DIGITAL 1-DAY LESSON
EDUCATOR GUIDE

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In this lesson, students will investigate the science behind the impact of opioids on the mind and body, focusing on different body systems. Through a series of activities, students will investigate changes in the body due to prescription opioid misuse and heroin use. They will use this information to explain the science behind physical dependency and withdrawal.

The accompanying presentation was created with PowerPoint so that it can be used in a variety of classrooms. If you are using a laptop with an LCD projector, simply progress through the PowerPoint by clicking to advance. All of the interactive aspects of the presentation are set to occur on click. Links to the corresponding videos can be found in the notes section of the PowerPoint. Hover over the video window to reveal the “play arrow” at the bottom. If you are using an interactive whiteboard, tap on each slide with your finger or stylus to activate the interactive aspects of the presentation. It does not matter where you tap, but you can make it appear as if you are making certain things happen by tapping them. In the notes for each slide, there will be information on how to proceed.
The use and misuse of opioids such as heroin, morphine, and prescription medications is a serious national problem that affects the health of communities, including their social and economic welfare. There are approximately 144 drug overdose deaths per day in the United States, with 63% of those deaths related to pharmaceutical opioids or heroin.\(^1\) About 15 million people indicated misusing prescription painkillers in 2014, while nearly one in five teens say they have misused prescription medicine at least once in their lifetime to get high.\(^1\) To address this complex problem, federal agencies are working to inform patients, parents, teens, pharmacists, and educators about the dangers of opioid misuse.

This guide was created to give educators ideas and strategies for presenting the content in the digital lesson. It provides slide-by-slide details for educators to be prepared to engage with students as they explain, discuss, and effectively facilitate the content in the presentation. The presentation is designed to cover one 45-minute class session, but it is flexible, depending on the students’ needs and time available.

During the lesson, students will learn about endorphins (“feel-good chemicals”). The human body produces natural endorphins in response to certain sensations—mainly stress, fear, or pain. These chemicals reduce pain and produce a sense of euphoria (feeling good).

Students will also be introduced to opioids, which are drugs that are either derived from the opium poppy plant or that are synthetically produced to have similar effects. Heroin is an example of the former type, but there are many other opioids, including legal drugs such as morphine, codeine, and fentanyl, which doctors prescribe to patients in extreme pain. Opioids have a chemical structure similar to endorphins, which enables them to attach to the same places in the brain. As a result, the brain cannot tell the difference between the effects from activities that produce natural endorphins (e.g., exercising, laughing, and eating chocolate) and the effects caused by taking opioids.

Then, students will examine the structure of neurons and the process of neurotransmission to better understand how opioids affect the body, particularly the nervous system. Neurons are the tiny nerve cells that send messages along the human nervous system. Some of these messages control life-sustaining functions, such as circulation, respiration, and digestion. Opioids block pain signals from reaching the brain by attaching to certain parts of neurons called opioid receptors.

Finally, students will examine the short-term and long-term effects of opioid misuse on the systems of body. Opioids primarily affect the nervous system, but changes to this system impact a number of the body’s other systems, including circulatory (slowed heart function), respiratory (slowed breathing), and skeletal (bone thinning). Repeated opioid use leads to physical dependency (changes in the body that cause systems to require the drug in order to function) and tolerance (the body’s need to absorb more of a drug to achieve the same effects). When prolonged opioid use is stopped, the body experiences a shock called withdrawal, which has number of serious effects on the body’s systems.

At different points in the lesson, students may be tempted to share personal information about opioid misuse by themselves or others. As always, be sure to follow school or district policies about the sharing of personal information about minors.
ENGAGE

Overview: Students will be introduced to what endorphins and opioids are, why endorphins are released, why opioids are prescribed, and how the effects of opioids mimic the feeling of endorphins. Then, they will investigate what it means to misuse opioids.

SLIDE 1

Click to display the image of the brain. Ask students if they’ve ever seen an image of a brain “lighting up” like this. What do they think is happening here?

