



BrainWaves: Substance Use and Addiction

A Catalyst Curriculum

The *BrainWaves: Substance Use and Addiction* module leverages core essentials of the broader Catalyst Curriculum to help youth understand how substance use affects their developing brains, while reducing stigma and empowering them with the knowledge to make safer, science-informed choices.

Designed for grades 6-8, these modules were developed by an interdisciplinary team at the University of Minnesota, including the [Masonic Institute for the Developing Brain](#), [Extension Department of Youth Development](#), and the [Medical Discovery Team on Addiction](#).



Why it matters

Modern society faces an increasing number of addictions, ranging from traditional substances like drugs and alcohol to behavioral addictions like gaming, social media, and online gambling. In 2023, 16.7% of Americans aged 12 and older had struggled with a substance use disorder in the past year.¹ The digital age has made these activities more accessible, amplifying their addictive potential. Understanding the brain's role in addiction helps address these rising challenges.

- The adolescent brain is still developing—substance use during this time can lead to **long-term behavioral and neurological consequences**.
- Youth are often bombarded with **misinformation** or fear-based messaging about drugs.
- Understanding brain science can help youth feel **informed, less judgmental, and more open to seeking help**.

Framing addiction as a brain-based disease helps youth understand that it's not simply a behavior that someone chooses. This understanding helps destigmatize addiction and build empathy. Providing youth with space to discuss what addiction does to the brain and body can also empower youth to process a very complex topic in a safe way.

¹ Substance Abuse and Mental Health Services Administration. (2023, November 13). [National survey on drug use and health](#).

Learning Objectives

The purpose of the *BrainWaves: Substance Use and Addiction* module is to provide a meaningful learning experience for middle school aged youth to develop a deeper understanding of the neurobiology behind addiction so they feel empowered to make safer, science-informed choices about substance use. The curriculum has the following overarching learning objectives:

1. Equip youth with **science-informed tools** to stay safe and make healthier decisions.
2. Promote understanding that **addiction is a brain-based condition**.
3. **Reduce stigma** by showing that addiction is complex, treatable, and deserves empathy.

Scope and Sequence

The *BrainWaves: Substance Use and Addiction* module includes 10 lessons across two units that introduce the neuroscience of substance use and explore how addiction can biologically change the brain over time. Each unit includes four unit-specific lessons plus one "Neuroscience Companion" lesson drawn from the broader *BrainWaves* curriculum. These companion lessons provide core neuroscience background that supports the concepts and vocabulary used throughout the module.

This module was designed to be taught as a cohesive sequence, with lessons building on one another. That said, lessons can also be taught individually or rearranged to fit your group's needs. If you plan to teach select lessons rather than the full module, we recommend reviewing the suggested prerequisites to ensure youth have the foundational knowledge needed to follow along.

Unit 6: Effects of Drugs on the Brain

[Lesson 19: What are Drugs?](#) 8

Youth learn the concept of psychoactive drugs and the types that most commonly affect adolescents by sorting their terms and images and exploring the myths associated with them.

Suggested Prerequisites: None

[Lesson 20: Motivations for Drug Use](#) 22

Youth explore the motivations for the use of psychoactive drugs and the values that can influence decisions by discussing some real-life scenarios.

Suggested Prerequisites: None

[Lesson 21: What Makes Drug Use Risky](#) 34

Youth learn about some of the factors that influence a drug's impact and risk of overdose through a simulation activity.

Suggested Prerequisites: Lesson 19

[Neuroscience Companion Lesson - Lesson 2: Neurons](#) 41

Youth create their own neuron models and put them to action through a simulation to learn how the brain communicates with the body, which allows us to think, feel, and move.

Suggested Prerequisites: None

Lesson 22: How Drugs Disrupt the Brain 48

Youth learn how drugs can disrupt the signals our brains use every day—impacting how we think, move, feel and react—by visualizing what that looks like in a movement activity.

Suggested Prerequisites: Lesson 19, Companion Lesson 2

Unit 7: Addiction Neurobiology

Lesson 23: Understanding Addiction 59

Youth learn that addiction is a brain-based disorder that develops through repeated drug use and leads to biological changes like tolerance and dependence, by building shared language and reducing stigma through discussion and art work.

Suggested Prerequisites: Lesson 20

Lesson 24: Tolerance and Dependence 64

Youth learn how the brain and body adapt to repeated substance use over time, by exploring biological changes like tolerance, dependence, and the body's attempts to maintain balance through several activities.

Suggested Prerequisites: Lesson 20, Lesson 23

Neuroscience Companion Lesson - Lesson 11: Rewards and Decision-Making 70

Youth learn how drugs can hijack the brain's reward system through a simulation activity.

Suggested Prerequisites: Companion Lesson 2

Lesson 25: Hijacking the Reward System 75

Youth learn how drugs can hijack the brain's reward system by exploring how dopamine influences what we prioritize and applying that learning through real-life scenarios.

Suggested Prerequisites: Lesson 20, Companion Lesson 2, Lesson 23, Companion Lesson 11

Lesson 26: The Addiction Cycle 84

Youth learn about the stages of the addiction cycle through a storyboard activity and explore how understanding addiction as a cycle shapes their assumptions and thinking.

Suggested Prerequisites: Lesson 20, Companion Lesson 2, Lesson 23, Lesson 24, Companion Lesson 11, Lesson 25

Standards Connection

Content supports the following education standards.

BrainWaves Lesson	Science Standards	2025 Minnesota Health Standards		
Lesson 19: <i>What are Drugs?</i>		5.5.1.01 5.5.1.02 6.2.2.05 6.2.5.01	6.3.5.01 6.5.1.01 6.5.1.03 6.5.1.05	6.5.1.08 6.5.1.09 6.5.2.08
Lesson 20: <i>Motivations for Drug Use</i>		5.5.8.01 6.2.2.03 6.3.5.01	6.5.1.01 6.5.1.10 6.5.2.02	6.5.2.03 6.5.2.04 6.5.2.09
Lesson 21: <i>What Makes Drug Use Risky?</i>	NGSS MS-LS1-8 NGSS MS-LS1-3 NGSS MS-LS1-2	5.5.1.01 5.5.1.02	6.5.1.02	6.5.1.09
Lesson 22: <i>How Drugs Disrupt the Brain</i>	NGSS MS-LS1-8 NGSS MS-LS1-2	5.5.1.01 5.5.1.02	6.5.1.02 6.5.1.03	6.5.1.09
Lesson 23: <i>Understanding Addiction</i>		5.5.1.01 5.5.1.02	6.5.1.02 6.5.1.03	6.5.1.05 6.5.1.09
Lesson 24: <i>Tolerance and Dependence</i>		6.5.1.02 6.5.1.03	6.5.1.05 6.5.1.08	6.5.1.09
Lesson 25: <i>Hijacking the Reward System</i>	NGSS MS-LS1-8	5.5.1.01 5.5.1.02 6.5.1.02	6.5.1.03 6.5.1.05	6.5.1.08 6.5.1.09
Lesson 26: <i>The Addiction Cycle</i>		5.5.1.01 5.5.1.02 5.5.1.04	5.5.1.05 6.5.1.08 6.5.1.09	6.5.1.13 6.5.3.02 6.5.3.04

Laying the Framework

Tips for Facilitation

Before facilitating the curriculum, it is strongly recommended you guide young people to identify *why* learning about substance use and addiction is important. This is especially essential as we want youth to feel empowered to take ownership of their learning. When youth are able to connect and apply their learning to real-life situations and everyday life, they are more likely to engage in meaningful ways.

- Invite young people to share their thoughts and reflect on the following question(s):
 - Why does this matter?
 - Why should I care?

- Why might an understanding of drugs/substances be important?
- Why might an understanding of addiction be important?
- Find ways to build in youth decision-making and youth voice.
 - Ask youth questions:
 - What are you interested in learning about when it comes to this topic?
 - What do you already know about the topic?
 - What are you curious about?
 - Invite youth to ask questions! If a question arises that can't be answered at the moment or you don't feel equipped to answer, be sure to acknowledge their curiosity and follow up at a later time. If time permits, ask youth if they'd like to research the question together as a group. What can we learn? Can we figure this out as a team? This is also an opportunity to address how to sift through all of the information (and often misinformation) that is online. What source are we pulling this information from? Is this the NIH, CDC websites or is this information from a random blog post?
- Build in opportunities for youth to co-facilitate pieces of the curriculum.
 - Example steps to support youth in co-facilitation:
 - Consider doing the activities with a small group of youth leaders first and modeling the facilitation. Open up the space for youth to ask questions and develop an understanding of the lesson content, so they feel confident in their ability to co-facilitate.
 - Partner youth together to facilitate activities, rather than ask them to teach on their own.

Below is a *suggested* list of activities that youth could help facilitate with adult support. These include activities from each lesson in units 6-7. Facilitators are encouraged to consider the strengths and comfort levels of their youth participants when determining facilitation roles.

Lesson	Activity	Tips for Facilitation
Lesson 19	● <u>Activity 1</u>: What Do You Want to Know? (5 minutes) ● <u>Activity 3</u>: Myth Busting (10 minutes)	<u>Activity 3</u> : Adult facilitator(s) should fill in the gaps with background information
Lesson 20	● <u>Introduction</u>: "Would You Rather" Activity (3 minutes)	
Lesson 21	● <u>Introduction</u> (5 minutes) ● <u>Activity</u>: Drug Use Risk Factors (25 minutes)	<u>Activity 1</u> : Recommendation would be to have youth lead the activity portion of each round and the adult facilitator(s) lead the reflection portion after each round. This activity would be best facilitated by youth <i>after</i> they have had a chance to experience the lesson.

Lesson 22	• <u>Activity</u>: Bean Bag Pass (30 minutes)	Assign 2-3 youth to support the drug team in the activity- have them explain the drug team's role for each round.
Lesson 23	• <u>Introduction</u> (5 minutes) • <u>Activity 1</u>: Nuggets Video (15 minutes) • <u>Activity 2</u>: Addiction Art (15 minutes)	<u>Activity 1</u>: Have youth lead the reflective questions following the Nuggets video. Adult facilitator(s) should step in when there's an explanation of topic content (e.g., tolerance and dependence) to ensure concepts are understood <u>Activity 2</u>: Youth could read and reflect with their peers on the poem embedded in the activity.
Lesson 24	• <u>Activity 1</u>: Tolerance Analogy (5 minutes) • <u>Activity 2</u>: Dependence Demonstration (5 minutes) • <u>Activity 3</u>: Balance (10 minutes)	With adult support, youth could help co-facilitate each of three activities in this lesson (e.g., leading their peers through the instructions for each activity); adult facilitators should ensure concepts are effectively communicated and understood
Lesson 25	• <u>Activity</u>: Reward System Hijacking (20 minutes)	Assign youth the different scenarios to read aloud to their peers (both from the healthy reward system and hijacked reward system)
Lesson 26	• <u>Activity</u>: The Cycle of Addiction Storyboard (20 minutes)	Assign a youth leader for each of the three groups who can read through the handout and help lead discussion and the creation of the storyboard

Key Frameworks to Emphasize

- *BrainWaves: Substance Use and Addiction* is a science-informed and research-supported *prevention* program.
- This program is not about telling you what to do. It's about equipping you with knowledge and skills to make safer, science-informed decisions about substance use.
- While anyone can develop addictive behaviors, addiction is fueled by neurobiological changes in the brain—addiction is not just about making unhealthy or risky choices. It's not about lacking willpower. Chronic (repeated) substance use actually changes the way your brain works!
- When you have a deeper understanding of the brain and how it works, you can start to unpack the complexities of humans and how we function—our thinking, our learning, our language, our humor, our decision-making, how we express our emotions, how we process challenges, how we love, how we build relationships, how we create– it's all interconnected!
- This is a reciprocal learning experience! We won't always have all the answers, but we can learn from each other and discover new things together.

