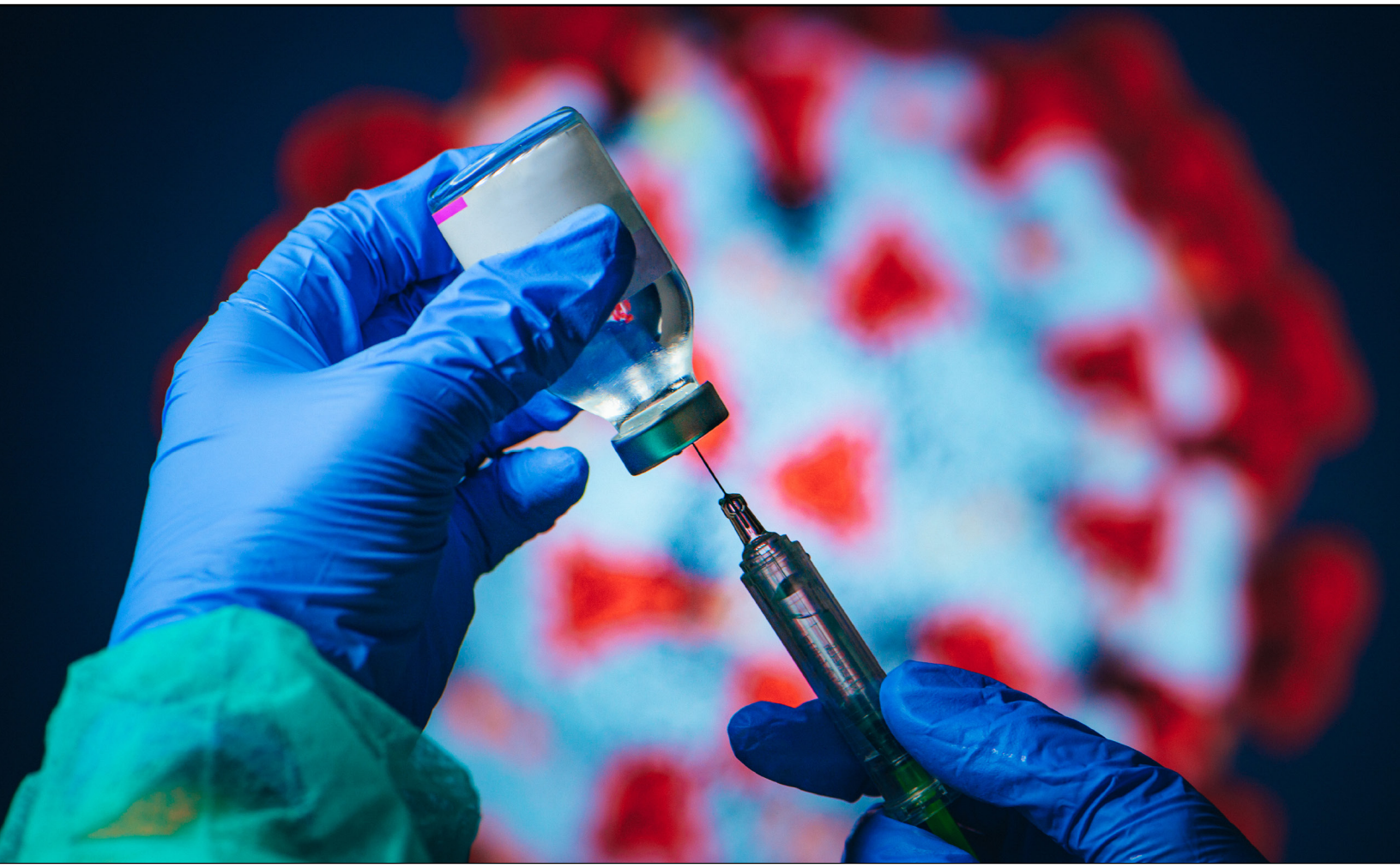
Smithsonian | SCIENCE *for Global Goals*

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

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This NGSS Teacher Companion Guide is based upon, and intended to be used in conjunction with, the Smithsonian Science for Global Goals Guide *Vaccines! How can we use science to help our community make decisions about vaccines?* © 2022 Smithsonian Institution.

For a list of project advisors, please see *Vaccines! How can we use science to help our community make decisions about vaccines?*

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Smithsonian
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Dear Educators,

Now more than ever, we recognize the need for all students to have the tools and knowledge needed to gain an understanding of the science and social science of vaccines. To address that need, the Smithsonian Science Education Center, in collaboration with the InterAcademy Partnership and with the support of the Gordon and Betty Moore Foundation, developed *Vaccines! How can we use science to help our community make decisions about vaccines?* The May 2021 Community Response Guide was designed to help young people learn more about the concerns of their community in order to communicate accurate, helpful, and trusted information about vaccines.

Vaccines! features eight tasks that incorporate investigations and hands-on science to help students discover, understand, and take action. Students learn about vaccines throughout history; understand the science of how vaccines work; explore how vaccines are developed; examine issues of equity, access, and misinformation; and develop an action plan for addressing concerns about vaccines in their communities. The guide was designed for youth across the globe and is available in multiple languages to be used either at home with siblings, parents, or caregivers, or in schools with teachers.

In 2022, thanks to additional support from Northrop Grumman, the Smithsonian was able to make the *Vaccines!* content more accessible and applicable for students, educators, school districts, and state education agencies in the United States who have adopted the Next Generation Science Standards (NGSS) or similar standards. This new NGSS Teacher Companion Guide is intended to be used in tandem with the student-facing *Vaccines!* Community Response Guide. It provides additional conversations, activities, and support for educators to easily adapt the content for an NGSS classroom. In the Teacher Companion Guide, you will see that lessons center around a phenomenon or problem and include a table outlining the Performance Expectations (PEs) and the NGSS elements reflective of three-dimensional learning.

A special thank you to the author and developer of this Teacher Companion Guide, Logan Schmidt, for her tremendous expertise and understanding of NGSS and curriculum development, and for her careful research and ability to translate complex ideas into meaningful content for youth.

We hope the content in this Teacher Companion Guide will support you and your students as you engage with *Vaccines! How can we use science to help our community make decisions about vaccines?* We are all committed to a healthier world. And science education—and action—can help us accomplish this goal together.

Sincerely,

Carol L. O'Donnell

Dr. Carol O'Donnell, Director
Smithsonian Science Education Center

Vaccines!
How can we use science to help our community make decisions about vaccines?
NGSS Teacher Companion Guide

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Student Assessment

Use this assessment before starting the guide to gauge students' understanding of the history and science of vaccines, their interest in STEM careers, and their sense of agency, comfort with data, and science behaviors. Then, offer the assessment again after completing the guide to determine how students have been affected by their work.

Student Name_____

1. I know how vaccines work in the body.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
2. I know how vaccines were first developed.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
3. I know how people make sure vaccines are safe to use.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
4. I can explain how vaccines work.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
5. I would be interested in a job that uses science, technology, engineering, or math.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
6. I know the best way to communicate information to my community.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
7. I feel confident that I could understand a graph, table, or chart that has data.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
8. I know how to use data to help my community make decisions.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
9. I know how to tell if an article, social media post, news report, or other source of information is true or false.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely
10. I am confident that I could use science to help my community make good decisions about vaccines.
    a. I agree completely
    b. I agree
    c. I am not sure
    d. I disagree
    e. I disagree completely

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

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	60 minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts, such as:

Ask questions about how people think and feel about vaccines.

Phenomenon: People have different thoughts, feelings, and opinions about vaccines.		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Asking Questions and Defining Problems • Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information. • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.		