Once students have shared their thoughts, explain that messages in the brain are transmitted, or sent, across cells. This image shows messages being sent between cells in the brain—the colors (particularly red and yellow) represent brain activity that corresponds to messages being transmitted.

Then, click the slide to reveal the text definition of endorphins. The body’s nervous system produces endorphins in response to certain sensations—mainly stress, fear, or pain. In scientific terms, endorphins block messages of pain from reaching the brain and stimulate pleasure centers in the brain. Endorphins are only one type of neurotransmitter, or chemical that sends messages through the nervous system.
ENGAGE

SLIDE 2

Now that students know what endorphins are, they will learn what opioids are.

Click the slide to display the definition of opioids. Ask students if they know where opioids come from. Then, click to reveal that opioids can be synthesized, or made, from natural sources (like the poppy plant) and artificial sources (like chemicals in a laboratory).

Click the slide to the reveal the last bullet point. Explain that morphine, codeine, and heroin are in a class of drugs called opioids. Heroin is illegal, but doctors prescribe opioids to patients in extreme pain. These people might be recovering from surgery or a serious injury. In scientific terms, these drugs reduce the intensity of pain signals reaching the brain.

SLIDE 3

Now that students have learned what opioids are, they will learn what it means to misuse them.

Click the image on the slide to open the article.

Divide the class into small groups of three to four students. Make sure each group has access to the What Does It Mean to ‘Misuse’ Opioids? article (provided on page 15), either on a digital device or a printout. Give students time to read the article and take notes on a separate sheet of paper.

Ask students to discuss the following questions in their small groups:

- What new information did you learn?
- What information did you think was the most surprising?
- Why do you think the information is important to share with a peer?

Then, as a whole class, share out small-group responses.
Overview: In this section, students will compare an image of a healthy, functioning nervous system to one that has been impacted by opioid misuse. Students will study the parts of a neuron and the process of neurotransmission to understand how opioids affect the body and why this matters.

SLIDE 4

Now that students know what opioid misuse means, they will examine the effects of opioids on the human nervous system.

Display the two images of the brain, which is part of the body’s nervous system. Ask students to identify which image shows a healthy brain (left) and which shows the brain of a person who misuses opioids (right).

Click the slide to reveal the question at the bottom. Explain that one of the most important practices that scientists do is ask questions. Scientific questions help identify relationships and clarify information. Direct students to generate a list of questions they have about opioid misuse. Examples may include:

- What’s the relationship between endorphins and opioids?
- How does misusing opioids affect the human nervous system and other body systems?
- Why is quitting opioids so difficult?
Now that students have examined the effects of opioids on the nervous system, they will learn the structure of a neuron to investigate how neurotransmission works.

Depending on the grade level, explain or recall that the body’s nervous system is made up of a network of tiny nerve cells called neurons. Your sense organs (e.g., eyes, ears, nose, skin) send messages to your brain about stimuli outside your body; your brain processes these messages and sends back its own messages that command your body to respond in appropriate ways. All this communication happens through extensive networks made up of neurons.

Click to display the image of the neuron, with four labeled parts. Describe how neurons are composed of several parts: soma (cell body), dendrites (branches), and an axon (fibers) leading to a terminal (bulb). Point to each part. Make connections, or encourage students to do so, between their body parts in the model activity and the neuron. (The body is the soma, the arm is the axon, and their fingertips are the terminal.) Then, ask students to predict what each part of a neuron does.

Once students have had a chance to explore the image, explain the purpose of each part. The branches (dendrites) receive messages from neighboring neurons. The middle (soma) processes the information. It creates an electrical signal (a major impulse called the action potential) and sends it down the fiber (axon) toward the bulb at the tip (terminal); the signal can then be transferred to the dendrites of a neighboring neuron. Use your finger or the onscreen pointer to trace this movement on the slide.
Now that students understand the role of neurotransmitters, they will learn how opioids simulate natural endorphins during neurotransmission. This everyday analogy may help students better understand this process: Neurotransmitters are like “keys” that fit certain “locks” in the brain. Different keys fit different locks. Because the shapes of opioids and endorphins are similar, opioids are able to fit into “locks” intended for endorphins.