Important Concepts to Know

The *BrainWaves: Substance Use and Addiction* curriculum provides a more comprehensive explanation of the neuroscience concepts labeled “Background” within each lesson, but there are a few key terms that are very integral to the content and revisited throughout the units. Be sure to familiarize yourself with these concepts ahead of instruction.

- **Psychoactive Substances:** chemicals that people put into their bodies that can change how they think, how they feel, or how they act.²
- **Addiction:** a chronic brain disease where drug use becomes compulsive and hard to stop, even when it causes harm [33].
- **Tolerance:** the more someone uses a substance over time, the less effective that substance becomes. [1]
- **Physical Dependence:** the body gets so used to a drug that it struggles without it (it experiences withdrawal symptoms)
- **Addiction Cycle:** a three-stage process that cycles, repeats, and intensifies over time; the addiction cycle includes the following stages: “Use & Feeling Better”, “Withdrawal & Feeling Worse” and “Intrusive Craving & Anticipation”.

Additional Resources

[Parent Talk Kit: Tips for Talking and What to Say to Prevent Drug and Alcohol Abuse](#)

[Mind the Message: Talking with Youth About Substance Use](#)

© 2026 - The *BrainWaves: Substance Use and Addiction* module is part of [BrainWaves](#), a Catalyst Curriculum. The materials that appear in this *BrainWaves: Substance Use and Addiction* module (except those for which reprint permission must be obtained from the primary sources) may be reproduced for non-profit educational/training activities. We do, however require that the following statement appear on all reproductions:

Russo, J.P., Cable, J., Lehman, J., Walker, K., Otto, M., & Tzenis, J.. (2025). *BrainWaves*. St. Paul, MN: Regents of the University of Minnesota.

² Hart, C. L., & Ksir, C. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw Hill.



Lesson 19: What are Drugs?

What it is

Youth learn the concept of psychoactive drugs and the types that most commonly affect adolescents by sorting their terms and images and exploring the myths associated with them.

Why it matters

In an age where accurate information competes with prevalent misinformation, learning to recognize the many forms of drugs, their uses, and their street names empowers youth to make informed decisions.

Getting started

Time: 40 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- Means to share [slide deck](#)
- [Introduction](#)
 - Flipchart paper
 - Marker
- [Activity 1: What Do You Want to Know?](#)
 - Scrap paper - 1 per person
 - Writing utensil - 1 per person
- [Activity 2: What's What?](#)
 - [Psychoactive Drug Types signs](#) - 1 set per group of 3-4 people
 - [Drug Types Cards](#), printed and cut out - 1 set per group of 3-4 people
 - [Drug Types Key](#) - 1 copy, for the facilitator
- [Activity 3: Myth Busting](#)
 - Two objects (like bandanas or cones) to mark "home base" lines
 - Masking Tape Provided
 - Space to run

Facilitator Prep:

- Print and cut out copies of the [Psychoactive Drug Types signs](#) and [Drug Types Cards](#). You will need one set of each for every group of 3-4 people. *Tip: Place each set of signs with a set of cards and either clip together or place in envelopes to make it easier to pass out to groups.*
- Print and study the [Drug Types Key](#) (or have on hand for your own facilitation purposes).
- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding

options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

Youth may be familiar with the term “substance” from their science classes, referring to substances with chemical properties like water or oxygen. When we talk about substances, we’re talking about chemicals that people put into their bodies that can change how they think, how they feel, or how they act. [1, 2, 3]

Youth might know these chemicals as “drugs,” like cocaine or fentanyl. But when we’re talking about substances, we’re not just thinking about illegal drugs, we’re also thinking about substances that are more common like alcohol or cigarettes or nicotine vapes. Not all substances carry the same levels of danger or have the same effects on us, but what they do all have in common is that they’re **psychoactive**—meaning they affect how our brains work.

For more information, see the [Facilitator Background Deep-Dive](#).

Words to Know

Psychoactive: affecting how the brain works

Substances/drugs: chemicals that people put into their bodies that can change how they think, how they feel, or how they act

What to do

Introduction (5 min)

1. Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. (Slide 2) Ask youth, “**What comes to mind when you hear the word drugs or substances?**” Write down their thoughts on a board or easel paper for all to see.
3. Ask youth what themes they notice in everyone’s comments. For instance, there may be some negative effects or warnings, types of substances, people or places they associate with drugs, emotional reactions, or even some judgements or views about substances. They may also have questions. We’ll get to those!
4. Ask, “**How should we define a drug?**” *A drug is any chemical substance that changes the body’s normal functioning. **Note:** Though “substance” is a broader term than “drug,” for purposes of this program, we’ll often use the term “drug” and “substance” interchangeably.*
5. (Slide 3) Explain that today the focus is going to be on **psychoactive** drugs. Have youth turn to a partner to brainstorm their ideas on what they think psychoactive drugs are. Then ask for volunteers to share their ideas.
6. **Click in slide 3 to reveal the psychoactive substances image.** Have youth turn back to their partner and talk about what they see. Then reflect as a large group:
 - **What do you see in the blue circle?** *We’re used to thinking about these substances (cocaine,*

methamphetamine, fentanyl, heroin, MDMA, LSD, psilocybin mushrooms) having a harmful effect. These substances affect the brain.

- *What about the substances shown in the yellow circle (cannabis, THC, nicotine, caffeine, kratom, kava, alcohol)? These substances are often easier to access or more socially accepted, but they can still negatively affect the brain.*
7. Make sure they understand that throughout the program, they'll hear the word drug or or substances. We're talking about psychoactive drugs, which are chemical substances that impact brain function by causing changes in mood, emotions, awareness, perception, thoughts, and/or behavior.

Activity 1: What Do You Want to Know? (5 minutes)

8. (Slide 4) Ask youth, "What are your questions or fears about drugs? What are you curious about?" Make sure youth have scrap paper and writing utensils and then give them 1-2 minutes to write down their questions. Let them know they're going to be read, so they probably want to leave off their names.
9. When they're done, have them crumple their paper and throw it in the middle of the room and then grab someone else's paper. Circle up and have each person read one question from the paper they picked up.

Alternatively, with the remaining 2-3 minutes, give youth the option to turn to 1 or 2 others to share their questions with each other.

10. Collect all the questions/concerns. Throughout this lesson, and subsequent lessons, make sure to address each question or concern.
11. (Slide 5) Explain the key takeaway:

Key Takeaway: It's natural to have questions and curiosities about things in life such as drugs/substances as you grow up. Having open and honest conversations about substance use, especially with a trusted adult or caregiver, can provide you with the knowledge to make safe, healthy and science informed choices.

Activity 2: What's What? (15 minutes)

12. (Slide 6) *What are some of these drugs we're talking about?* Ask youth if they've ever heard words or phrases that don't mean what they sound like (e.g, brain freeze, jellyfish, hot dog).
13. Explain that drugs also sometimes have names that are misleading and may sound fun but are actually harmful. Use a board or easel paper to write down some examples, asking youth to provide their own answers for why the names are misleading:

Street Name	What it actually is	Why it's misleading
Molly	MDMA	<i>Sample answer: Sounds harmless</i>

Skittles	Prescription pills	<i>Sample answer: Sounds fun</i>
Sauce	Alcohol	<i>Sample answer: Sounds everyday</i>

14. Ask, "Why do you think people use these names?"
15. (Slide 7) Split youth into groups of 3-4 people and give each group a set of [Psychoactive Drug Types signs](#) and a set of [Drug Form cards](#).
16. Have groups find a floor or table space to place the signs. Ask them to determine which forms (illustrations) they may see as examples of the different psychoactive drug types and then place it under the appropriate drug type sign.
17. (Slides 8-19) Once they're done categorizing, review their work and make corrections as necessary, using the [Drug Types Key](#) or slides 8-19. For each category, ask youth what they know about what the characteristics are of each drug type, using the **Background** section to fill in the gaps of their knowledge.
18. (Slide 20) Point out that there are not only many drugs that make up each category, but there are also many terms and nicknames used to identify them in different social circles, as well as different forms (pills, powder, liquid, etc.). Then ask:
 - Why might it be important to know the different forms or terms these drugs take?
 - What could be the risk of not knowing?
19. (Slide 21) Explain the key takeaway:

Key Takeaway: There are many different names and forms that drugs can take, which can sometimes look or sound innocent, but that doesn't mean they're safe. There is a risk in not knowing what's in a substance or where it originally comes from. Understanding these risks as you navigate different social circles can empower you to set boundaries and make safe and healthy choices about substance use.

Activity 3: Myth Busting (10 minutes)

20. (Slide 22) Play a game of "Owls and Crows" to see what myths of drug effects they can bust. Divide the group into two groups—an Owls team and a Crows team—and have the teams line up facing each other. About 10 feet behind each team, place a bandana on the ground to indicate home base (or use a wall behind each team). When the leader reads a statement (below) about drug effects, if the statement is true, the Owls chase the Crows; if it's false, the Crows chase the Owls. Players who are tagged before crossing the home base join the opposite team. **Alternative:** Designate one side of the room as *True*, and the other side as *False* and have youth move to the side of the room according to their answers.
21. (Slides 23-34) Read the following statements one at a time:
 - You can overdose on caffeine.
True: It takes a lot, but high amounts of caffeine can cause seizures, heart arrhythmia, or even death.
 - Caffeine doesn't affect the brain like a drug would.

- False. Caffeine is a psychoactive drug that blocks certain "relaxation receptors" in the brain.*
- **You can't get addicted if you only use drugs occasionally.**
False. Even occasional use, especially with opioids, stimulants, and nicotine, can lead to addiction.
 - **You can hallucinate from cannabis.**
True. THC can cause visual and auditory hallucinations.
 - **Addiction is just a lack of willpower.**
False. Addiction is a disease that changes the brain's chemistry and function, which willpower can't control.
 - **People who are addicted to drugs choose that lifestyle.**
False. Substance use disorders can affect anyone and are medical, not behavioral conditions.
 - **If you use an opioid for pain, it acts on your brain differently than if you use it to get high.**
False. Opioids impact the brain the same no matter why you're taking them. The difference is in how they're used. The amount, how often, and whether a doctor is monitoring use is what determines whether opioids provide safe pain relief or carry a high risk for misuse or addiction.
 - **Some people have flashbacks from psychedelics weeks or months later.**
True. This is another rare but true phenomenon called Hallucinogen Persisting Perception Disorder (HPPD).
 - **Nicotine is as addictive as heroin or cocaine.**
True. Nicotine ranks as one of the most addictive drugs because of how strongly it takes over the brain's reward system.
 - **Vapes can be dangerous even if they only have flavoring.**
True. E-liquids can contain nicotine, even when labeled as nicotine-free. Flavoring in vapes also can contain chemicals such as propylene glycol, glycerin, and other substances, which may be safe in food or skincare but can become harmful when heated and inhaled. [16]
 - **Smoking marijuana is a good way to treat pain by yourself.**
False. You should go to a trusted doctor to help you treat pain. Medical marijuana is only recommended under a doctor's supervision. [16]
 - **Substance use can run in families and make someone more likely to develop a use disorder.**
True. Just like other traits can run in families, the risk for substance use can too. It doesn't mean it will happen—it just means some people may need to be a little more careful.