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- Attitudes Toward COVID-19 Vaccine graph
- Student journals

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

1. Ask students to complete Task 1, Discover, steps 1–9 (reproduced in the box) in the Community Response Guide.

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?*

1. Share the graph showing attitudes toward the COVID-19 vaccine (Figure 1).

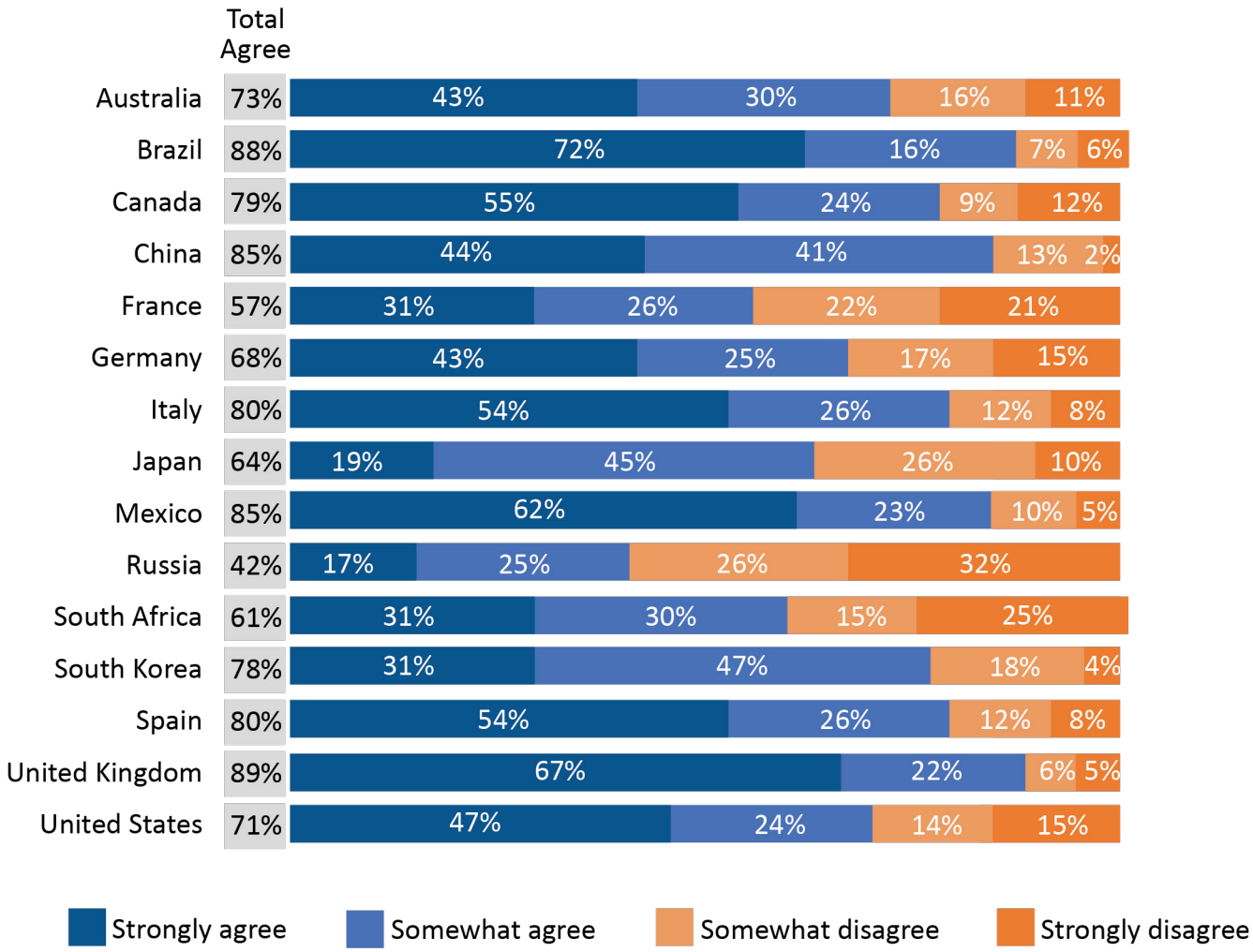

Figure 1: Poll of attitudes toward a COVID-19 vaccine, from January 2021.

2. Explain to students that this graph shows how a sample of people in certain countries responded to the statement, "If a vaccine for COVID-19 were available to me, I would get it." This information was collected in January of 2021. Tell students that this graph is a kind of phenomenon: It shows how people around the world felt about the decision to get a COVID-19 vaccine.
3. Instruct students to create a table with three columns in their journal and label the columns I notice, I think, and I wonder.

4. Ask students to study the graph on their own and record what they can observe (I notice), possible explanations for what they observed (I think), and what they still have questions about (I wonder).
5. Next, ask students to complete a think, pair, share activity with a partner. Ask them to share one thing they noticed and one thing they thought about the graph.
6. Bring the class back together.
7. Ask students to share out with the class what they noticed and thought about the graph.
8. Remind students that they recorded some thoughts and feelings about vaccines in their journals in the Task 1, Discover activity. Ask them to think about their answers in step 7 and the answers from other members of their team.
9. Ask, "Did everyone in our class answer these questions the same way?"
10. Then ask students, "Think about your own answers and what you observed in the graph. Does it seem like people in these countries have the same thoughts, feelings, and opinions about vaccines?" Students will likely answer that they have observed that people in these countries do not have the same thoughts, feelings, and opinions about vaccines.
11. Tell students that this phenomenon shows that people have different thoughts, feelings, and opinions about vaccines. As scientists, students can collect more information to help others make decisions. Tell students that in this task, they are going to gather information about how their community thinks and feels about vaccines. In the rest of the guide, they will also gather information about how vaccines work. This information will help their community make good decisions about vaccines.
12. Ask students to brainstorm what kinds of investigations they could do and what methods they could use to find out more about how people in their community think and feel about vaccines. Tell students to record their ideas in their journal. Figure 2 has examples of investigations.

How could we investigate how our community thinks and feels about vaccines?
Do a survey of community members Interview family members Interview elected officials in our community Read news reports about vaccines in our community Look for social media posts about vaccines within our community

Figure 2. Examples of student investigations.

13. Ask students to think back to what they recorded in the I wonder column. Prompt students to use those wonderings as inspiration for what they want to ask their community about vaccines in their investigations. Tell students to record their questions in their journal. Figure 3 has examples of questions.

What questions do we want to ask?
Would you get a vaccine? Why or why not? Do you feel like vaccines are safe? Why or why not? Do you know what a vaccine is? How do you think vaccines work? Who do you go to for advice about vaccines? What do you want or need to know about vaccines?

Figure 3. Examples of student questions.

Asking questions: Students collaboratively generate questions about the phenomenon that they can investigate within their community using available resources.

14. Students should feel free to create their own investigations. However, if students need more scaffolding and support, they can complete Task 1, Understand, steps 6–10 (reproduced in the box) in the Community Response Guide. This series of steps guides students through how to conduct a survey about vaccines in their own community.

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 13 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.

15. Direct students to work individually, in pairs, or in small groups to plan and carry out their investigations to collect information about how people in their community think and feel about vaccines. They should record and keep this information in a safe place, as it will inform their action plan at the conclusion of the module.

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

1. Ask students to complete Task 1, Act, steps 1–4 (reproduced in the box) in the Community Response Guide.

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 Community Concerns. Title one column Concerns. List the concerns of the people you surveyed. Include any worries they shared or information they needed. Title the second column Information. 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?

2. Tell students to keep the Community Concerns paper in a safe place. They will use it throughout the guide.

Task 2: Why are vaccines important?