Click to display the image and ask students a series of questions to guide their inquiry:

○ What do you notice about the shape of each “key”—i.e., the natural endorphin and an opioid like morphine? (Circle the bottom section of each—i.e., the section that fits into the opioid receptors. They are similar.)

○ The opioid receptor is the “lock” from the analogy. What type of “lock” does each key fit into? (Both natural endorphins and opioids such as morphine fit into opioid receptors.)

○ What conclusion can you draw from this relationship? (The brain cannot tell the difference between natural endorphins and opioids.)

After students have drawn their own conclusions, explain that opioids mimic the action of endorphins by fitting in the same locks (binding to opioid receptor sites in the brain). This affects feelings of pain as well as a person’s overall emotional state. However, endorphins are not harmful or addictive like opioid drugs are. Endorphins come from positive activities such as exercising, laughing, and eating certain foods. Click the slide to display the text (“The brain cannot tell the difference!”).
Overview: In this section, students will examine how opioids impact body systems. Students will evaluate this information to describe which body systems are most impacted by opioid misuse. This will lead to a discussion around the science of physical dependency (what happens when you misuse the drug over time?) and withdrawal (what happen when you suddenly stop using opioids?).

SLIDE 7

This slide is a review of human body systems. Click the slide to display the images of the bodies. Ask students to identify what each image represents.

Then, click to display the text labels. From left to right, the images show the circulatory, nervous, respiratory, digestive, skeletal, and muscular systems.

Ask students to reflect on how each body system functions in a healthy person. If time allows, each student should write a brief (six words) description of each system. (For example: Circulatory = “Heart pumps blood back and forth.” Digestive = “Mouth eats, stomach digests, intestines move.”)
Now that students have considered healthy, functioning body systems, they will examine the short-term effects of opioid misuse on these systems.

First, ask students to consider ways that an endorphin rush affects each system in the body. Ask: What effects appear during or immediately after? What effects might appear years later? Then, direct students to organize their effects into “short-term” (seconds, minutes, hours, days) and “long-term” (weeks, months, years).

Then, display the slide. Using a large sheet of chart paper, direct students to organize the effects listed on the slide into each system: nervous (euphoria), circulatory (slowed heart function), respiratory (slowed breathing), digestive (dry mouth, nausea and vomiting), muscular (warm flushing of the skin, heavy feeling in fingers and toes, itching), and skeletal (bone thinning).

- Connect these short-term effects to the brain and nervous system by interacting with the image and saying the following:
  - “Opioids can slow breathing by altering activity in the brainstem (point to this section), which controls automatic body functions such as breathing and heart rate.”
  - “Opioids can increase feelings of pleasure by altering activity in the limbic system (circle this system), which controls emotions.”
  - “Opioids can block pain messages transmitted through the spinal cord (draw an arrow up along this section) from the body.”
Now that students have examined the short-term effects, they will examine the long-term effects of opioid misuse on the body.

First, ask students to consider ways that opioid misuse affects other systems in the body. Ask: Which effects occur over the long term? Remind students that long-term refers to weeks, months, or years after use.

Then, display the image. **Using the Long-Term Effects of Opioid Misuse** student activity sheet (provided on page 16), direct students to organize the effects listed on the slide into each system: circulatory (infection of heart, collapsed veins), respiratory (pneumonia), digestive (decreased liver function), and nervous (tolerance, physical dependency). Note that abscesses, or sores caused by the buildup of pus, can affect a variety of systems, most noticeably the integumentary (skin).

The most important conclusion is that a long-term effect of opioid use is physical dependence. Once a person becomes physically dependent on opioids, they require increasing amounts of the drug (tolerance) and suffer withdrawal (defined in slide 11) if they cease using the drug. They also risk becoming addicted, which happens when seeking and using the drug becomes a compulsion, or the primary purpose in life. This greatly increases the risk of experiencing the other long-term effects.²
Now that students have a general understanding of how opioids initially affect the body, they will examine specific problems caused by opioid misuse. Ask, “After seeing all these effects on the body, how could opioid misuse lead to tolerance and physical dependency?”