22. (Slide 35) Explain the key takeaway:

Key Takeaway: There are a number of misconceptions about substances. By understanding how substances impact the brain, you can be better equipped to replace harmful myths about substances with empathetic, science-based information.

Reflection (5 minutes)

23. (Slide 36) Gather everyone together to talk about their experience.
- What's one impactful thing you learned that you didn't know before?
 - What myths about substances were busted for you?

Lesson 19 References

1. Hart, C. L., & Ksir, C. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw Hill.
2. World Health Organization. (n.d.). [Drugs \(psychoactive\)](#). World Health Organization.
3. Australian Government Department of Health. (2019, July 17). [What are drugs?](#)
4. Alcohol and Drug Foundation. (2025, June 6). [Alcohol](#).
5. Lachenmeier, D. W., & Rehm, J. (2015). [Comparative risk assessment of alcohol, tobacco, cannabis and other illicit drugs using the margin of exposure approach](#). *Scientific Reports*, 5, 8126.
6. Gable, R. S. (2004). [Comparison of acute lethal toxicity of commonly abused psychoactive substances](#). *Addiction*, 99(6), 686–696.
7. Alcohol and Drug Foundation. (2025). [Tobacco](#).
8. Henstra, C., et. al. (2022). [Managing intoxications with nicotine-containing e-liquids](#). *Expert Opinion on Drug Metabolism & Toxicology*, 18(2), 115–121.
9. Alcohol and Drug Foundation. (2025). [Cannabinoids](#).
10. Gorelick, D. A. (2023). [Cannabis-related disorders and toxic effects](#). *New England Journal of Medicine*, 389(24), 2267–2275.
11. Alcohol and Drug Foundation. (2025). [Opioids](#).
12. Alcohol and Drug Foundation. (2025, June 6). [Fentanyl](#).
13. Alcohol and Drug Foundation. (2025, June 6). [Heroin](#).
14. Alcohol and Drug Foundation. (2025, June 6). [Oxycodone](#).
15. Kelly, E., Sutcliffe, K., Cavallo, D., Ramos-Gonzalez, N., Alhosan, N., & Henderson, G. (2023). [The anomalous pharmacology of fentanyl](#). *British Journal of Pharmacology*, 180(7), 797–812.
16. Alcohol and Drug Foundation. (2025, August 6). [Stimulants](#).
17. Alcohol and Drug Foundation. (2025). [Cocaine](#).
18. Alcohol and Drug Foundation. (2025). [Amphetamines](#).
19. Alcohol and Drug Foundation. (2025, June 6). [Crystal methamphetamine \(Ice\)](#).

Facilitator Background Deep-Dive

Examples of substances that teens might encounter.

1. Alcohol [\[4\]](#)

- *Examples:* Beer, wine, seltzers, vodka, liquor
- *How it makes people feel:* Drunk, more relaxed, happier OR sadder
- *How it messes with people:* Impaired judgement, slow reflexes, low coordination, difficulty with concentrating
- *Overdose dangers:*
 - Dangerously slowed breathing, persistent vomiting, passing out, coma, death
 - Risk of overdosing: High [\[5, 6\]](#)

2. Nicotine [\[7\]](#)

- *Examples:* Cigarettes, cigars, vapes
- *How it makes people feel:* "Buzzed", more relaxed, more alert/focused, better mood, jittery
- *How it messes with people:* Headaches, nausea, lower appetite, restlessness, EVALI (E-cigarette or Vaping Associated Lung Injury)
- *Overdose dangers:*
 - Dangerously rapid heartbeat, difficulty breathing, seizure
 - Risk of Overdosing: Low (cigarettes) to Medium (vapes) [\[5, 8\]](#)

3. Marijuana [\[9, 10\]](#)

- *Examples:* Cannabis vapes/carts, THC drinks/edibles, THC oils, smoking (joints, blunts, pipes, bongs)
- *How it makes people feel:* Feeling high, relaxed, happy, more sociable, hungry
- *How it messes with people:* Impaired judgement, slow reflexes, anxiety, paranoia, memory impairment, dry mouth
- *Overdose dangers:*
 - The effects of marijuana are generally not life threatening, but it can result in panic attacks, recurrent or excessive vomiting, rebound anxiety, and in rare cases, psychosis³
 - Risk of Overdosing: Low⁴ [\[5, 6\]](#)

4. Common Opioids [\[11, 12, 13, 14\]](#)

- *Examples:* Fentanyl⁵, Heroin, Oxycodone, Hydrocodone, Kratom/⁷OH (*has both opioid and stimulant-like effects, but isn't regulated, so it is difficult to know how it will affect different people*)
- *How it makes people feel:* Feeling high, positive mood, extremely relaxed, relieved of pain
- *How it messes with people:* Confusion, slurred speech, very drowsy, reduced appetite, headache, body aches, nausea

³ THC induced psychosis is a common reason for people needing to be sedated in the ER.

⁴ In some cases, especially with children, marijuana use has led to seizures and dangerously slowed breathing that required medical support such as intubation. This risk is greater with edibles like gummies, since they often contain much higher doses than smoking.

⁵ Fentanyl is often present in substances sold as something else (fake Xanax, cocaine, methamphetamine, and sometimes cannabis) and can lead to overdose death this way.

- *Overdose dangers:*
 - Dangerously slowed breathing, dangerously slowed pulse, passing out, brain injury, coma, death
 - Risk of Overdosing: Very High [[5](#), [6](#), [15](#)]

5. **Common Stimulants** [[16](#), [17](#), [18](#), [19](#)]

- *Examples:* Cocaine/crack, Amphetamines, methamphetamine, prescription medicines for ADHD
- *How it makes people feel:* Feeling high, positive mood, more alert/focused, more confident, more energetic
- *How it messes with people:* Anxiety, paranoia, reduced appetite, aggression/hostility, insomnia
- *Overdose dangers:*
 - Dangerously rapid heartbeat, stroke, seizure, kidney failure, difficulty breathing, extreme overheating, passing out
 - Risk of Overdosing: Medium to High [[5](#), [6](#)]

Activity 2: Psychoactive Drug Types

Alcohol

Nicotine

Marijuana

Opioids

Common

Stimulants

Activity 2: Drug Form cards

1



2



3



4



5



6



7



8



9



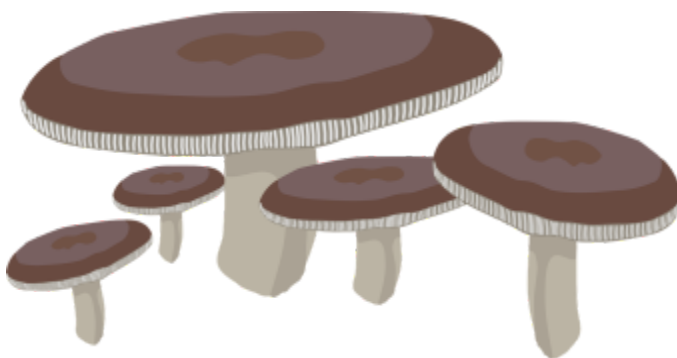
10



11



12



Activity 2: Drug Forms Key

Illustrations

1. Hypodermic needle: Can be used for prescription drugs such as insulin, vaccines; illicit drug use includes heroin, cocaine, meth, steroids. **Drug category: Opioids, Common Stimulants**
2. Vape pen and vape mod: Vapes can contain significantly more nicotine than the average cigarette. **Drug form: Nicotine, Marijuana**
3. Bong: Typically used for smoking marijuana. **Drug category: Marijuana**
4. Powder: Common form of cocaine, meth, heroin, MDMA/Ecstasy. **Drug category: Opioids, Common Stimulants**
5. Plant: The plant shown here is a marijuana leaf, but other drugs may be seen and used in plant form, such as tobacco, opium, and cocaine. **Drug category: Nicotine, Marijuana**
6. Stamps or blotter paper: When licked could contain dose/drop of LSD. **Drug category: Common Stimulants**
7. Pills: Could contain any drug. It's also important to know that counterfeit or illicit drugs can contain unknown or unexpected substances. **Drug category: Opioids, Common Stimulants**
8. Cigarettes: Used to smoke tobacco or marijuana; can be laced with other drugs as well. **Drug category: Nicotine, Marijuana (most common); can also contain Common Stimulants and Opioids**
9. Bottle: Could contain alcohol or forms of liquid drug, such as caffeine or kratom/7OH. **Drug category: Alcohol (most common); can also contain Common Stimulants and Opioids**
10. Muffin: Could contain marijuana or other forms of ingestible drugs. **Drug category: Marijuana**
11. Candy: Could contain marijuana or other forms of ingestible drugs. **Drug category: Marijuana**
12. Mushrooms: Psilocybin is a psychedelic compound found in mushrooms. **Drug category: Common Stimulants**

Drug Forms

Alcohol

- Forms: drunk as beer, liquor, wine, cider/hard seltzers; eaten as alcohol-filled or soaked fruit, candies, Jell-O, or frozen treats
- Mixed forms & their nicknames: Speedball (alcohol mixed with cocaine); Blackout Mix (alcohol mixed with benzodiazepines, such as Xanax)
- Related terms: booze, sauce, juice, firewater, giggle juice, hooch

Nicotine

- Forms: cigarettes, cigars, pipes, chewing tobacco, snuff, e-cigarettes (vapes), pod systems (small devices with prefilled pods, like Juul), mods (larger customizable vaping devices), gum, patches, nasal spray, nicotine inhalers
- Related terms: pods, mods, cigs, smokes, e-juice, Juul

Marijuana

- Forms: Smoked, or eaten in candy, cookies, brownies
- Related terms: weed, pot, grass, herb, dope, flower, joint (rolled in a cigarette), blunt (rolled in a cigar wrap), spliff (joint mixed with tobacco), bong, cannabis

THC (tetrahydrocannabinol)—main psychoactive drug in cannabis

- Forms: dried cannabis flowers (buds), oil, wax, resin
- Related terms: Tetra, D-9/Delta 9, oil/hash/honey oil

CBD (Cannabidiol)—drug used for calming, pain relief, and as anti-inflammatory

- Forms: Used as drops, oil, or eaten in gummies
- Related terms: hemp oil (note that actual hemp oil doesn't necessarily have CBD in it), chill drops, calm chews

Opioids

- Prescription forms (swallowed as pills or injected) include oxycodone, hydrocodone, codeine, morphine, and fentanyl.
- Prescription names include Vicodin, Norco, Lortab, Zohydro ER, OxyContin, and Percocet.
- Street drug forms (swallowed as pills or injected, smoked, or snorted in powder form or as a nasal spray) include heroin, opium, and either synthetic, or counterfeit pills made to look like prescription forms.
- Related terms: Perks, oxys, hydros, vikes, lean, morph, junk, smack, dope

