



# Protecting Our Lungs

Over the past decade, there has been a significant increase in the number of youths using **electronic cigarettes (e-cigarettes)** to vape. While it was originally believed that these products were safer than their paper counterparts, new data suggest that these products have several harmful chemicals and side effects, including addiction, that could impact the respiratory health of those who use them.

## Terms to Know

<b>Addiction</b>	an urge to do something that is hard to control or stop
<b>Citizen scientists</b>	people — young or old — who help collect data for research projects conducted by professional scientists
<b>Electronic cigarette (e-cigarette)</b>	a device that heats a liquid to the point where it becomes a vapor that a user can inhale
<b>E-cigarette aerosol (e-Aerosol)</b>	a substance designed to be used in an <b>e-cigarette</b> ; It can contain harmful additives, including <b>nicotine</b>
<b>Nicotine</b>	a highly addictive chemical found in tobacco that is quickly absorbed into the bloodstream when smoked
<b>Public health</b>	the science of protecting and improving the health of people and their communities
<b>Vaping</b>	the inhaling of a vapor created by an <b>electronic cigarette (e-cigarette)</b> or other <b>vaping</b> devices

## Understanding E-cigarettes

Most **e-cigarettes** have a battery, a heating element, and a place to hold a liquid. They produce an aerosol by heating a liquid that usually contains **nicotine**, which can harm brain development, and other harmful chemicals that help to make the aerosol. **E-cigarettes** are sometimes called other names and come in a variety of designs. Some **e-cigarettes** look like regular smoking objects like cigarettes, cigars, or pipes, while others look like everyday items. Using an **e-cigarette** is sometimes called "**vaping**."



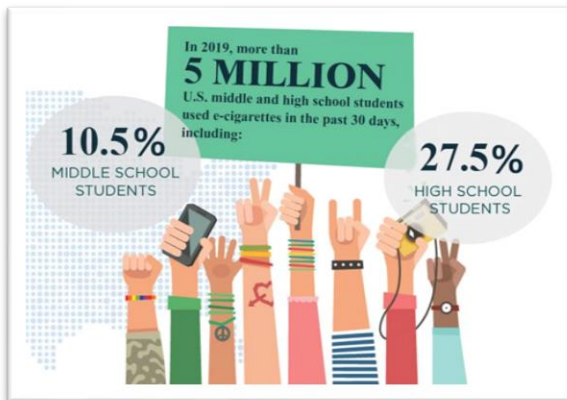
### Think About It

1. How do e-cigarettes work?
2. What types of devices can e-cigarettes resemble?
3. Why is nicotine dangerous?



## Vaping and the Centers for Disease Control and Prevention (CDC)

While **vaping** is a relatively new practice, **e-cigarettes** have been in existence since the 1960s. In 1963, Herbert A. Gilbert received the first patent for what would be the basis of the current model. It wasn't until the 21<sup>st</sup> century that the devices took off. In 2003, Hon Lik, a pharmacist, developed an **e-cigarette** with the hope that it would help chronic smokers quit. The devices began to spread, and by 2010, multiple types of **e-cigarettes** were on the market. Initially, most advertisers touted them as a safe alternative to smoking.



Due in part to the flavorings many manufacturers created for **e-cigarettes**, the number of youths **vaping** significantly increased. CDC, along with other health organizations, began tracking **vaping** statistics among youth and determined that 1 in 4 high schoolers and 1 in 10 middle schoolers were **vaping** on a regular basis. More worrisome was the lack of evidence to support the idea that **vaping** was a safe way to prevent people from using traditional smoking methods. CDC, along with other health organizations tracks vaping statistics among youth.

**Vaping** is not only dangerous to users; it also can harm those around the user with secondhand exposure. Users breathe **e-cigarette aerosol** into their lungs. Bystanders can also breathe in this **e-cigarette aerosol** when the user exhales it into the air. Many people are unaware of the dangers of **vaping**. In a study of young users of JUUL, a popular **e-cigarette**, researchers found that approximately two-thirds of JUUL users aged 15 – 24 did not know that JUUL always contains **nicotine**. All JUUL **e-cigarettes** have a high level of **nicotine**. According to the manufacturer, a single JUUL pod contains as much **nicotine** as a pack of 20 regular cigarettes.

Lawmakers in countries across the world have expressed concern at the idea of youths not understanding the possible harm that could come from using the devices. CDC has teamed up with other agencies, including the United States Food and Drug Administration (FDA), to support research into **vaping**, raise awareness about the potential dangers of **vaping**, and inform policymakers on how to create laws to protect young people from misinformation about **vaping**. Currently, CDC, FDA, state and local health departments, and other clinical and **public health** partners are investigating a national outbreak of **e-cigarette**, or **vaping**, product use-associated lung injury (EVALI).