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	90 Minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts, such as:

Obtain information and analyze data to gather evidence for how vaccines affect the prevalence of common diseases.

Phenomenon: Vaccines change the spread and effect of diseases.		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. **Obtaining information** • Critically read scientific texts adapted for classroom use to determine the central ideas and/or obtain scientific information to describe patterns in and/or evidence about the natural and designed world.		**Patterns** • Graphs, charts, and other images can be used to identify patterns in data.

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- World Map of Disease I image
- World Map of Disease II image
- Student journals
- KLEWS chart

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

1. Remind students that in the previous task, they explored how they and their community think and feel about vaccines. Students discovered that people have different thoughts, feelings, and questions about vaccines.
2. Ask students to recall some of the questions they recorded in Task 1, Understand, step 4 and step 13. Tell students that their questions and wonderings are going to drive what they do in the rest of the guide. They are going to collect information to answer those questions and help their community make good decisions about vaccines.
3. Tells students you have created a KLEWS chart to help them organize the information they collect throughout the guide. An example is shown in Figure 4.

Driving Question: *How can we help people make good decisions about vaccines?*

K **What we think we know**	**L** **What we are learning**	**E** **Evidence (from our data)**	**W** **Wonderings**	**S** **Scientific concepts and words**

Figure 4: Example of KLEWS chart.

4. Tell students that they will fill in some of the columns now, and the others as they progress through the module.
5. Ask students to remember their answers to the questions about vaccines in Task 1, Discover, step 7. They should also recall the conversations they had with team members about vaccines in step 8. These answers represent what they already know about vaccines, both as individuals and as a class.
6. Prompt students to share what they already know by asking, "Based on your own experiences and conversations with your group, what do you already know about vaccines?

7. Record students' shares in the **K** column. Responses might include:
   - *I got vaccines when I was really young.*
   - *Vaccines can help you not get sick.*
   - *Vaccines are made by people.*
   - *Vaccines are sometimes given as shots.*
8. Record students' questions and their community's questions about vaccines in the **W** column. If more than one student has the same question, consider adding a check or tic mark next to that question. Questions might include:
   - *How do vaccines work in our bodies?*
   - *How can we tell that vaccines are working?*
   - *How do we know vaccines are safe?*
   - *Who makes vaccines?*
   - *What diseases can vaccines help with?*
   - *Where do we get vaccines?*
   - *What do we want or need to know about vaccines?*
9. Let students know that they will be collecting evidence to help answer many of their questions throughout the module. This evidence will help students guide their community to make good decisions about vaccines.
10. As students go through the module, encourage them to add to the KLEWS chart as they gain more information, evidence, wonderings, and scientific concepts and words.
11. Ask students to complete Task 2, Discover, steps 1–5 (reproduced in the box below) in the Community Response Guide. This activity helps students assess their prior experience with vaccines.

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. 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.

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

1. Share the World Maps of Disease I image.

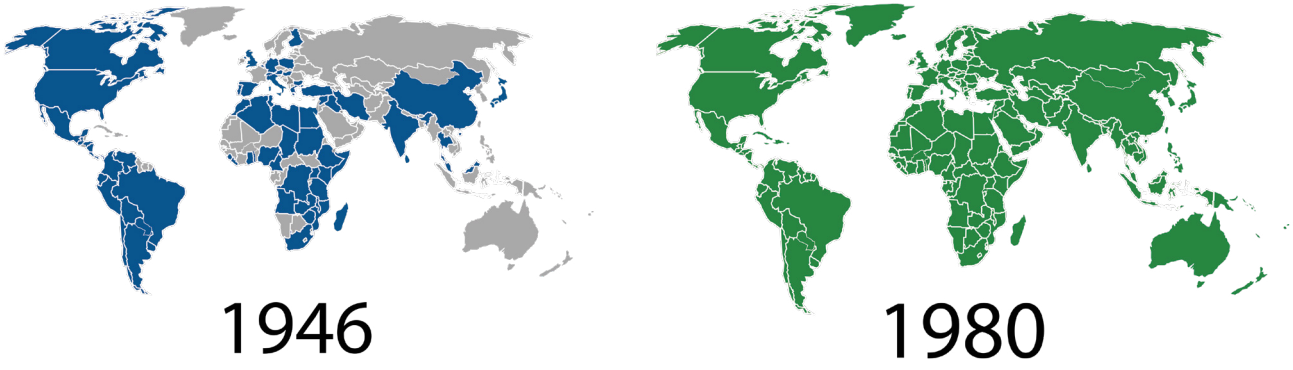

Figure 5: World Maps of Disease I.

2. Explain to students that this image uses a map and colors to show which countries had cases of a disease in 1946 and in 1980. Countries that had cases of the disease are in blue. Countries without cases of the disease are in green. Countries with no data about the disease are in gray.
3. Instruct students to examine the data in the world map on their own first. Prompt them to notice, think, and wonder about the map (they do not need to record their thoughts, but will be discussing them with a classmate).
   - Everything they notice about the changes on the maps between 1946 and 1980
   - What they think might have caused the changes on the maps between 1946 and 1980
   - What they wonder about what caused the changes
4. Share the World Maps of Disease II image.

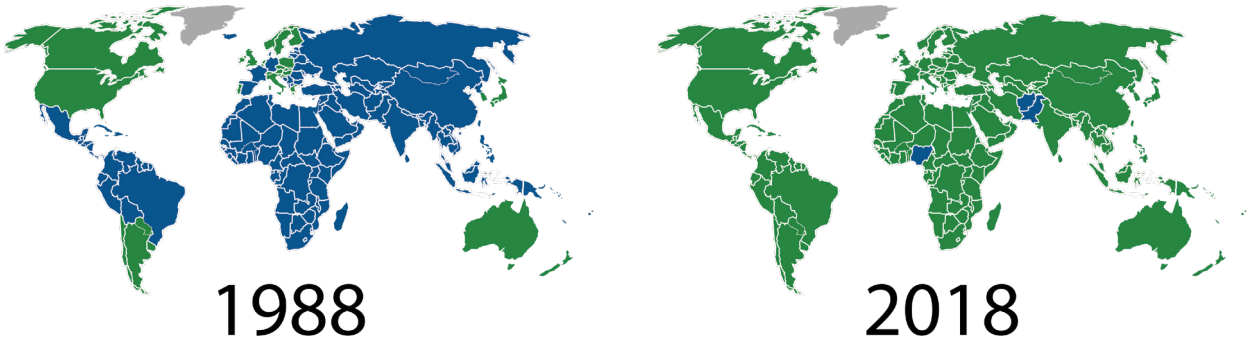

Figure 6: World Maps of Disease II.

5. Explain to students that this image uses a map and colors to show which countries had cases of a disease in 1988 and in 2018. Countries that had cases of the disease are in blue. Countries without cases of the disease are in green. Countries with no data about the disease are in gray.
6. Instruct students to examine the data in the world map on their own first. Prompt them to notice, think, and wonder about the map (they do not need to record their thoughts, but will be discussing them with a classmate).
   - Everything they notice about the changes on the maps between 1988 and 2018
   - What they think might have caused the changes on the maps between 1988 and 2018
   - What they wonder about what caused the changes

Analyzing and interpreting data: Students analyze the world maps using a notice, think, wonder activity.

7. Ask students to turn to a partner and share their thoughts from the notice, think, wonder activity. Prompt them to discuss:
   - What patterns do they notice in each world map? For example, how did the number of countries with the disease change over the years? Did it decrease, stay the same, or increase?
   - What do they think might have caused this pattern?