Other Illicit Drugs

Cocaine:

- Forms: Inhaled/smoked/injected as powder or smoked/inhaled from heated crystals
- Related terms: Coke, blow, crack, rock

Methamphetamine:

- Forms: Inhaled as powder, smoked, injected, or swallowed from crystals or as pill
- Related terms: Meth, crystal, crank, Tina, Yaba, ice

LSD:

- Forms: Usually ingested (one drop is a dose) from blotter paper or gel tabs placed on the tongue, dropped directly on the tongue, or in sugar cubes into drinks.
- Related terms: Acid, Lucy, tabs, blotter, dots, windowpane (gel tab form), electric Kool-Aid (LSD-laced drink)

Psilocybin mushrooms

- Forms: Eaten whole (fresh or dried), brewed as tea, mixed with food, or as capsules
- Related terms: Shrooms, mushies, caps and stems

DMT (Dimethyltryptamine)

- Forms: Smoked or vaped as powder or crystal or mixed with herbs like cannabis; drank as dark brown liquid
- Related terms: Dimitri, elf spice

Benzodiazepines

- Pills or liquid (Xanax, Ativan, Valium, Temazepam, etc.), usually either swallowed/drank, or injected
- Related terms: Benzos, tranks (short for tranquilizers), zannies/xannies (short for Xanax), z-bars (another name for Xanax bars), bricks

Ketamine

- Forms: Snorted as powder, or swallowed, injected, or mixed in drinks
- Related terms: Special K, Kit Kat, Ket, Super K



Lesson 20: Motivations for Drug Use

What it is

Youth explore the motivations for the use of psychoactive drugs and the values that can influence decisions by discussing some real-life scenarios.

Why it matters

Understanding what drives drug use and how it fits into their personal values and belief systems, youth are better able to make safe and informed choices, and extend greater empathy to those who use substances.

Getting started

Time: 40 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- Optional: Means to share [slide deck](#)
- Scrap paper
- Writing utensil - 1 per person
- Easel paper or black/white board & marker
- [Scenarios](#) - 1 copy per group of 3-4 people
- [Value Cards](#) - 1 copy per person

Facilitator Prep:

- Go through the questions you collected from Activity 1 in [Lesson 19](#) and mark the ones that this lesson will address.
- Print [scenarios](#) and [Value Cards](#). They do not need to be cut out.
- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

As we learned in [Lesson 19](#), psychoactive substances alter how the brain works by causing changes in mood, emotions, awareness, perception, thoughts, and/or behavior. [1] There are many reasons why people use substances, in part because there are a variety of different substance effects [2]. Many people—especially teens—try substances out of curiosity, just to see what they're like [3], but there are also several other reasons why people use substances:

1. **Enhancement:** To feel good and increase positive emotions [\[4\]](#)
2. **Social:** To connect with others, having fun [\[4\]](#)
3. **Conformity:** To fit in, avoiding social rejection [\[4\]](#)
4. **Coping:** To manage difficult feelings (like sadness, worry, stress, boredom), physical pain, or traumatic experiences [\[4\]](#), [\[5\]](#), [\[6\]](#)
5. **Performance:** To improve focus, energy, and do better in different activities [\[4\]](#), [\[6\]](#)
6. **Reinforcement:** To satisfy cravings, seek rewarding feelings, or follow habits formed by repeated substance use [\[5\]](#), [\[6\]](#)
7. **Withdrawal:** To relieve or avoid negative feelings or physical symptoms from not using substances [\[1\]](#), [\[6\]](#)

There are also a variety of reasons people choose to not use substances, whether that be because of family expectations, cultural norms, legal concerns, or health risks. But values can play another important role in guiding the choice to use or not use drugs. Values are like our guiding principles—the values we hold dearest reflect the essence of what drives our actions, reactions, and decisions.⁶ We all have many values, some more important to us than others. For example, when weighing whether we want to drink alcohol at a party to fit in, our value of being authentic to ourselves might outweigh our value of being accepted. Knowing what we value can help us make choices that we feel good about and are true to ourselves.

What to do

Introduction (5 minutes)

1. Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. (Slides 2-4) Play a round of “Would You Rather,” asking youth to stand on one side of the room or the other according to what they would rather do. Between each, ask for volunteers to explain their reasoning.
 - Would you rather have a lot of friends or a lot of money?
 - Would you rather always be honest, or always be kind?
 - Would you rather help a neighbor or help a family member?
3. (Slide 5) Explain that there are always reasons behind the actions we take in scenarios like this. The goal of today is to explore the factors that influence drug use. Ask youth, “Off the top of your head, what are some reasons people use drugs?”
4. Share any questions collected from Activity 1 from [Lesson 19](#) that will be addressed in this lesson.

Activity 1: Motivation Scenarios (15 min)

5. (Slide 6) Break youth into groups of 3 or 4 and give each group a page of [scenarios](#). Assign each group one of the scenarios, or allow them to choose one. *Note: If adapting this for youth older than*

⁶ Russo, J.P. & Skuza, J.A. (2025). [Lead Your Life, Tell Your Story: A Curriculum to Guide Youth Personal Leadership](#). St. Paul, MN: University of Minnesota.

8th grade, consider providing a scenario as an example but then ask them to come up with their own scenarios.

6. Come back together as a large group and have the small groups share with the large group what they came up with as answers to the questions for each scenario.
7. Ask youth, “Why is it important to understand what drives people to use drugs—how does your understanding help you, and how does it help others?”
8. (Slide 8) Explain the key takeaway:

Key Takeaway: We are all motivated by different things in life. When we take time to understand what might drive someone to use drugs, it can help us build greater empathy and understanding for those who use substances.

Activity 2: Values (15 minutes)

9. (Slides 9-10) Explain that just as in these scenarios, and with the scenarios we talked about in the “Would You Rather” exercise, part of what drives our actions are our values. Explain that values are things, ideas, or ways of being that most important to us. For instance, honesty may be a value that someone can have—being honest is very important to them. Family may be another thing that someone values highly. Ask youth, “What’s another example of a value that someone may have?”
10. (Slide 11) Explain to youth that they’re going to spend some time understanding their own values. Give each person a copy of the [Value Cards](#) and have them look through them on their own. Have them choose their top 5 values and mark them with a circle or a star. If they don’t see any that they like, they can create their own and write them down.
11. (Slide 12) Ask youth, “What experiences in your life led you to have those values?” For instance, maybe money or wealth is a value, because for some people it represents security or freedom. But what experiences may have led you to choose that value over another? Maybe traveling around with family helped instill adventure as a value—having the opportunity to explore new places and meet new people. Give youth about 5 minutes to think and journal about their answers to this question.
12. (Slide 13) Have youth get into small groups of 2 to 4 people to share some or all of the values they chose. Ask them to share with each other an example of what experiences in their lives led them to have one or more of the values they chose.
13. After 10 minutes, ask for a couple of volunteers to share with the large group an example of a value they chose and what experiences led them to hold this value.
14. (Slide 14) Have youth think about the scenarios they did in **Activity 1**. Using one of the scenarios a group chose, ask youth, “What values could have influenced that situation, either to motivate the person to use drugs or, if remembered, could have helped them choose not to?”
15. Ask youth, “When you think about your values, how does drug use fit into the things that are most important to you?” Ask youth to think and journal about this. Give them a few minutes and then allow them the option to pair up with someone to share what they thought about.
16. (Slide 15) Explain the key takeaway:

Key Takeaway: A person's value system is uniquely theirs, shaped by lived experiences. Our values can strongly influence our actions, behaviors and decisions. Knowing what you stand for ahead of time can guide your decisions in moments of pressure.

Reflection (5 minutes)

17. Debrief the experience:

- How might the short-term motivations of using a drug/substance feel different than the long-term impact on your life, your goals or your future?
- How do/could your values play into the decisions that you make regarding drug use?
- What would be the one thing you could tell your family/friends about substance use from this lesson?

Lesson 20 References

1. Mahu, I. T., et. al. (2021, December 1). [Different drugs come with different motives: Examining motives for substance use among people who engage in polysubstance use undergoing methadone maintenance therapy \(MMT\)](#). *Drug and Alcohol Dependence*, 229(Pt B), Article 109133.
2. Peirce, J. M., et al. (2006). [Effects of lower-cost incentives on stimulant abstinence in methadone maintenance treatment: A National Drug Abuse Treatment Clinical Trials Network study](#). *Archives of General Psychiatry*, 63(2), 201–208.
3. Cooper, M. L. (1994). [Motivations for alcohol use among adolescents: Development and validation of a four-factor model](#). *Psychological Assessment*, 6(2), 117–128.
4. Biolcati, R., & Passini, S. (2019). [Development of the Substance Use Motives Measure \(SUMM\): A comprehensive eight-factor model for alcohol/drugs consumption](#). *Addictive Behaviors Reports*, 10, 100199.
5. Cooper, M. L., et.al. (2015). [Motivational models of substance use: A review of theory and research on motives for using alcohol, marijuana, and tobacco](#). In K. J. Sher (Ed.), *The Oxford Handbook of Substance Use and Substance Use Disorders* (Vol. 1, pp. 375–421). Oxford University Press.
6. Hart, C. L., & Ksir, C. J. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw-Hill.

Values activity adapted from [Lead Your Life, Tell Your Story](#), Lesson 2, © 2025 by J.P. Russo & J.A. Skuza.

Motivation Scenarios

Scenario 1: Your friend Sam recently has been bullied and often seems angry and withdrawn. Sam asks you and two other friends to go with him to the school dance, but once there, he spots some of the people who have been bullying him and he convinces you all to leave. You all walk to his house where Sam offers everyone some THC gummies.

1. Why do you think Sam might be wanting to use drugs in this scenario?
2. What else could Sam do to cope with what he's feeling?
3. If you didn't want to eat any gummies, what could you say or do?



Scenario 2: You have access to your parent's car. Your best friend John calls you and asks for a ride to pick something up, but he won't tell you what he's grabbing. John has been very depressed lately and struggling in school. Since you haven't seen him recently, you're just happy to hear from him and decide to humor him. As you're driving, you realize he's meeting up with someone who picked up some 6-packs of beer for him; you continue on. On the ride home, John starts drinking one of the cans and says he's ready to get drunk, which is completely unlike him.

1. Why do you think John decided to get drunk?
2. What else could John do to cope with his mental health?
3. Why might you have wanted to continue driving your friend even after you realized what they wanted?
4. What else could you have done instead?



Scenario 3: Jamie has a lot going on that's stressing her out at home, and school is now also piling up, including a big test. She's been complaining to some friends about how hard it is lately to concentrate. One of them says she has some Adderall prescribed to her for ADHD that helps her focus. She offers to sell some to Jamie.

1. Why might Jamie want to use Adderall?
2. What else could she try instead to help with her concentration and stress issues?
3. If she didn't want to take it, what could she do or say?



Scenario 4: Rani hears about kratom shots from friends who say they help you feel more awake and relaxed. Rani tries one before hanging out and feels some of the effects her friends described. Then a few weeks later, Rani starts using kratom before school to stay alert and focused. Soon, it takes more than one shot to feel the same effect. When she runs out, she starts to get headaches, feels shaky, nauseated, and has trouble sleeping. She feels grumpy and sick until finding more kratom.