### Think About It

1. Why are e-cigarettes more appealing to young people than regular cigarettes?
2. Why is vaping a public health issue?
3. What are some organizations CDC works with to address the dangers of vaping?



## From the Expert:

Watch this clip to hear from Dr. Brian King, who works in CDC's Office on Smoking and Health. He discusses **e-cigarettes** as an emerging **public health** challenge. Find out what is known about **e-cigarettes** and the potential long-term health effects of their use among young people and across the broader population. <https://youtu.be/k1a3xoAf5g>

## Call to Action

The main problem with **vaping** is the lack of knowledge the public has about the possible dangers. As a citizen scientist, you can assist CDC in raising awareness about **vaping** dangers by following these three steps:



**1. Create model lungs.** When we breathe, we use multiple parts of the body, including the lungs and the diaphragm. Building a model will give you a visual representation of how those parts work together to keep us breathing.



**2. Conduct a vaping demonstration.** **Vaping** can fill the lungs with many aerosols, including **nicotine** and vitamin E acetate. Laboratory data show that vitamin E acetate, an additive in some THC-containing **e-cigarette**, or **vaping**, products, is strongly linked to the EVALI outbreak. Your demonstration can give your peers an idea of one of the ways scientists think this damage happens.



**3. Share your findings.** One of the ways DC communicates information is through social media. Your demonstrations can help CDC communicate the work they have done and are doing to improve access to information about the dangers of vaping.



## Why Participate? A Message from CDC

CDC's Office on Smoking and Health (OSH) is the lead federal agency for comprehensive tobacco prevention and control. Tobacco use is the leading cause of preventable disease, disability, and death in the United States. OSH believes that by implementing programs like its National Tobacco Control Program, they can reduce tobacco-related diseases and deaths by:

- Preventing young people from starting to smoke
- Promoting quitting among adults and young people
- Reducing exposure to secondhand smoke
- Identifying and eliminating tobacco-related disparities

You can support these efforts by raising awareness about **vaping** within your community. More information can be found at

<https://www.cdc.gov/chronicdisease/resources/publications/aag/tobacco-use.htm>



## Think About It

1. What issues with **vaping** did Dr. King present?
2. Why is it important to find out the long-term effects of **vaping**?
3. What role do **citizen scientists** play in tobacco prevention and control?



## Design the Lung Model Vaping Demonstration

The engineering design process allows engineers to develop and test solutions to problems. You can use the process to help determine the best way to demonstrate how **vaping** can affect the lungs. You will first build the lung model, then you will design a demonstration to show your peers the effects of **vaping** using your lung model.

### Define the problem

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

- How does vaping affect the lungs?
- What should the public know about vaping?

### Do background research

Find information about the problem. Check out this helpful link from CDC. You may also do your own research.

- [https://www.cdc.gov/tobacco/basic\\_information/e-cigarettes/Quick-Facts-on-the-Risks-of-E-cigarettes-for-Kids-Teens-and-Young-Adults.html](https://www.cdc.gov/tobacco/basic_information/e-cigarettes/Quick-Facts-on-the-Risks-of-E-cigarettes-for-Kids-Teens-and-Young-Adults.html)

### Specify requirements

Determine what your solution needs to have to succeed.

- How do **e-cigarette aerosols** move through the respiratory system?
- What are the key facts needed for my **vaping** demonstrations?

### Brainstorm, choose and develop solutions

For each part of your design, ask yourself the following:

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

### Build a prototype

Design and build your model.

- Remember that your demonstration should help people understand the concerns surrounding vaping.

### Test and redesign

Test the prototype you made with a demonstration.

- Invite peers to view your demonstration. After the demo, question your peers on their new knowledge about vaping.
- Redesign your demonstration based on their input.

### Communicate results

Sharing the information you collect is key!

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



## Create a Lung Model

### Tools of the Trade

Your model will give viewers an idea of how the respiratory system works. When you breathe, your diaphragm, a muscle at the bottom of the chest cavity, moves down to create space. Air travels through the nose or mouth down the windpipe and into your lungs. Your lungs remove oxygen from the air and send it into your bloodstream. Your model will need several components:

- **Windpipe- 2 bendable plastic straws**
- **Lungs- 2 small balloons**
- **Chest cavity- 1 plastic bottle, 16oz or 20oz**
- **Diaphragm- 1 large balloon**

You will also need the following:

- **Scissors**
- **Tape**
- **Clay**



### Prepare the Windpipe and Lungs

1. Cut one of the straws at the bend. Discard the longer piece.
2. Cut a small slit at the bend of the second straw. Insert the short piece of the first straw into the slit of the second straw. The two straws together should form the shape of a Y.
3. Use glue, tape, or clay to seal the space where the straws connect so that no air can escape.
4. Attach one small balloon to each straw.