Patterns: Students identify patterns in the data in the world maps.

8. Ask students to complete Task 2, Understand, steps 2 and 4 (reproduced in the boxes) in the Community Response Guide.

Obtaining information: Students gather information and evidence from the two scientific texts in the guide to add learning and evidence to their KLEWS chart.

> 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.

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.

9. Ask students to work with a partner. Have them discuss the following:
   - What effect did vaccines have on the diseases smallpox and polio?
   - How do the two maps give us evidence of that?
10. As a class, ask students to reflect on the activity. What could they add to their KLEWS chart?
11. Remind students that their goal is to help their community make good decisions about vaccines. Part of that goal is sharing information with others. Explain that they can share information using models.

12. Tell students to complete Task 2, Understand, steps 5–18 (reproduced in the box) in the Community Response Guide. These steps guide students through creating a model of how vaccines can develop herd immunity in a population and how that immunity can change as vaccination rates change.

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.

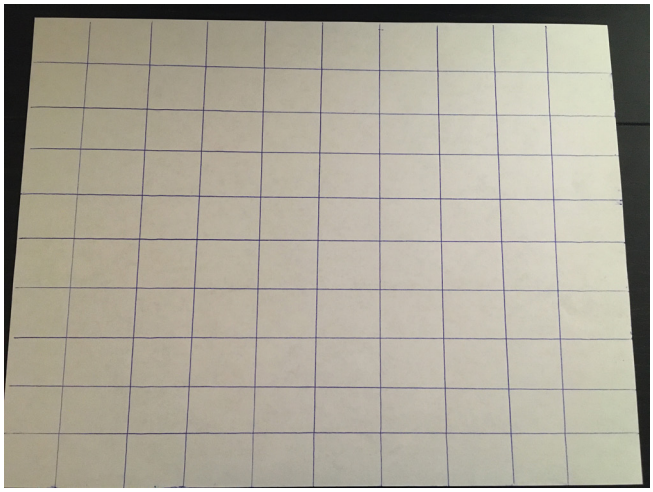

Figure 5: Sample paper with 100 boxes.

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.

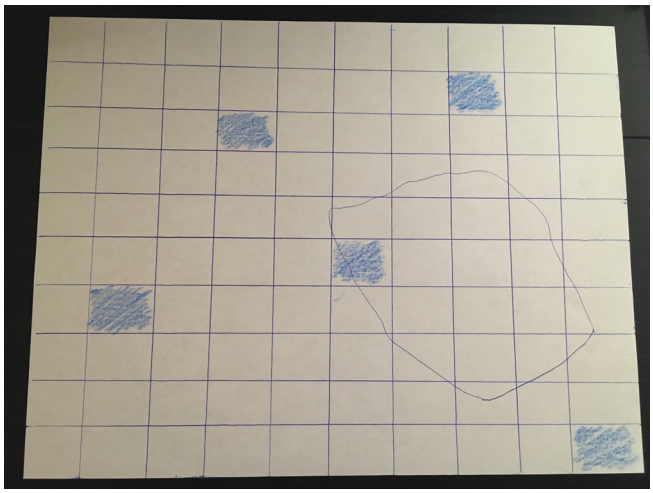

Figure 6: In this model of 95 percent herd immunity, one person (represented by the colored box within the outline) is newly infected after being exposed to measles by an infected person (who came into the community.

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

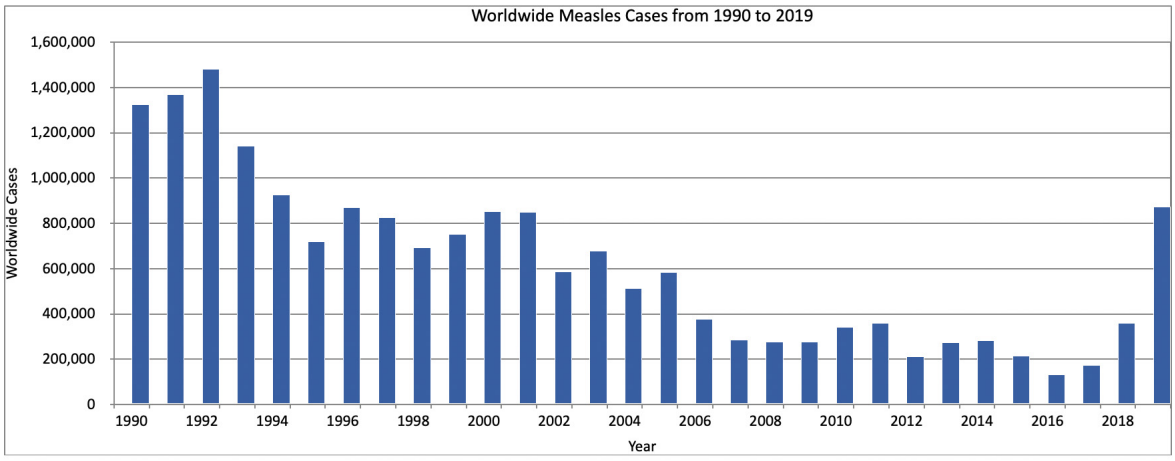

Figure 7: Worldwide measles cases from 1990 to 20198.

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.
    c. Would you expect the number of cases to rise if a community had herd immunity?
    d. 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]

13. After students have completed their modeling activity, bring the class back together to discuss the following questions about the model:
    - What were the parts of the model? What did each part represent?
    - How did the model help you understand how herd immunity works?
    - Would you change anything about the model?
    - Why might scientists want to use models instead of real people when showing how diseases spread and can be prevented?
14. As a class, ask students to reflect on the modeling activity. What could they add to their KLEWS chart?

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

1. Ask students to complete Task 2, Act, steps 1–3 (reproduced in the box) in the Community Response Guide.

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.

Task 3: How do vaccines work?

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	60 Minutes

Task-Level Performance Expectation (Task Objective): This task could be one in a series of tasks building toward the following performance expectation:

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

Phenomenon: The human body's immune system responds to pathogens in many ways.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop and/or use a model to predict or describe phenomena. **Constructing Explanations** • Apply scientific ideas, principles, and/or evidence to construct, revise, and/or use an explanation for real-world phenomena, examples, or events.	**LS1.A: Structure and Function** • In multicellular organisms, the body is a system of multiple interacting subsystems.	**Systems and System Models** • Models can be used to represent systems and their interactions—such as inputs, processes, and outputs—and energy, matter, and information flows within systems.

	These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions.	**Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationship among its parts; therefore, complex natural and designed structures/ systems can be analyzed to determine how they function.

Elementary Alignment:

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

High School Alignment:

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- Body Defenses images
- World Map of Disease I image
- Student journals
- KLEWS chart

Discover: *How does my body protect me?*

1. Share the Body Defenses images.



Figure 7: Images showing body defenses.

2. Ask students to describe what they think is happening in each image. Their answers may include:
   - *I see a cut on someone's knee. It looks red and puffy.*
   - *An adult is holding a thermometer and holding their hand to a child's forehead. I think that means the child has a fever.*
   - *That person is using lots of tissues and holding their nose. I think they have a runny nose.*
3. Ask students if they have ever personally experienced what they observed happening in each image. What caused them to experience that? How did they feel? Did they get better? How? Their answers may include:
   - *I fell on the ground and scraped up my knee. It really hurt! The skin got puffy and I could see some redness. I had to put antibiotic cream on it for a few days and cover it with a bandage.*

- *I got a cold. My grandmother took my temperature and said I had a fever. I felt hot and tired for two days. I eventually felt better.*
- *Sometimes when I have a cold my nose runs all day and all night. I have so much mucus coming out of my nose. It drips down from the back of my nose, too, and even my throat gets sore.*

4. Tell students that the experiences they had were because their body was trying to keep them safe from disease. Fevers, swelling, sneezing, runny noses, and sore throats are signals that the body is trying to fight an infection.
5. To help them find out more about the body's defenses, ask students to complete Task 3, Discover, steps 3 and 6 (reproduced in the boxes) in the Community Response Guide.