1. Why do you think Rani wants to use Jubi?
2. What else could she have done to meet this need?
3. What can Rani do now?



Scenario 5: During lunch, a group of kids are huddled together looking at your friend's phone. You walk over and notice a TikTok video of an influencer discussing which flavored vape they like best. One of your friends invites you to try out some vape flavors after school.

1. Why do you think your friend wants to vape?
2. What else could your friend do to meet this need or desire?
3. If you didn't want to join your friend, what could you do or say?
4. If you wanted to encourage your friend to make a different choice, what could you do or say?



Value Cards⁷

Authenticity "Your time is way too valuable to be wasting on people that can't accept who you are." —Turcois Ominek	Simplicity "Possessions, outward success, publicity, luxury—to me these have always been contemptible. I believe that a simple and unassuming manner of life is best for everyone, best for both the body and the mind." —Albert Einstein	Inner Beauty "Beauty is in the eye of the beholder and it may be necessary from time to time to give a stupid or misinformed beholder a black eye." —Jim Henson
Humility "The only true wisdom is in knowing you know nothing." —Socrates	Hope "Hold fast to dreams, For if dreams die Life is a broken-winged bird, That cannot fly." —Langston Hughes	Learning "I did then what I knew how to do. Now that I know better, I do better." —Maya Angelou
Knowledge "No thief, however skillful, can rob one of knowledge, and that is why knowledge is the best and safest treasure to acquire." —L. Frank Baum, <i>The Lost Princess of Oz</i>	Education "Education is the most powerful weapon which you can use to change the world." —Nelson Mandela	Persistence "Success is not final, failure is not fatal: it is the courage to continue that counts." —Winston S. Churchill
Happiness "Success is getting what you want, happiness is wanting what you get." —W.P. Kensella	Success "I'm a success today because I had a friend who believed in me and I didn't have the heart to let him down." —Abraham Lincoln	Action "The way to get started is to quit talking and begin doing." —Walt Disney Company

⁷ Values activity adapted from [Lead Your Life, Tell Your Story](#), Lesson 2, © 2025 by J.P. Russo & J.A. Skuza.

Money "Money is not the only answer, but it makes a difference." —Barack Obama	Inclusivity "Generations of heroic Americans have made America more inclusive, more expansive, and more just." —Cory Booker	Family "Family is not an important thing. It's everything." —Michael J. Fox
Activity "I shall be active and vigorous even from the tomb." —Sai Baba	Religion "Atheism turns out to be too simple. If the whole universe has no meaning, we should never have found out that it has no meaning..." —C.S. Lewis	Spirituality "Prayer is not asking. It is a longing of the soul. It is daily admission of one's weakness. It is better in prayer to have a heart without words than words without a heart." —Mahatma Gandhi
Humor "A day without laughter is a day wasted." —Charlie Chaplin	Truth "Rather than love, than money, than fame, give me truth." —Henry David Thoreau	Ambition "We can each define ambition and progress for ourselves. The goal is to work toward a world where expectations are not set by the stereotypes that hold us back, but by our personal passion, talents, and interests." —Sheryl Sandberg
Belonging "When you get to a place where you understand that love and belonging, your worthiness, is a birthright and not something you have to earn, anything is possible." —Brene Brown	Balance "Everything in moderation, and there's a perfect balance in this life if we can find it." —Ryan Robbins	Challenge "A key ingredient in innovation is the ability to challenge authority and break rules." —Vivek Wadhwa

Control "You cannot always control what goes on outside. But you can always control what goes on inside." —Wayne Dyer	Creativity "Creativity involves breaking out of established patterns in order to look at things in a different way." —Edward de Bono	Adventure "Life is either a great adventure or nothing." —Helen Keller
Create your own	Create your own	Create your own
Create your own	Create your own	Create your own



Lesson 21: What Makes Drug Use Risky?

What it is

Youth learn about some of the factors that influence a drug's impact and risk of overdose through a simulation activity.

Why it matters

By exploring how different factors can influence a drug's impact, youth gain an understanding of the risks involved in drug use no matter what form the drug comes in. This knowledge empowers them to make safer, more thoughtful, and more informed decisions about substance use.

Getting started

Time: 35 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- Optional: Means to share [slide deck](#)
- Container (bucket, plastic bag, etc.) - 1 for the facilitator
- Per team (two equal-sized teams):
 - [Multicolored pom-poms](#)
 - 4-5 [Medium \(~6-inch\) balls](#)
 - 1 small empty bucket labeled as "the brain"
 - 1 large bucket filled halfway with pom-poms labeled as "the body"
- Plastic cups - 1 per person

Facilitator Prep:

- Go through the questions you collected from Activity 1 in [Lesson 19](#) and mark the ones that this lesson will address.
- Set up each group's station for the [What Makes a Drug Dangerous?](#) activity.
 - Place a label on the large bucket that says, "Brain," and then fill it with pom-poms. It should have more pom-poms than the small bucket can hold.
 - Place a label on the smaller bucket that says, "Body," and set it near the pom-pom-filled bucket.
 - Feel free to use whatever will work as a labeling mechanism (e.g., paper and tape, masking tape, etc.)
 - Have the plastic cups and medium-sized balls accessible.
- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding

options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

People experience psychoactive drug effects because drug molecules are able to interact with the brain, but these interactions don't just affect how someone feels. Substances also have the ability to impair a person's overall functioning (decision making, motor control, social abilities), destabilize a person's mental health, and even lead to overdose—these impacts can arise from just a single substance use session.

However, it would be inaccurate to imply someone will die any time a substance is used, so then what factors create these risks? What is it that makes substance use risky? To answer these questions, let's first look at how drug molecules get to the brain in the first place.

The way a drug enters a person's body is called its **route of administration**. Whether someone takes a hit of a nicotine vape, eats a THC gummy, drinks an alcoholic drink, or snorts cocaine, the substance will get absorbed into the bloodstream through capillaries—tiny blood vessels that are found in the inner linings of our lungs, intestines, and noses. Once in the bloodstream, drug molecules can flow throughout the body and cross into the brain—this is when risks of impaired functioning, destabilized mental health, and overdose come into play.

Unfortunately there isn't a simple rule for how bodies process substances that predicts these outcomes. Higher doses increase the risk of harm, but genetics and other individual differences mean one person might feel the drug effects they were expecting while another might go into crisis from the same dose. This response uncertainty is part of why drug use is inherently risky. However, we do know three major factors that increase the risk of harm:

1. How quickly a drug can flood into the brain based on its route of administration.
2. Whether there is a delay between using a substance and experiencing its effects, which is also influenced by its route of administration.
3. How high the overdose risk is based on what substance is being used.

For more information, see the [Facilitator Background Deep-Dive](#).

What to do

Introduction (5 min)

1. Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. (Slide 2) Ask youth, "**What makes a drug dangerous?**" *Sample answers: how much of a drug you take, what type of drug you take, how high you get, how much of an effect is felt.*
3. Upon hearing youth's responses, emphasize that they mentioned different factors and not just one thing. Explain that this is true of many different situations in life.

4. (Slide 3) Ask youth if they've ever seen a viral post on Social Media—viral meaning it reaches lots of people. Ask, “What do you think makes a Social Media post (or video or reel) go viral?” *Sample answers: who shares the post, what platform it's on, the time of day it was posted, who shares it or reposts it, what their following looks like, how cool it is.*
5. Say, “Just like with a Social Media post, there is no one factor that makes it go viral, and there are many factors that influence the impact.”
6. (Slide 4) Explain that this is similar to drugs and that there is no one factor that determines how dangerous a drug is or can be once it's taken.
7. (Slide 5) Ask youth to recall **Activity 2** from [Lesson 19](#), when they had to sort through the various terms and pictures of the types of drugs. Ask if they can remember some of the forms that drugs come in (*powder, pills, cigarettes, vapes, needles, stamps, drops, candy, drinks, etc.*). Ask, “Do you think that some forms of drugs are safer than others?”
8. Let's keep this question in mind as we go through this next activity.

Activity: Drug Use Risk Factors (25 minutes)

9. (Slide 6) Split youth into two equal-sized teams. If there are less than 10 people, create one team.
10. Identify or ask for one volunteer from each team to be in charge of the smaller empty bucket (“the brain”). The remaining team members will be in charge of the larger pom-pom-filled bucket (“the body”). Let youth know that they'll participate in three rounds.

Note for facilitator: The outcomes of this activity are meant to be messy! The empty buckets will likely overflow during some of the rounds. *This is intentional.*

Round 1: Flooding into the Brain

Setup

- (Slide 7) Give each youth a plastic cup.
- Share with “the body” team that their goal is to fill up “the brain” bucket with pom-poms as quickly as possible using their plastic cups.
- Share with “the brain” volunteers that their goal is to keep “the brain” from filling up by using their cup to pour the pom-poms back into the larger, pom-pom-filled bucket (“the body”).
- Tell youth this round is going to serve as an example of injecting a drug into a vein.
- (Slide 8) Communicate a few simple rules:
 - Don't stop people from filling “the brain” bucket.
 - Use only the cups (not your hands) to fill the bucket, and don't squish them down.
 - Let teams know they should continue pouring and dumping until the cue of “stop” or “freeze”!

Begin the round.

- Continue the round until “the brain” buckets overflow.

Reflect on Round 1:

- (Slide 9) Have youth look at “the brain” bucket and ask “Has the bucket overflowed? What are you seeing?” *Sample answer: The bucket filled all the way up and some of the pom-poms were spilling over.*

- Ask “the brain” volunteer: *How easy or difficult was it to keep “the brain” bucket from overflowing? Sample answer: It was difficult; I couldn’t keep up.*
- Share with the group *“A lot of the drug flooded into the brain and began piling up. When a drug is injected directly into the bloodstream, the body doesn’t really have a chance to filter much of the drug out before it gets to the brain”*
- Ask youth, *“Why is it a problem that a drug builds up in the brain?” Sample answer: It might damage or hurt your brain; it might make you really high or feel really high.*
- (Slide 10) Explain the key takeaway:

Key Takeaway: The more of a drug that rushes into the brain, the stronger the effects it will have. When this happens quickly and all at once like with injection, the drug user has little time to recognize the effects of overdose.

Round 2: Delayed Effects

Setup:

- (Slide 11) Have youth help you reset their stations by giving all of the pom-poms to the facilitator who will place them in a container. Both the “brain” bucket and “the body” bucket should be empty.
- Ensure each youth has a plastic cup.
- Assign or ask for a new volunteer to be in charge of “the brain.”
- Have the facilitator dump three cups full of pom-poms into each team’s “body” bucket.
- Let teams know that Round 2 has the same goal as Round 1, but this time they will be starting with fewer pom-poms in “the body” bucket.
- Tell youth this round is going to serve as an example of eating a THC gummy.

Begin the round:

- After 20 seconds, the facilitator will dump three more cups full of pom-poms into each team’s “body” bucket.
- Continue adding more pom-poms every 20 seconds until the “brain” bucket overflows. Once that happens, say “Stop!” to end the round.