Windpipe



Lungs

### Prepare the Chest Cavity and Diaphragm

5. Cut the plastic bottle in half. Discard the bottom half.
6. Place the windpipe and lungs inside the chest cavity (top half of the bottle). The windpipe should stick out of the top of the bottle.
7. Secure the windpipe by molding the clay around the top of the bottle so that the space around the straw is closed. Make sure you do not crush the straw.
8. Cut the top of the large balloon and tie a knot in the neck.
9. Stretch the large balloon around the end of the bottle.



Chest Cavity

### Complete and Test the Model Lung

10. Pull down on the diaphragm (the knotted end of the large balloon). The lungs should inflate.
11. If the lungs do not inflate, check your clay to make sure the top is completely sealed and try again.



Complete Model Lung



## Conduct a Vaping Demonstration

### Tools of the Trade

In your demonstration, you will show how **e-cigarette** aerosols enter the lungs. Using an eyedropper, place 3-4 drops of cooking oil into the top of the straw. Then pull down on the diaphragm to spread the oil into the lungs. The oil will build up in the lungs and will not come out. This shows how vitamin E acetate is found in the lung fluid of people with **e-cigarette**, or **vaping**, product use-associated lung injury (EVALI).

For your demonstration, you will need the following:

- Your Lung Model
- Cooking Oil- the oil serves as vitamin E acetate, which is a harmful substance found in **e-cigarette** aerosol
- Eye Dropper- the eye dropper serves as the **e-cigarette**
- Recording Device- this can be a web camera or a cell phone
- Pen and Paper

### Write Your Script

Before you record your demonstration, write a script to make sure you include all the important information about the dangers of **vaping**. Your script should include several parts:

- A short explanation about your lung model and explanation of each part of your model
- Talking points for your demonstration of the working lung model
- A short explanation about what the cooking oil and eye dropper represent
- Talking points for your demonstration of vaping using the cooking oil, eye dropper and lung model

Using the space below or your own paper, draft a short script for your demonstration.

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## Sketch Your Storyboard

A storyboard is a set of sketches that show how a story will be filmed. Think about each part of your script. What will it look like to the viewer? Using the boxes below, create a small sketch for each part of your demonstration.


## Record Your Demonstration

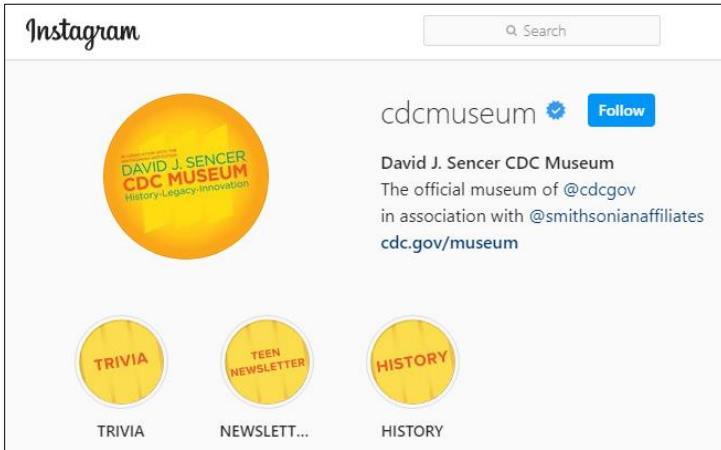
Now that your script and storyboard are complete, you can record your demonstration. Before you begin, practice your script a couple of times so you feel comfortable. Once you are finished recording, review your demonstration with your family and friends. You may find things you want to change. That is okay! Re-record until you are comfortable with the final product.



## Share Your Findings

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

As the lead federal agency for comprehensive tobacco prevention and control, CDC uses their Tobacco Free Twitter and Facebook pages to protect the public's health from the harmful effects of tobacco use. You can contribute to their efforts by posting your demonstration to Twitter or Facebook using **@CDCTobaccoFree**.







## Reflections

Now that you have completed this investigation, think about what you learned from your research and demonstration. Answer the questions below.

1. What are some of the dangers associated with **vaping** and **e-cigarettes**?  
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2. What is the biggest challenge CDC faces with **vaping**?  
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3. What approach should organizations like CDC use to help teens understand how **vaping** affects their health?  
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4. How can schools help CDC raise awareness about the effects of **vaping**?  
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5. Public smoking has been banned in many places because of the effect it has on the health of others. Should **vaping** be included in these bans? Why or why not?  
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6. In 2020, FDA began prioritizing enforcement against unauthorized flavored products that appealed most to kids. Some people feel this isn't enough and that **vaping** should be banned completely. Should **e-cigarettes** be banned completely? Why or why not?  
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