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).

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.

6. Explain that these are just some of the ways the body uses its own defenses to fight disease. Vaccines can also help fight disease. Vaccines work by helping the body activate some of its other defenses against disease. Tell students that they will learn more about how vaccines work in the next activity.

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

1. Refer to the KLEWS chart. Point out any questions from the community or from students related to "How do vaccines work?" Remind students that while they have gathered evidence that vaccines help to keep people safe from disease, they and other people in the community need to know more about *how* vaccines work to keep them safe from disease. This will help people make good decisions about vaccines.
2. Tell students that they will use modeling to learn more about how vaccines work. Using models enables us to mimic what happens inside the body when a person gets a vaccine.
3. Ask students to complete Task 3, Discover, step 8 (reproduced in the box) in the Community Response Guide.

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.

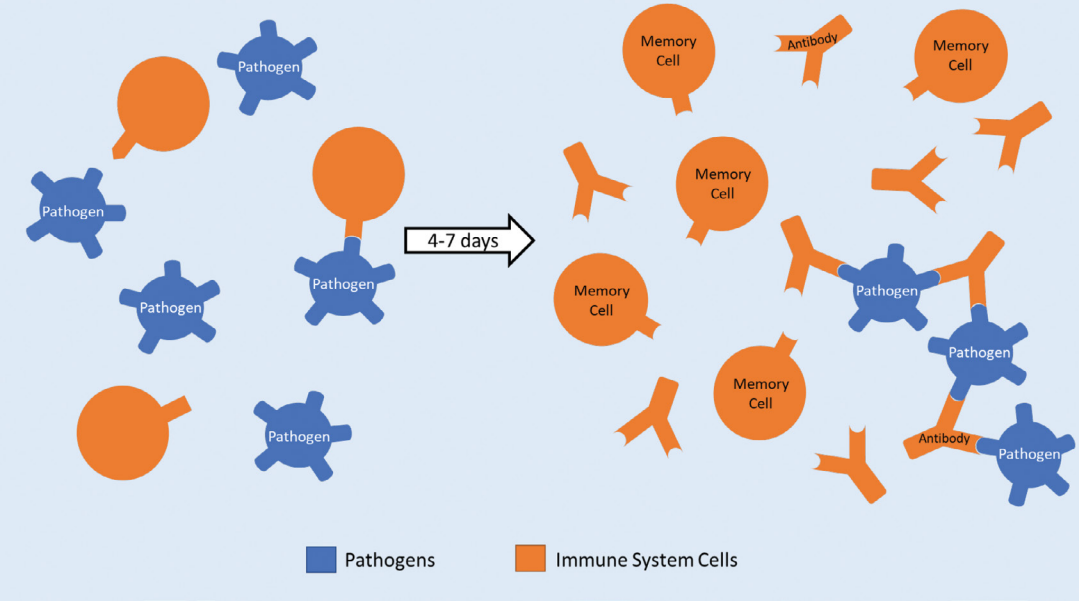

Figure 8: Formation of memory cells and antibodies after meeting a pathogen.

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.

4. Ask students if there are any terms they would like to add to the **S** column of the KLEWS chart.
5. Tell students that the guide explains how the memory cells of the body can make antibodies, which fit onto specific parts of a pathogen, like a key fits into a lock. The lock and key model is just one kind of model for pathogens and antibodies.
6. Ask students to work with a partner and answer the following questions:
   - Can you think of other ways to model how pathogens and antibodies interact in the body?
   - What kind of model could you use for memory cells?

Developing and using models: Students use their own knowledge and experiences to brainstorm a model that describes how pathogens, antibodies, and memory cells interact.

7. Ask students to complete Task 3, Understand, steps 1–9 (reproduced in the box) in the Community Response Guide. These steps guide students through creating a model of how vaccines work in the human body to keep people safe from disease.

Systems and system models: Students use the model in the guide to observe the interactions between antibodies and pathogens.

Structure and function: Students use the model in the guide to observe how the shape and structure of antibodies are linked to their function. They also use the model to observe the relationship between antibodies and pathogens and analyze the function of vaccines.

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.

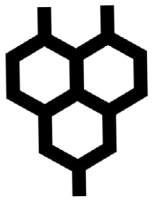

Figure 9: Pathogen model.

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.

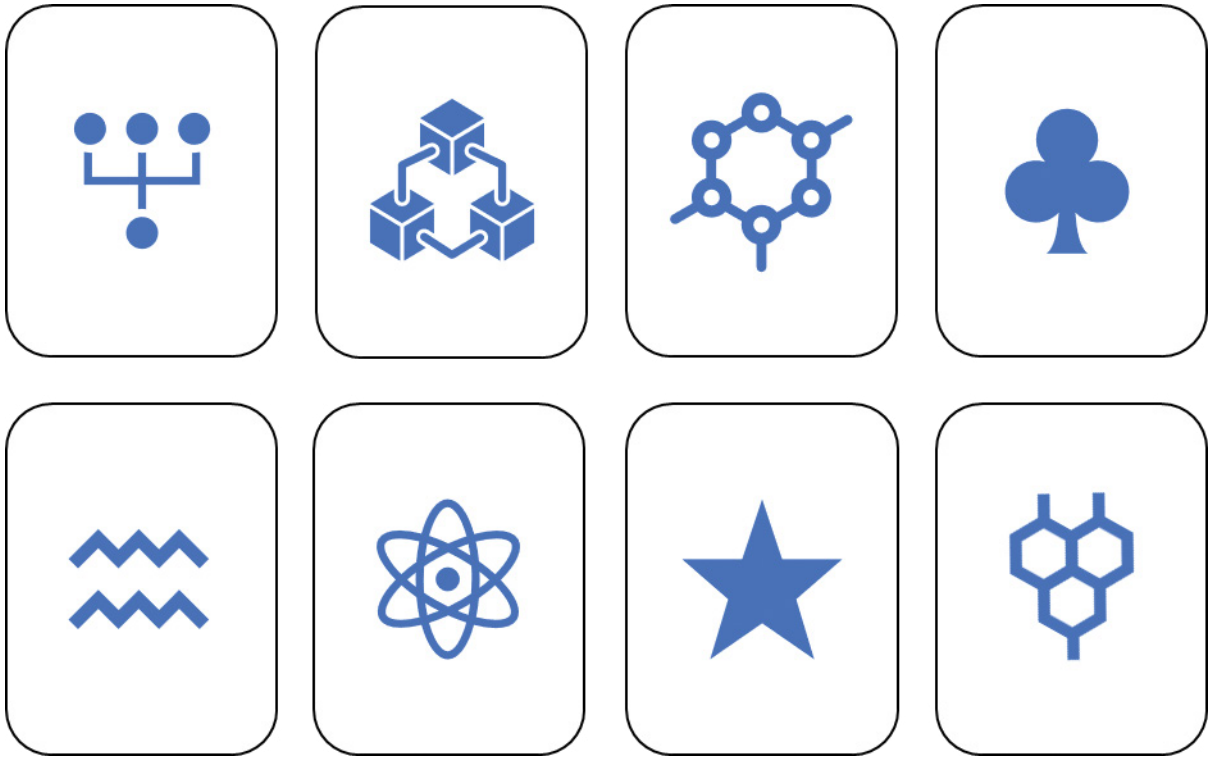

Figure 15: Pathogen models.