Reflect on Round 2:

- (Slide 12) Ask youth, *“What was different about this round?” Sample answers: “The brain” bucket didn’t overflow as quickly; pom-poms kept getting added to “the body” bucket.*
- Ask the “brain” volunteer, *“How difficult was it to keep pom-poms out of your bucket at the start of the round? Did this change as the round went on?” Sample answers: It was easy to keep pom-poms out of the bucket at the start, but it got harder as the round went on.*
- Explain to youth that pom-poms kept getting added to the buckets throughout the round to represent someone using a drug several times in one session. For example, taking a THC gummy and then 20 minutes later, taking a couple more gummies.

- Ask youth, “Why might someone take more of a drug so quickly?” *Sample answer: They didn't feel any effects from the drug so they decided to take more; they thought they took too low of a dose.*
- Ask youth “Why is it a problem to take more of a drug before the effects kick in?” (If necessary, remind youth about what happened towards the end of Round 2.) *Sample answers: It's going to all hit you at once; a lot of the drug is going to build up in the brain; you might get really high.*
- (Slide 13) Explain the key takeaway:

Key Takeaway: When someone takes a drug orally (by eating, swallowing or drinking it), the effects don't kick in right away. Substances can take time to digest, metabolize and reach the brain. If someone decides to take more of a drug because they haven't felt the effects kick in yet, they put themselves at a greater risk for losing control and even overdose.

Round 3: A Drug's Overdose Risk

Setup:

- (Slide 14) Have youth put away the pom-poms. Both buckets should be empty.
- Assign or ask for a new volunteer to be in charge of “the brain”.
- Have the facilitator put 4-5 medium-sized (6-inch) balls into each team's “body” bucket.
- Let teams know that Round 3 has the same goal as Round 1, but this time they will be using beach balls instead of pom-poms. There will be no cups this round. Let youth know they can use their hands to transfer the beach balls between buckets.
- Tell youth this round is going to serve as an example of smoking fentanyl.

Begin the round:

- Continue the round until “the brain” buckets overflow. This should happen very quickly.

Reflect:

- (Slide 15) Ask youth, “How quickly did “the brain” bucket overflow in this round?” *Sample answers: Really quickly; it didn't take long at all.*
- Ask youth, “Why do you think we used beach balls this round instead of pom-poms?” *Sample answers: To represent a stronger drug/how strong the drug is.*
- Explain to youth that drugs like fentanyl have a much stronger impact on the systems that keep us alive, like breathing. This means that even a small amount of fentanyl carries the risk of overdose, no matter how it was taken. This is part of what makes fentanyl so dangerous.
- (Slide 16) Explain the key takeaway:

Key Takeaway: A drug like fentanyl is dangerous no matter how it is taken. This is especially important to understand because you don't always know what you're taking or where it comes from. Even if you think you're taking one drug, it could be laced with a drug like fentanyl, putting you at risk for overdose.

Clean-up and Reflection (5 minutes)

11. Allow time for youth to clean up the pom-poms and stack cups.
12. (Slide 17) Gather everyone together to talk about the collective experience.
 - Let's circle back to the question we asked at the start of the lesson. After going through the activity, do you think that some forms of drugs are safer than others?" *No matter the way in which a drug is taken (powder, pills, cigarettes, vapes, needles, stamps, drops, candy, drinks, etc.), there is risk involved; and some drugs like fentanyl are dangerous no matter how you take them.*
 - Based on the activity, what makes a drug dangerous? *When someone takes a drug, there is no one factor that determines its danger level. How fast and how much drug floods into the brain, how delayed its effects are, and how potent the drug is all contribute to the risks involved.*
 - Why might knowing this information be important?

Lesson 21 References

1. Hart, C. L., & Ksir, C. J. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw-Hill.
2. Garza, A. Z., Park, S. B., & Kocz, R. (2023, July 4). [Drug elimination](#). In StatPearls [Internet]. StatPearls Publishing.

Facilitator Background Deep-Dive

The Blood-Brain Barrier

Not all chemicals in our bloodstream can enter the brain. A semipermeable, protective layer of cells called the blood-brain barrier (BBB) limits what substances can enter the brain while still allowing oxygen and nutrients through. [1] Psychoactive drugs have specific chemical properties that allow them to cross the BBB, which is why they can affect how we think and act.

Drug Absorption, Metabolism, and Concentration

As mentioned in the **Background** section, the higher dose of a drug that is used, the larger the drug effects, as well as the greater the risk of harmful outcomes. [1] The specific effects and risks that are seen depend on (1) what substance is used (see [Lesson 19's Facilitator Background Deep-Dive](#) for more), and (2) how quickly a substance can reach its peak concentration in the body/brain. For the latter, a drug's speed of getting to the brain and its peak concentration depend on the route of administration used.

For example, when a drug is swallowed, it must dissolve in the gut before it can be absorbed into the small intestine's capillaries. [1] How much of the drug gets absorbed into the bloodstream can vary depending on the substance and what else is in the stomach. [1] Then before it can circulate through the rest of the body and reach the brain, the drug will pass through the liver and get partially broken down via first-pass **metabolism**. [1] Because of these two processes (gut absorption and metabolism), the buildup of drug concentrations for oral ingestion is slow. [1] This may sound reassuring, but the delayed onset of substance effects often causes people to take more before the first dose hits, which increases the risk of harmful outcomes.

In contrast, other routes of administration avoid first-pass metabolism before reaching the brain. [1] After they're absorbed into the bloodstream—through the lungs (smoking/vaping), the nasal lining (snorting), the mouth lining (nicotine pouches), or under the tongue (sublingual)—they can initially bypass the liver and reach the brain more quickly. [1] These routes have faster onset times and often higher peak concentrations than oral ingestion. [1] Then on the extreme end, injecting a drug into a vein bypasses both absorption and first-pass metabolism, meaning the brain can quickly get flooded with a very high concentration of the drug. [1] These routes afford someone little time to react in the event of overdose.

Drug Elimination from the Body

Once a drug is in the bloodstream, it will continue to circulate throughout the body—including back to the brain—until it gets metabolized (often in the liver) and excreted from the body (often through the kidneys). Special enzymes in the liver are able to chemically alter drug molecules, turning them into byproducts called metabolites [1, 2]. Most of the time, these metabolites are biologically inactive, meaning they can no longer affect the brain or body. But some drug metabolites remain psychoactive and must be broken down further before they are deactivated, as with certain byproducts of THC [1]. Metabolized drugs have an easier time being excreted by the kidneys [1, 2]. As they're excreted, drug concentrations drop in the blood and their effects fade.



Neuroscience Companion Lesson

Lesson 2: Neurons

What it is

Youth create their own neuron models and put them to action through a simulation to learn how the brain communicates with the body, which allows us to think, feel, and move.

Why it matters

Understanding how neurons work introduces youth to how the brain and nervous system function, laying the groundwork for further learning in the health sciences. It can help them understand how their thoughts, feelings, and behaviors are processed and encourage them to engage in activities that support healthy brain function and interaction with their world, such as getting enough sleep, eating a balanced diet, and exercising regularly.

Getting started

Time: 45 minutes

Grade level: 6-8

Delivery mode: Online, blended, or in person

Materials:

- Means to share [slide deck](#) and accompanying YouTube videos
- — Board/easel paper and marker
- — Masking tape
- 4 Sample pipe cleaner neurons (see **Facilitator Prep**)
- 1 Pair of scissors for every 3 or 4 people
- 3 Pom-poms per group of 3 people
- 1 Piece of candy per person
- 5 Pipe cleaners per person (*4 different colors; 1 color used twice*)
- 1 (Optional) Print copy: [Pipe Cleaner Neuron Instructions](#) per person

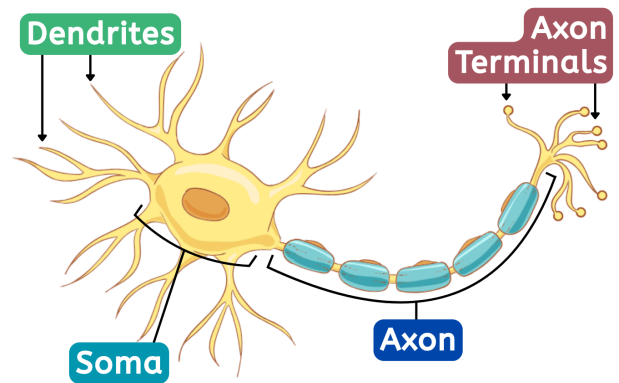
Facilitator Prep:

- Use the [Pipe Cleaner Neuron Instructions](#) to make 4 pipe cleaner neurons that you can use for the demonstration in **Activity 3**.

Background

Our brains are made up of billions of specialized cells called **neurons**. At the most basic level, a neuron's job is to receive, integrate, and transmit information to other cells throughout the nervous system. To accomplish this, neurons use a combination of electrical and chemical signaling.

To understand how neuron signaling works, it's helpful to reference a diagram (see image to the right). First, a neuron receives incoming signals at its **dendrites**—these signals can either encourage the neuron to fire or discourage it from firing. All of the incoming signals are combined in the neuron's **soma** or its cell body, and if enough signals tell it to fire, it will generate an electrical impulse called an **action potential**. This electrical signal travels down the length of the **axon**, toward the **axon terminals** where it triggers the release of **neurotransmitters**—which are chemical messengers (like dopamine)—into the **synapse** (the tiny space between two neurons). Once they're in the synapse, these neurotransmitters can bind to receptors on the dendrites of other neurons, starting the whole process over. In short, neurons communicate by receiving chemical signals, firing electrical signals down their axon, and passing on their own chemical signals to many other connected neurons.



This network of neuronal communication is the foundation for everything we experience, and ultimately gives us the ability to interact with the world around us.

Words to Know

Neuron: cells in the brain and nervous system that receive, process, and send information throughout the body using electrical and chemical signals

Dendrites: branched extensions of a neuron that receive incoming chemical signals (neurotransmitters) from other neurons and other types of cells

Soma: the cell body of a neuron where it combines its incoming signals that are encouraging (or discouraging) it to fire an electrical impulse (an action potential)

Action potential: a fast electrical impulse that travels down the length of a neuron once it receives enough signals encouraging it to fire

Axon: a long, thin part of a neuron that carries an electrical signal away from the soma towards target cells. Many axons are wrapped in myelin, a substance that insulates the axon and helps the signal travel faster.

Axon terminals: the branched ends of an axon that convert an electrical signal back into a chemical signal by releasing neurotransmitters into the synapse

Neurotransmitters: chemical messengers that neurons use to communicate with each other by binding to receptors on another neuron

Synapse: the tiny gap between two neurons (or a neuron and another cell) where neurotransmitters carry a signal from one cell to another

What to do

Introduction (5 minutes)

1. (Slide 2) Ask for a volunteer to catch a bean bag—throw it to the volunteer and have them throw it back to you.
2. Ask the group, “What did the volunteer have to do to catch the bean bag? How was their brain involved?”
3. (Slide 3) Share this 10-second [Neurons or Nerve Cells](#) video (linked in slide 3 of the [slide deck](#)), and ask, “What are you seeing? What is all that light traveling so quickly?”
4. Explain that these are brain cells called **neurons**, and they are part of what make up your brain and the rest of your nervous system throughout your body. This video simulates what neurons look like in action. The lights in the video look like electricity, and it is! Those electrical signals help neurons communicate with each other.
5. Neurons enable us to think, feel, and move—like telling our hand to reach out and catch a bean bag. Let’s learn more about how that happens.