Show students the following series of clips from the “Chasing the Dragon” documentary. Click the links in the slide notes to watch each clip.

- **Clip 1 – Physical Dependency**
  Ask: How would you define someone who is physically dependent on opioids? What behaviors suggest that someone is misusing opioids?

- **Clip 2 – Stealing**
  Ask: Why might individuals misusing opioids steal?

- **Clip 3 - Shift to Prescription Opioids**
  Ask: Why do you think physical dependency on opioids has shifted from heroin to prescription opioid misuse?

- **Clip 4 - Challenges**
  Ask: What challenges does physical dependency present for opioid misusers and their families?

After watching and discussing the segments, direct students to write or draw a conclusion of how the effects of opioids help to explain why people may misuse opioids.
Now that students have examined the short- and long-term effects of opioid use, they will examine what happens when a person who is physically dependent on opioids suddenly stops. Ask students if they have any routines (like brushing their teeth every morning) and how their bodies would feel if this routine were interrupted.

Click the slide to reveal the definition of withdrawal. Ask students to identify the causes of withdrawal (physical dependence and tolerance) and describe the possible effects.

Then, click to display the image. Ask students to describe what they see and identify the short- and long-term effects.

Recall that physical dependence causes the body to adapt to the presence of a drug. Explain that withdrawal symptoms occur if drug use is stopped or reduced suddenly. Withdrawal may occur within a few hours after the last time the drug is taken. Symptoms of withdrawal include restlessness, anxiety, muscle and bone pain, insomnia, diarrhea, vomiting, cold flashes with “goose bumps,” and involuntary leg movements. Major withdrawal symptoms peak between 24–48 hours after the last use and subside after about a week. However, some people have shown persistent withdrawal signs for many months.

Give students a few minutes to revisit their questions from the beginning of Explore. They may add new questions, revise existing ones, or respond to questions answered by the videos in this section.

Opioid pain medications are now the single deadliest drug in the U.S. There were almost 19,000 deaths from prescription opioid overdoses in 2014, compared with about 4,000 deaths back in 1999. That’s an increase of 375 percent in 15 years. Fortunately, fewer than one percent of those deaths were teens.

The number of teen deaths from opioids is much lower than for adults, because fewer teens than adults are misusing prescription opioids. Last year, NIDA’s annual Monitoring the Future (MTF) survey found that teens’ use of opioids has been decreasing in recent years. That means more teens are making smart choices about misusing opioid pills. That’s the good news.

**The dangers of misuse**
It’s still important to know that teens are at risk for misusing opioids. Even though the percentage of deaths for teens is low compared to adults, we still lost 76 young people in 2014 from prescription opioid overdoses, which resulted from misuse of the drug.

“Misusing” opioids could mean different things, including: taking an opioid that was prescribed for someone else (even if you’re taking it to reduce your own pain) or taking a higher dose of an opioid than you were prescribed. It can also mean taking an opioid (whether yours or someone else’s) to get high.

**Opioids can bring relief—and risks**
Some people may believe that because the opioid was prescribed by a doctor, that means it’s safe to take. But a prescription means the doctor wants you to take a certain amount of an opioid at specified time intervals (daily, twice daily, etc., depending on what the doctor says), and then to stop taking it as soon as you can get relief from over the counter medicines, like aspirin or Tylenol.

If you have leftover opioids, you should dispose of them. The Food and Drug Administration has guidelines on how to safely dispose of drugs.

Bottom line: It’s worth remembering that opioids, like any prescription drug, can be helpful if used correctly, but dangerous if they’re not taken under a doctor’s order, exactly as directed. When it comes to teens’ misuse of opioids, do your part to keep the numbers heading down!

LONG-TERM EFFECTS OF OPIOID USE

- Tolerance
- Physical dependency
- Abscesses
- Pneumonia
- Infection of heart
- Decreased liver function
- Collapsed veins