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

8. Share the World Map of Disease I image again.
9. Ask students, "Can you use the scientific terms vaccine, pathogen, memory cells, and antibodies to describe what happened between 1946 and 1980?" Student answers may include descriptions like this one:
   - *Polio was a disease caused by a pathogen. Then someone invented a vaccine for polio. That vaccine helped a person's memory cells make antibodies that fit onto a polio pathogen. If that person was exposed to the polio pathogen, their body could make a lot of antibodies really quickly. This prevented the person from getting very sick. This meant that fewer people got sick from polio each year. Eventually almost no one got polio anymore.*

 **Constructing explanations: Students use the information they gathered in Tasks 2 and 3, including images, scientific texts, and models, to construct an explanation for the Task 2 phenomenon: Vaccines change the spread and effect of diseases, as shown in the World Map of Disease I image.**

10. Tell students that sometimes after getting a vaccine, a person may have a mild fever or feel ill for a very short period of time. Ask students, "Can you think of why that person's body might react that way to a vaccine?" Students may respond:
    - *The vaccine works by making the body fight against a dead pathogen or parts of a pathogen. It isn't the same as fighting against a live pathogen, but the body still tries to defend itself. Fevers and feeling ill are a part of the body's own defenses against infection.*
11. As a class, ask students to reflect on the activity. What could they add to their KLEWS chart?

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

1. Ask students to complete Task 3, Act, steps 3–6 (reproduced in the box) in the Community Response Guide.

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?

Task 4: How do we know vaccines are safe?

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	50 Minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts, such as:

Evaluate existing solutions for making sure vaccines are safe, and communicate that information.

Problem: People are not sure if the COVID-19 vaccine is safe.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Defining Problems • Define a design problem that can be solved through the development of an object, tool, process, or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. **Designing Solutions** • Apply scientific ideas or principles to design, construct, and/or test a design of an object, tool, process or system. **Obtaining, Evaluating, and Communicating Information** • Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, or system) in writing and/or through oral presentations.		

Elementary Alignment:

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- Student journals
- KLEWS chart

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

1. Ask students to complete Task 4, Discover, steps 1–3 (reproduced in the box) in the Community Response Guide on their own.

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.

Task 4

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.

2. Ask students to work with a partner or a small group to complete Task 4, Discover, steps 4 and 5 (reproduced in the box) in the Community Response Guide.

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.

3. Bring the class back together and ask, "How did your answers to what makes you feel most safe compare to the answers of your partner or group?" Encourage students to share out what makes them feel the most safe about using a new product.
4. Explain to students that the COVID-19 vaccines are also a new product. As with any new product, it is important to know that the vaccines are safe to use.

5. Refer to the KLEWS chart. Point out any questions from the community or from students related to "How do we know vaccines are safe?"
6. Remind students that although they have gathered evidence that vaccines work, and have learned more about how they work, they and other people in the community may still have questions about how we know vaccines are safe to use.
7. Ask, "Why might it be a problem that some people are not sure if vaccines are safe to use?" Student answers might include:
   - *Vaccines help keep people safe from disease. If people don't get the vaccine, they might not be safe from disease.*
   - *If enough people don't get the vaccine we might not get herd immunity. The disease could keep spreading.*
   - *Some people can never get vaccines because it isn't safe for them, such as people with weak immune systems. They are vulnerable. We need to protect those people by encouraging others to get vaccinated.*

 **Defining problems: Students explain why a lack of information about or confidence in the COVID-19 vaccine is a problem for both individuals and communities that needs to be solved.**

8. Tell students that in this task, they will work toward solving this problem by developing and evaluating various solutions for helping people understand that the COVID-19 vaccines are safe to use.

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

1. Tell students to work with a partner or a small group.
2. Say, "Imagine you are in charge of making a new COVID-19 vaccine. You need to make sure it is safe to use in someone's body. What steps would you take to make sure the vaccine was safe?"
3. Direct students to record their brainstorming in their journals.
4. As students are discussing their plan with their partner or group, circulate and use the following guiding questions to help students brainstorm:
   - How could you test that the vaccine is safe to use in the human body?
   - Who would you want to ask for help in making a plan?

- Would you ask certain people, groups, or parts of the government to supervise or comment on your plan?
- How will you know you have been successful?
- How could you communicate to people that the vaccine was safe to use? Remember your answers from the Task 4, Discover activity. Keep those answers in mind when choosing how to communicate to others.

Designing solutions: Students apply scientific ideas or principles to brainstorm a process to determine whether a vaccine is safe to use in the human body.

5. As students complete their brainstorming, ask them to pair up with another partner or small group. Ask them to share out their ideas with the other students.
6. Prompt students to add to, modify, or remove steps from their process based on what they heard from other groups. Tell them to keep their process saved in their journal. They will come back to it later in this activity.
7. Bring the class back together.
8. Tell students that there is already a process in the United States that makes sure that vaccines are safe to use in the human body. It is called a clinical trial. Explain that students are going to learn more about clinical trials and then compare them to their own process.
9. Ask students to complete Task 4, Understand, step 3 (reproduced in the box) in the Community Response Guide on their own.

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.

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.

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.

10. Bring the class back together.
11. Ask students if there are any terms they would like to add to the **S** column of the KLEWS chart.
12. Direct students to get back together with their partner or small group. Ask them to consider the steps they wrote in their journal. Based on what they just read in Task 4, Understand, step 3, what would they like to add, modify, or remove from their steps?

 **Designing solutions: Students refine their process using new scientific information.**

13. Ask students to complete Task 4, Understand, steps 4–7 (reproduced in the box) in the Community Response Guide.

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?

14. Ask students to get back together with their partner or small group. Based on what they just read in Task 4, Understand, steps 4–7, what would they like to add, modify, or remove from their steps?

Designing solutions: Students revise and optimize their steps for making sure vaccines are safe to use in the body, using information from Task 4, Understand, steps 4–7.

15. As a class, ask students to reflect on the activity. What could they add to their KLEWS chart?

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

1. Ask students to complete Task 4, Act, steps 3–5 (reproduced in the box) in the Community Response Guide.

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.
    c. Who in your community will you share this information with?
    d. 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.

Communicating information: Students communicate accurate information about clinical trials for vaccines to their community in a way that is customized for their audience.

2. As they complete these steps, remind students to think back to Task 4, Discover, steps 1–5. The information from these steps can help students create communications that best address concerns in their community. For example, if they discovered that most people in their community use social media to share and find information, they could share information about clinical trials using social media. That way, they have a good chance of reaching young people who are unsure about the safety of vaccines.

Task 5: How do we know vaccines work?

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	60 Minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts.

Problem: Some people do not believe that the COVID-19 vaccine works to keep people safe from disease.		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. **Developing and Using Models** • Develop and/or use a model to predict and/or describe phenomena.		**Patterns** • Graphs, charts, and images can be used to determine patterns in data. • Patterns can be used to identify cause-and-effect relationships.

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- Student journals
- KLEWS chart

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

1. Remind students that you asked them in the last task, "How will you know a clinical trial has been successful?" Ask again. Student answers may include:
   - *If no one gets seriously ill or dies from taking the vaccine, then I know it is safe to use in the human body.*
2. Refer to the KLEWS chart and the **W** column. Ask students, "Are there any other questions that might be answered by doing a clinical trial?"
3. If students do not generate the desired response, explain that clinical trials not only figure out if the vaccine is safe, but they can also help answer questions about whether the vaccine works the way it is supposed to.
4. Ask students, "What does it mean to you if a vaccine works? What would that look or feel like?" Student responses might include:
   - *I don't get sick at all.*
   - *My family members don't get sick, or if they do, they don't get very sick.*
   - *The vaccine keeps people out of the hospital.*
   - *My grandparents are really old and vulnerable, but if they have the vaccine, they won't die from the disease.*
5. Ask students to complete Task 5, Discover, step 2 (reproduced in the box) in the Community Response Guide.