Activity 1: Make a Neuron (10 minutes)

6. (Slide 4) To learn more about how they work, we’re going to explore the structure of a neuron by making our own neuron models. Pass out pipe cleaners and scissors. Each person should have 5 pipe cleaners in 4 different colors.
7. Briefly show a diagram of a neuron and explain the parts. They’ll get to know these parts well over the next couple of activities, so it’s OK if they don’t remember the names of the parts for now!
 - Dendrites receive messages in the form of chemical messengers called neurotransmitters.
 - The soma (the nucleus or brain of the neuron cell) decides whether or not to fire off an electrical signal.
 - The electrical signal travels down the axon (the myelin sheath covers the axon to help the signal travel faster).
 - The axon terminals release neurotransmitters to tell the next neuron what to do.
8. (Slides 5-9) Use slides 5 to 9 to demonstrate each step of making a pipe cleaner neuron and have them follow along (and/or pass out [instruction sheets](#)). In the notes of each slide, you will ask youth to guess what part of the neuron they are making by comparing it to the neuron diagram, and you will explain the part’s function.
9. (Slide 10) Their completed neuron should look something like the one shown on slide 10. After helping with any trouble-shooting, have youth trace their finger along their neuron as you review how it works:
 - The dendrites receive chemical messages called neurotransmitters.
 - The soma combines all the incoming info and decides whether to send an electrical signal called an action potential.

- The electrical signal travels down the axon (the myelin sheath helps this signal travel faster).
- The axon terminals release other chemical messages (neurotransmitters) to other neurons.

10. (Slide 11) Explain the key takeaway:

Key Takeaway: Neurons are cells that send and receive chemical and electrical messages throughout the brain and nervous system, allowing us to think, feel, and move.

Activity 2: Neuron Messengers (10 minutes)

11. As we learned, neurons use both electrical and chemical signals to communicate. Play the [How Neurons Communicate](#) (1:18 min) video to show how the neurons process both chemical and electrical signals.
12. (Slide 13) Have youth place a finger on the dendrites of their neurons. As the video describes, the dendrites receive chemical messages called **neurotransmitters**. The electrical signals travel *within* a neuron, while these chemical signals transmit information across the **synapse** (gap) *between* neurons.
13. (Slide 14) To demonstrate how neurons connect, have youth pair up briefly to hold up their neurons to each other, dendrites of one to the axon terminals of the other.
14. (Slide 15) Play the [Synapses In Action](#) (16 seconds) video so show youth what this looks like. In the video, you saw axon terminals release the neurotransmitters, and the dendrites of another neuron receiving the neurotransmitters.
15. (Slides 16-18). There are all kinds of these neurotransmitter chemicals in your brain that help communicate information. Most of them work all throughout our brains, but some are best known for certain jobs, like helping control our emotions. Ask youth which neurotransmitters they recognize and help them come up with examples of activities that help neurons release these chemicals, such as:
 - (Slide 16) **Adrenaline** (fight/flight): watching a scary movie, making an exciting sports play
 - (Slide 17) **Dopamine** (motivation/reward): completing a homework assignment, eating chocolate, playing a video game
 - (Slide 18) **Acetylcholine** (muscle activation): kicking a soccer ball, playing piano, doing a push-up
16. (Slide 19) Do a few very quick little exercises and ask youth to name which neurotransmitter they may be feeling the effects of as a result.
 - Tell youth that you are going to randomly call on someone to sing a song in front of the whole group. Pause for a moment and then say, "**Don't worry, no one actually has to sing. Just introducing the idea was probably enough to make many of you (if not all of you) feel nervous.**"
 - *Nervousness of adrenaline*
 - Do a quick hand gesture pattern (clap, snap, tap) and have youth copy you.
 - *Muscle contraction of acetylcholine*
 - Toss a piece of candy to the first person to guess your middle name/pet's name.
 - *Reward/motivation of dopamine*

17. (Slide 20) The next two neurotransmitters aren't as closely tied to specific functions like some of the other ones.
- **Glutamate**: turns neuron activity up (excites)—helps strengthen connections during learning
 - **GABA**: turns neuron activity down (inhibits)—helps keep the brain calm, balanced, and controlled
18. Ask youth to consider what would happen if we didn't have these neurotransmitters. For instance, without dopamine, we wouldn't feel motivated to do certain things like hanging out with friends or doing homework. Without adrenaline, some sports may not feel as exciting. Without acetylcholine, movement would be really hard, if not impossible!
19. (Slide 21) Explain the key takeaway:

Key Takeaway: Neurons need neurotransmitters to communicate with each other so that we can go about our daily tasks, such as sports, homework, and hanging out with friends.

Activity 3: Neurons in Action (15 minutes)

20. Let's put all this into action! Ask for another volunteer to catch a bean bag you throw to them and have them throw it back. Ask youth to think about what was happening in the volunteer's brain and nervous system to be able to catch the bean bag.
21. (Slide 23) Have youth form groups of 3 with their pipe cleaner neurons and ask them to decide which person will be the volunteer "body." This person will stand while the rest of the group builds a neuron pathway on them. Pass out pom-poms to each group.
22. Draw a simple outline of a human body on the board. Explain that you will model how neurons communicate from the brain to the hand using this outline. As you build the pathway on the board taping pipe cleaner neurons in place, each small group will follow along by positioning (not taping) their neurons on their volunteer "body."
- Your brain first responds to a stimulus—in this case, your eyes see the bean bag flying towards you. Neurons in the brain receive chemical signals, including the neurotransmitter **glutamate**, which helps activate the pathway.
 - *Tape a neuron to the head of the outline figure with the dendrites facing the eyes and the axon terminals facing the back of the brain (occipital lobe). Have one person in each group hold their neuron to their volunteer's head in the same way.*
 - *Place a pom-pom at the axon terminals to represent the glutamate being passed.*
 - Motor neurons in the brain use glutamate to pass the message from the brain to the spinal cord.
 - *Tape another neuron along the spine, making sure the dendrites are oriented toward the axon terminals of the previous neuron. Have youth position their neuron the same way on the upper back of the volunteer.*
 - *Place a pom-pom at the axon terminals to represent the glutamate being passed.*
 - Motor neurons in the spinal cord transmit the signal to muscle fibers in the arm. The neurotransmitter **acetylcholine** helps trigger muscles to contract.

- Tape another neuron along the arm, dendrites facing the axon terminals of the previous neuron. Have youth position their neuron along the volunteer's arm in the same way.
- Place a pom-pom at the axon terminals to represent the acetylcholine.

23. (Slide 22) Explain the key takeaway:

Key Takeaway: Neurons connect our brain to the rest of the nervous system, linking our muscles and senses and allowing us to process and interact with our external world.

Reflection (5 minutes)

24. (Slide 23) Gather as a large group to talk about the experience.

- What did you learn about neurons that you did not already know?
- What is the most interesting thing you learned?
- How is it helpful to know about how neurons work?
- What other questions did this bring up for you?

Take it further

- Have youth work in small groups to come up with a way to visually demonstrate how neurons communicate, using the pipe cleaner neurons they made, pom poms, and any other items in the room to help them.
- Have youth learn about what can happen when neurons are damaged or nerve cells stop working and then share with the group what they learned.

Author: Jessica Pierson Russo, UMN Extension Department of Youth Development

Reviewer: Jonathan Lehman, Research Professional II, Community Engagement and Education Hub, Masonic Institute for the Developing Brain

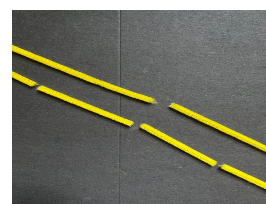
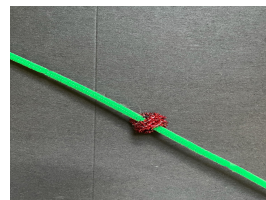
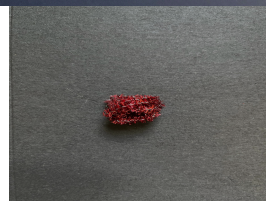
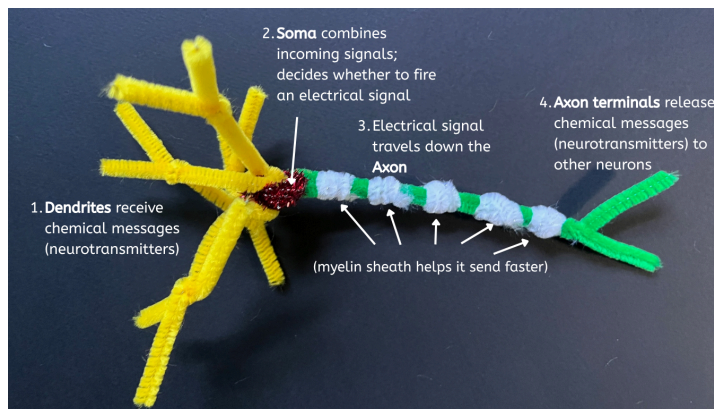
Pipe Cleaner Neuron Instructions⁸

Materials:

- 5 pipe cleaners in 4 different colors
- Scissors

Instructions:

1. Take your two pipe cleaners that are the same color and set them aside.
2. Choose a different color to make your **soma** (cell body). Roll it into a loose ball.
3. Take another color pipe cleaner and push it through the ball so you have two halves on either side of the cell body. Then twist the two halves so you have one branch. This is the **axon**.
4. Take the two pipe cleaners you set aside in step one and cut one of them in half. Cut the other one into four equal pieces. Push each of these pieces through the cell body and twist them slightly however you'd like to make branches, like a tree. These will be the **dendrites**.
5. Select another color and cut it into four or five pieces. Wrap each piece along the length of the axon to represent the **myelin sheath**.
6. Take the end of your axon and separate the ends a bit to make the **axon terminals**.



⁸ Activity adapted from [University of Wisconsin—Madison Pipe Cleaner Neuron Activity](#).



Lesson 22: How Drugs Disrupt the Brain

What it is

Youth learn how drugs can disrupt the signals our brains use every day—impacting how we think, move, feel and react—by visualizing what that looks like in a movement activity.

Why it matters

Substances don't just make an individual feel a certain way—they can actually change the way the brain works. When youth have a deeper understanding of how drugs and substances can disrupt the brain's normal signaling systems, they're better able to recognize the risks and understand what is happening to the brain when drugs are in their system.

Getting started

Time: 45 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- Optional: Means to share [slidedeck](#)
- [Introduction](#)
 - Two pre-made pipe cleaner neurons
 - Optional: Means to watch [How Neurons Communicate](#)
- [Activity: Bean Bag Pass](#)
 - [Bean bags](#) - 20 total
 - 5 per group (2 groups total)
 - 5 per "drug team" (2 people total)
 - Bucket or other [container](#) - 2 per group (2 groups total)
 - [Drug Role cards](#)

Facilitator Prep:

- Go through the questions you collected from Activity 1 in [Lesson 19](#) and mark the ones that this lesson will address.
- Using the Pipe Cleaner Neuron Instructions in [Lesson 2](#), prepare two pipe cleaner neurons for the [Introduction](#).
- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

Drugs can change how brain cells (neurons) talk to each other. Normally, neurons send chemical messages using neurotransmitters—tiny messengers that help your brain control what you think, feel, and do. The neurotransmitters are released from one neuron, across a gap (called a **synapse**), and bind to **receptors** on another neuron before being cleared away. Drugs can interfere with this messaging in three common ways:

1. Some drugs **mimic** neurotransmitters, activating their receptors at the wrong time (acting as receptor **agonists**, like THC in cannabis).
2. Other drugs **block** receptors so the message can't get through (acting as receptor **antagonists**, like caffeine keeping you awake by blocking signals that promote sleepiness).
3. Some drugs **change how much** of a neurotransmitter is available, making signals stronger or last longer (like cocaine acting as a **reuptake inhibitor**, preventing certain neurotransmitters from being cleared away as quickly).

