Division - Digital Media & Communications
Ashley Deese
Reuben Brenner-Adams
Sofia Elian
Cara Hackett
Hannah Osborn
Ryan Seymour

Project Advisors

Dr. Mary Ashinyo, MD, MPH
Physician Specialist - Public Health
Deputy Director of Quality Assurance, Ghana Health Service
Accra, Ghana

Emily Backes, JD, MA
Senior Program Officer Committee on Law and Justice Board on Children, Youth, and Families
The National Academies of Sciences, Engineering, and Medicine
Washington DC, USA

Dr. Carlos del Rio, MD
Distinguished Professor of Medicine in the Division of Infectious Diseases at Emory University School of Medicine, Executive Associate Dean for Emory at Grady, Professor of Global Health in the Department of Global Health, Professor of Epidemiology at the Rollins School of Public Health and co-Director of the Emory Center for AIDS Research
Atlanta, Georgia, USA

Dr. Lieve Fransen, MD, PhD
Senior Executive Partner at P4TT
Duisburg, Flemish Region, Belgium

Dr. Panagis Galiatsatos, MD, MHS
Assistant Professor, Division of Pulmonary & Critical Care Medicine
Co-Chair, JHHS Health Equity, Office of Diversity, Inclusion, & Health Equity
Co-Director, Medicine for the Greater Good
Clinical Responsibilities:
Director, Tobacco Treatment Clinic at Johns Hopkins Medicine
Associate Director, The Hereditary Hemorrhagic Telangiectasia Center of Clinical Excellence
Physician, The Obstructive Lung Disease Group at Johns Hopkins Medicine
Johns Hopkins School of Medicine
Teaching Faculty, Johns Hopkins School of Nursing
Baltimore, Maryland, USA

Dr. Luiz A C Galvão, MD, MPH, DSc
Researcher FIOCRUZ
Rio de Janeiro, Brazil

Dr. Yvens Laborde, MD
Ochsner Health, Medical Director, Global Health Education, Medical Director, Public Health, The Ochsner Health System
Assistant Professor of Medicine, Course Director, Medicine in Society – Haiti and The University of Queensland - Ochsner Clinical School
New Orleans, Louisiana, USA,
Port-au- Prince, Haiti, Brisbane, Queensland, Australia

Katrina Lashley, MA
Program
Coordinator, Smithsonian's Anacostia Community Museum
Washington DC, USA

Dr. John Njuma Libwea, PhD
Epidemiologist and Public Health Expert, Directorate for Disease Control, Epidemics and Pandemics,
Ministry of Public Health, Yaoundé, Cameroon

Dr. Stephanie Marton, MD, MPH
Medical Director of Pediatrics, The Center for Children and Women, Texas Children's Health Plan
Houston, Texas, USA

Dr. Angela Mashford-Pringle, PhD
Associate Director/Algonquin Waakebiness-Bryce Institute for Indigenous Health,
Dalla Lana School of Public Health,
University of Toronto
Toronto, Ontario, Canada

Dr. Anne McDonough, MD, MPH, MA
Associate Director of Occupational Health Services, Smithsonian Institution
Occupational & Environmental Health, Public Health Emergency Officer, United States Navy
Washington DC, USA

Dr. Valerie Montgomery Rice, MD, FACOG
President and Dean, Morehouse School of Medicine
Atlanta, Georgia, USA

Dr. Atiya Mosyam, MBBCh, FCPHM, MPH, MMed
Public Health Medicine Specialist
Senior Researcher: PRICELESS SA - SAMRC/Centre for Health Economics and Decision Science
Director: Common Purpose South Africa
Johannesburg, South Africa

Dr. Katherine O'Brien, MDCM, MPH, FRCPC
Director of the World Health Organization's Department of Immunization, Vaccines and Biologicals
Professor at Johns Hopkins Bloomberg School of Public Health
Baltimore, Maryland, USA

Dr. Sabrina Sholts, PhD
Curator of Biological Anthropology at the Smithsonian's National Museum of Natural History
Washington DC, USA

Dr. Bonnie Schmidt, PhD
Founder and President, Let's Talk Science
Ottawa, Ontario, Canada

Technical Reviewers

Dr. Toni Gabaldón, PhD
ICREA Research Professor Comparative Genomics Group Barcelona Supercomputing Centre and Institute for Research in Biomedicine
Barcelona, Spain

Dr. Melvenia Martin, PhD
Associate Director for the Center of Undergraduate Research/Project Director for McNair Scholars Program
New Orleans, Louisiana, USA

Dr. Sabrina Sholts, PhD
Curator of Biological Anthropology at the Smithsonian's National Museum of Natural History
Washington DC, USA

Smithsonian | SCIENCE for Global Goals

Parents, Caregivers, and Educators
Action Plans can be shared with us by using hashtag #SSfGG!

Twitter	**Facebook**	**Instagram**
@SmithsonianScie	@SmithsonianScienceEducationCenter	@SmithsonianScie

ScienceEducation.si.edu

Smithsonian Science for Global Goals (SSfGG) is a freely available curriculum developed by the Smithsonian Science Education Center in collaboration with the InterAcademy Partnership. It uses the United Nations Sustainable Development Goals (SDGs) as a framework to focus on sustainable actions that are student-defined and implemented.

Attempting to empower the next generation of decision makers capable of making the right choices about the complex socio-scientific issues facing human society, SSfGG blends together previous practices in Inquiry-Based Science Education, Social Studies Education, Global Citizenship Education, Social Emotional Learning, and Education for Sustainable Development.

developed by

Smithsonian Science Education Center

in collaboration with

iap SCIENCE HEALTH POLICY
the interacademy partnership