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.

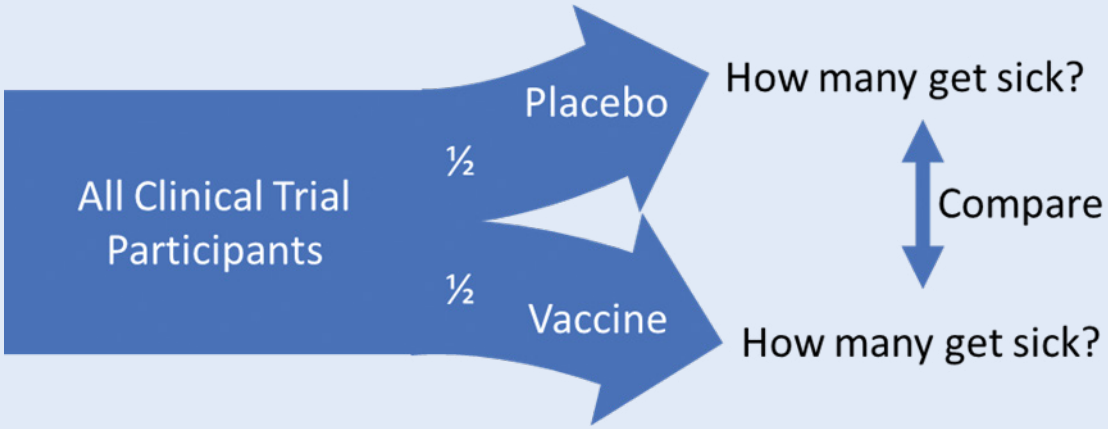

Figure 19: Example of how a clinical trial splits into a placebo group and a vaccine group.

6. Bring the class back together. Ask students if there are any terms they would like to add to the **S** column of the KLEWS chart.
7. Tell students they are going to analyze real-world data from an actual COVID-19 clinical trial. These data can help them figure out if the vaccine is working.
8. Ask students to complete Task 5, Discover, step 3 (reproduced in the box) by themselves first. Explain that "COVID-19 cases" is a count of all the people who tested positive for COVID-19 during the clinical trial. "COVID-19 severe sickness" is a count of all the people who had serious illness or were hospitalized during the clinical trial.

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.

9. Then ask students to share their answer to the question in step 3 with a partner or in a small group.

Analyzing and interpreting data: Students analyze a data set about the incidence of COVID infections and severe illness in vaccinated and placebo groups.

Patterns: Students use the table in Task 5, Discover, step 2, Figure 20 to identify the patterns of COVID-19 infection and severe illness in the data.

10. Bring the class back together and ask, "Do you think the data in Figure 20 show the vaccine worked? What evidence can you use from the table to support your answer?" Student responses might include:
    - *I know that the placebo group didn't get the vaccine. And that group had way more cases and severe illness than the vaccine group. I think getting the vaccine made it less likely to be infected and have severe illness. I think the vaccine works.*
    - *I saw that there was no severe illness in the vaccine group at all. But the placebo group had 30 people with severe illness. I think the vaccine works to prevent severe illness.*
    - *I see that people who had the vaccine still sometimes got infected with COVID-19. That made me wonder if the vaccine actually works. But none of the people in the vaccine group got severe illness and that makes me think that the vaccine works to prevent the really bad outcomes.*

Understand: *How do we know vaccines work?*

1. Use the KLEWS chart **W** column to remind students that they and their community had questions about whether vaccines worked to keep people safe from disease.
2. Tell students that in addition to using data from clinical trials to answer those questions, they can also use models.
3. Ask students to work with a partner or in small groups to complete Task 5, Understand, steps 1–12 (reproduced in the box) in the Community Response Guide. These steps will guide students through two models that show what can happen when unvaccinated and vaccinated people are exposed to COVID-19. Tell students that these data are from 2021 and reflect the rates of infection, severe illness, hospitalization, and death from that time.

Developing and using models: Students use a mathematical model to demonstrate the ratio of outcomes after hypothetical exposure to COVID-19 in an unvaccinated and vaccinated scenario.

Analyzing and interpreting data: Students compare their results between the unvaccinated and vaccinated scenario to draw conclusions about the efficacy of the vaccine. They also compare their results with their group members to refine those conclusions.

Patterns: Students observe the patterns of outcomes that result from both the unvaccinated and vaccinated scenarios as they compare results from each mode. These patterns help them discern the effects of vaccination on the outcomes of COVID-19 exposure.

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.
    e. How do the results from round 1 compare to round 2?
    f. What surprised you about the results from round 2?
    g. Were you worried that with a 65 percent efficacy rate the person in the model would be likely to get very sick?

4. As a class, ask students to reflect on the activity. What could they add to their KLEWS chart?

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

1. Ask students to complete Task 5, Act, steps 3–5 (reproduced in the box) in the Community Response Guide.

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.

Task 6: How should we make decisions about vaccines?

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	90 Minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts, such as:

Use evidence about the patterns of risk in a population to engage in argument about how to prioritize who gets vaccines.

Problem: Sometimes when medical treatments are new, not everyone can get access at the same time. When a disease affects different populations in different ways, this can create a problem.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence • Respectfully provide and receive critiques about one's explanations, procedures, models, and questions by citing relevant evidence and posing and responding to questions that elicit pertinent elaboration and detail. • Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. **Analyzing and Interpreting Data** • Analyze and interpret data to determine similarities and differences in findings.		**Patterns** • Graphs, charts, and images can be used to identify patterns in data.

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- Chart paper, interactive white board, or digital document
- Student journals
- KLEWS chart

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

1. Ask students to complete Task 6, Discover, steps 1–6 (reproduced in the box) in the Community Response Guide.

> 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?

2. Before beginning the Understand activity, remind students of the Emotional Safety Tip from Task 6, Discover, step 3. Tell students that they are going to continue reading about, analyzing, and making decisions about hypothetical people who are facing the risk of COVID-19. These hypothetical people may have characteristics that are like students' friends, family, or acquaintances. If at any point students want to pause or end their participation because the activity is upsetting, they can alert their team or the teacher.

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

1. Ask students to complete Task 6, Understand, steps 1–4 (reproduced in the box) in the Community Response Guide.

Engaging in argument from evidence: Students engage in a discussion and use guiding questions to critique one another's decisions.

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?

2. Bring the class back together. Call their attention to chart paper, an interactive whiteboard, or a digital document with a table that you have set up with the column and row headings seen in Figure 8. The headings mimic the descriptions in Task 6, Understand, step 1.
3. Ask students to add their answers to the class table. Prompt students to observe their classmates' answers.
4. Ask one or two students to share with the class their reasoning for how they filled out the table.

	40-year-old Latinx high school teacher starting in-person teaching	29-year-old Asian nurse working with cancer patients	85-year-old white retiree living in a care home	59-year-old Indigenous (American Indian) grocery worker caring for her elderly parent	34-year-old Black accountant working from home with a high-risk preexisting medical condition
1	x	x	x	x	x
2	xx	x	x	x	x
3		x	xxx		
4		xx		xx	x
5	xx			x	xx

Figure 8: Example of a class table based on Task 6, Understand, step 1, with sample student answers.

5. Ask students to turn to their partner to answer the next question: "Based on your own experiences, do you think everyone in the United States has exactly the same risk of getting sick, seriously ill, or dying from COVID-19? Or are some people more at risk than others? Why or why not?" Circulate, listening to student responses and prompting them to explain their reasoning. Student responses might include:
   - *I am most worried about the older people in my life. My grandma is 87 years old and she has some other health problems. When she got COVID-19 it made her really sick, but the younger people in our house did not get as sick.*
   - *My uncle is older and he has had cancer before. I worry that he is more at risk.*
   - *I think some other people might have more risk than I do. My family has a family doctor and we are able to get an appointment any time we want, and my mom's company pays for it. I don't think everyone has that option, so if they get sick, it might be more dangerous for them.*
6. Ask students, "Why might it be important to know who is most at risk of getting sick, seriously ill, or dying from COVID-19 when we are making decisions about vaccines?" Student responses might include:
   - *If someone is more at risk, it should be easier for them to get a vaccine.*

7. Explain to students that the Centers for Disease Control (CDC) collects data about which people in the United States at most at risk from COVID-19. Tell students that they are going to analyze some of those data. Explain that the data tables are from the spring of 2021.
8. Ask students to complete Task 6, Understand, steps 5–9 (reproduced in the box) in the Community Response Guide.

Analyzing and interpreting data: Students analyze and interpret CDC data tables to determine similarities and differences in the risk among age and racial groups in the United States.

Engaging in argument from evidence: Students use the two data tables in Task 6, Understand, steps 5–9 (reproduced in the box) to support their decision about who should get a vaccine first. Students also respond to questions from an ethical, economic, social, and health perspective to elaborate on their decision.

Patterns: Students identify the patterns of risk in the CDC data tables.

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.

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.

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?

9. Bring the class back together.
10. Tell students they are going to do a five places activity to share about their answers in the class table.
11. If you are teaching in person, designate five places in the classroom, one for each person represented in the class table from step 2 (e.g., one place is "40-year-old Latinx high school teacher starting in-person teaching," etc.). If you are in a virtual classroom, set up a shared digital document with five tables, columns, or headings labeled with each person represented in the class table from step 2, and ask students to add their names to the document to indicate their position.
12. Ask students, "Who should get vaccinated first?" and ask them to move to, point to, or otherwise indicate their choice.
13. Select at least one student from each of the five places to share their position and their justification. Prompt students to explain whether their initial answer changed, and why. Encourage students to respectfully provide feedback on one another's answers.

Engaging in argument from evidence: Students present an oral justification for the answers they gave in the class table, supported by data from the CDC tables in Task 6, Understand, steps 5–9. Students also respectfully provide and receive feedback on their answers, using data from the CDC tables.

14. If time allows, share the most recent COVID-19 Risk by Age Group and COVID-19 Risk by Race/Ethnicity tables from the CDC. These tables are continuously updated.
15. After students examine the updated tables, ask, "Why do you think rates of serious illness, hospitalization, and death from COVID-19 might have changed since the spring of 2021?" Student answers might include:
    - *The COVID-19 virus has changed over time.*
    - *Many people in the United States are now vaccinated.*
    - *I heard that we have some treatments for COVID-19 now.*
    - *We are getting better at taking care of people with COVID-19.*
16. As a class, ask students to reflect on the activity. What could they add to their KLEWS chart?

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

1. Ask students to complete Task 6, Act, steps 1–5 (reproduced in the box) in the Community Response Guide.

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.

Task 7: How do I get information about vaccines?

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	60 Minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts, such as:

Evaluate the credibility and accuracy of several sources of information about the COVID-19 vaccine.

Problem: Community members can't always find or access accurate information about the COVID-19 vaccine.		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Obtaining, Evaluating, and Communicating Information • Gather, read, and synthesize information from multiple appropriate sources, and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence.		

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide
- Student journals
- KLEWS chart

Task 7

Discover: *Where do I get my information?*

1. Ask students to complete Task 7, Discover, steps 1–3 (reproduced in the box) in the Community Response Guide.

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.

2. Revisit the KLEWS chart from Task 2 and highlight any statements or questions students have about getting information about vaccines.
3. Ask students to share why finding accurate information about the COVID-19 vaccine is important. Record their answers on the board, a chart, or a digital document.
   - Why is it important to them individually?
   - Why might it be important to their family and friends?
   - Why might it be important to their community?

Why is it important to us to find accurate information about the COVID-19 vaccine?
I want to make decisions to protect my health.
I am so confused about vaccines because it seems like everyone has something to say, but I don't know who is telling the truth.
I'm worried that my parents are getting information that isn't right. I worry that it means they are at risk of getting sick.
I want to be able to talk to my friends about this and all be on the same page.
I want to help my cousin understand how vaccines work.
I want my community to have correct information so they can make good choices about vaccines.
I worry that people in the community fight about vaccines because there are so many different sources of information.

Figure 9: Examples of student answers.

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

1. Ask students to find one to two sources of information about the COVID-19 vaccine. Remind them of the list of sources they created in the Discover activity, based on where they and members of their community get information. They can use that list to choose one to two sources of information.
2. Ask students, "How do you try to tell if a source is accurate or not?"
3. Tell students that they are going to evaluate the sources of information they selected. They can work alone, in pairs, or in groups.
4. Students can either use the methods for determining accuracy that they brainstormed in step 2, or they can do Task 7, Understand, steps 5–8 (reproduced in the box) in the Community Response Guide.

Evaluating information: Students gather multiple sources of information and asses the credibility, accuracy, and possible bias of each publication.

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.

a. 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.

b. 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.

c. 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

d. 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.

5. As a class, ask students to reflect on the activity. What could they add to their KLEWS chart?

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

1. Ask students to complete Task 7, Act, steps 1–4 (reproduced in the box) in the Community Response Guide.

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?

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

Grade Level	Subject	Total Time
Middle School (target audience)	Life Science	45 Minutes

Task-Level Performance Expectation (Task Objective): This task does not build toward one specific performance expectation. However, students have opportunities to develop and use grade-appropriate elements of science and engineering practices and crosscutting concepts, such as:

Design an action plan to communicate information to help members of a community stay safe and make good decisions about vaccines.

Problem: Our community needs accurate information to help them stay safe and make good decisions about vaccines.		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Obtaining, Evaluating, and Communicating Information • Communicate scientific and/or technical information (e.g., about a proposed object, tool, process, system) in writing and/or through oral presentations.	**ETS1.B Developing Possible Solutions** • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.	

Materials

- *Vaccines! How can we use science to help our community make decisions about vaccines?* Community Response Guide

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

1. Ask the students the following:
   - In looking at our KLEWS chart, what have we learned that will help us, our families, and our community make good decisions about vaccines?
   - What evidence have we collected that can support our claims and help us educate our community?
   - What are we still wondering that we need to investigate before we make a plan to help our community?
2. Have students complete Task 8, Discover, steps 1 and 2 (reproduced in the box), in the Community Response Guide.

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?*

1. Have students do Task 8, Understand, steps 1–5 (reproduced in the box), in the Community Response Guide.

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?*

1. Have students take action and complete their project.
2. Have students share their projects with their peers and their community.
3. Have students do Task 8, Act, steps 2–6 (reproduced in the box), in the Community Response Guide.

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.
   - What parts of your action plan went well?
   - What parts could have been better?
   - 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.
   - What would you do differently if your team planned another action?
   - What did you do in this guide that surprised you?
   - What was hard for you to do?
   - What are the most important things you learned?
   - What makes you the proudest?
   - How have you changed?