In each case, drugs change how the brain normally works, which can change how you feel, move, react, or think.

For more information, see the [Facilitator Background Deep-Dive](#).

Words to Know

Agonist: a type of drug that effectively “mimics” neurotransmitters. By activating receptors at the wrong time without an external stimulus, drug agonists can disrupt normal signaling, causing psychoactive effects.

Antagonist: a type of drug that effectively “blocks” receptors. By blocking neurotransmitters from binding to receptors and sending their signals forward, drug antagonists can keep certain parts of the brain from functioning normally, causing psychoactive effects.

Reuptake Inhibitor: a type of drug that effectively “boosts” neurotransmitter signals. By preventing neurotransmitters from being cleared from the synapse, reuptake inhibitors can make neuron signals stronger or last longer, causing psychoactive effects.

Stimulus: the action or “event” that happens inside or outside the body that triggers neurons to start signaling, like getting pinched.

Effect: the “result” of neuron signaling. It can be the feeling you experience or something your body does in response to a stimulus, like feeling pain.

Synapse: the tiny gap between two neurons where one neuron passes a signal to the next using neurotransmitters.

Receptor: the “docking site” on a neuron where neurotransmitters bind to help pass signals along.

What to do

Introduction (10 min)

1. Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. (Slide 2) Hold up two premade pipe cleaner neurons and ask youth to identify what is being held up—neurons! Ask youth, “Who can remember how neurons communicate?”⁹
3. (Slide 3) Following their responses, provide a very simplified summary referencing what was covered in [Lesson 2](#).
 - A neuron releases a neurotransmitter (chemical) into the **synapse**.
 - Once in the synapse, the neurotransmitter can bind to a receptor on the neuron, driving the signal onward.
 - The neurotransmitter then unbinds from the receptor and gets cleared from the synapse.
 - (Slide 4) Optional: Share the video, [How Neurons Communicate](#) (1:18 min)
4. (Slide 5) Explain that neurons don’t communicate randomly, they fire in response to something—called a **stimulus**—such as hearing exciting news or stubbing your toe. Ask youth:
 - “When you hear exciting news, how might you feel?”
 - “When you stub your toe, how might you feel?”
5. (Slide 6) Explain that when something happens (a stimulus), it starts a signal chain in your neurons, almost like a domino effect. That signal travels from neuron to neuron until it reaches a part of the brain where you can feel or experience the **effects** of the stimulus.
6. (Slide 7) “Let’s say a ball is thrown at you and you quickly react to catch it. What do you think is happening in the brain?” Write out the following visual for youth to see:
 - **Ball Thrown → Neuron Signaling → Ball Caught**
 - Explain, “You see the ball, your brain figures out what to do and sends a message through the spinal cord to your arm and hand so they can react.”
7. (Slide 8) Ask youth, “Now, let’s take the same example of someone throwing a ball to you. What do you think happens to that neuron signaling (neuron communication) when someone uses a drug? Let’s say that drug is THC.” Write out the following visual for youth to see:
 - **Ball Thrown → Altered Neuron Signaling → Ball hits you because you reacted too slowly**
 - Explain that drugs can change the signals our brains use everyday and can directly impact how we think, move, feel and perceive things.
8. Let’s explore this further!

Activity: Bean Bag Pass (30 minutes)

9. (Slide 9) Divide youth into two groups (if there are less than 8 youth total, one group is fine).
10. Have each team form a line, with an empty bucket at the end of the line, and a pile of bean bags at the front of the line. (The amount of space between each person doesn’t matter, so adjust based on the space you have available). Explain to youth:
 - The people on your team represent neurons.

⁹ For reference, see [Lesson 2: Neurons](#).

- The pile of bean bags represents the source of the signal.
 - Each bean bag represents the signal being carried from neuron to neuron.
 - The bucket represents the part of the brain where you feel or experience the effects of the stimulus.
11. Explain that the teams will be passing bean bags down the line, dropping them into the bucket at the end of the line. Share a few rules for each round:
- The first person in line can't grab any bean bags from the pile until **after** the "stimulus scenario" has been called out. They can also only grab **one** bean bag at a time.
 - The last person in line will place the bean bags they receive into the bucket.
 - Teams should continue passing bean bags down the line until they hear the cue "Stop!" (approximately 15-30 seconds per round).
12. Let youth know they will be playing four rounds.

Round 1: Typical Neuron Signaling

- (Slide 10) **Begin round 1:**
 - Stimulus: Say, "Stimulus! You just touched something cold!"
 - Players can now begin passing bean bags down the line, placing them into the bucket. Have groups continue until they run out of bean bags or you say "Stop!"
- (Slide 11) **Reflect and explain:**
 - "Passing bean bags into the bucket represents your brain processing that you just touched something cold. The signal traveled from neurons in your hand to your brain. What effect are you going to experience when you touch something cold?" *An effect might be that your hand begins to feel cold, or you might pull your hand away in discomfort.*
- (Slide 12) Explain the key takeaway:

Key Takeaway: All of our actions, feelings, and experiences are thanks to billions of neurons communicating with one another across our brain and body. This is the basis for how our brains function.

13. Reset the bean bags by grabbing them from the bucket and bringing them back to the front of the line.
14. (Slide 13) Ask for 1 volunteer per group who will serve as "the drug." Explain to the large group that their goal will be to disrupt the brain's normal communication by changing how the round is run.

Round 2: Drug Antagonist ("Blocker")

- **Before beginning Round 2:**
 - Drug Instructions: Tell the "drug" volunteers that they will stand in front of one of the neuron team members from their group, intercepting the bean bag and stopping it from being passed down the line. You can give them a Round 2 [Drug Blocker card](#) to remind them of their role.
 - Remind teams that the "drug" volunteers are going to change something about the round. Teams should still follow their Round 1 instructions if possible.
- (Slide 14) **Begin Round 2:**

- Stimulus: Say, "Stimulus! It's late at night around your normal bedtime!"
- Players will now attempt to pass bean bags down the line, but the flow of bean bags will be interrupted by the "drug" volunteers, blocking the signal from reaching the bucket.
- (Slide 15) **Reflect and explain**:
 - Ask, "What effect might you experience if it's around your normal bedtime?" *An effect might be that you're feeling sleepy or tired.*
 - Remind youth that the bucket represents the part of the brain where you experience the stimulus's effect. Ask youth, "Did the signal reach the part of your brain that makes you feel sleepy or tired?" *No.*
 - Ask youth, "What did the drug do to you?" *The drug blocked the signal that was supposed to tell your body how late it was, stopping you from becoming sleepy or tired.*
- Optional (Slide 16):
 - Explain that certain types of drugs can block neurotransmitters from completing the signals in your brain, leading to a reduced effect. These are called **drug antagonists**.
 - Ask, "What's an example of a drug antagonist?" *Caffeine.*
 - Explain, "Like in our Round 2 example, caffeine works as a drug antagonist, blocking the "sleep pathways" in your brain, preventing your brain from winding down and relaxing."
- (Slide 17) Explain the key takeaway:

Key Takeaway: Some drugs can interrupt or block brain signals. This matters because drugs can disrupt your brain's normal, everyday functions like sleep.

15. Reset the bean bags by having one of the group members bring them back to the front of the line.

Round 3: Drug Agonist ("Mimickers")

- **Before beginning Round 3**:
 - Drug Instructions: Hand the "drug" volunteers 5 bean bags. Tell them that they will be handing these bean bags to the first person in their team's line, one at a time. Tell them that they can begin as soon as you cue them to start. They should continue handing out bean bags until they hear you call out "stop!" You can give them a Round 3 [Drug Mimicker card](#) to remind them of their role.
 - Remind teams that the "drug" volunteers are going to change something about the round. Teams should still follow their Round 1 instructions if possible.
- (Slide 18) **Begin Round 3**:
 - Cue the "drug" volunteers to start passing their bean bags to the first person in their team's line. You won't call out any stimulus this round.
 - If youth hesitate because there was no stimulus called, encourage them to pass the bean bags down the line, leaving the pile on the ground alone.
- (Slide 19) **Reflect and explain**:
 - Ask, "What was the stimulus in this round?" *There was no external stimulus.*

- Tell youth, “Even though there was no external stimulus, some bean bags still made it into the bucket, which means there was still an effect in the brain. Let’s say the effect was losing your balance and feeling really uncoordinated.”
- Ask, “If there was no external stimulus, how is there an effect? What started the signal?” *The drug started the signal.*
- Explain, “Certain drugs can activate or start the neuron signaling in our brain without an external stimulus. So this means that we may experience a feeling or an effect too strongly or at the wrong time.”
- Optional (Slide 20):
 - Explain that drugs that can activate or start the neuron signaling in our brain without a stimulus are called **drug agonists**.
 - Ask, “What’s an example of a drug agonist?” *THC.*
 - Explain, “Like in our Round 3 example, THC can trigger certain effects we experience—like loss of coordination. By activating the receptors that help control the precision and timing of motor movements, THC can make someone’s movements slower and less coordinated, even when they’re trying to move normally.”
- (Slide 21) Explain the key takeaway:

Key Takeaway: Some drugs can kickstart brain signaling too strongly or at the wrong time. This matters because these drugs can disrupt basic functions we rely on every day—like motor coordination while driving—putting you and the people around you in unsafe situations.

16. Reset the bean bags by placing five bean bags in each team’s starting pile and giving five bean bags to each of the “drug” volunteers..

Round 4: Reuptake Inhibitors (“Booster”)

- **Before beginning Round 4:**
 - Drug Instructions: Tell the “drug” volunteer to monitor their group’s starting pile. Once it gets down to one bean bag remaining, they should add their bean bags to the pile.
 - Remind teams that the “drug” volunteers are going to change something about the round. Teams should still follow their Round 1 instructions if possible. You can give them a Round 4 [Drug Booster card](#) to remind them of their role.
 - This round will end as soon as all of the bean bags have made it into the bucket.
- (Slide 22) **Begin Round 4:**
 - Stimulus: Say, “*Stimulus! You just texted your friend and within a few seconds, you feel your phone buzz with a notification!*”
 - Players can now begin passing bean bags down the line, placing them into the bucket. Have groups continue until they run out of bean bags.
- (Slide 23) **Reflect and explain:**
 - Ask, “*What was the stimulus in this round?*” *You received a text on your phone.*
 - Ask, “*What effect might you experience if you receive a phone notification?*” *We might feel happy, intrigued, nervous, relieved, etc.*

- Ask, “What was different about this round?” The “drug” volunteer added more beanbags to the pile, making the round last longer.
- Remind youth that the bean bags represent the signal being passed from neuron to neuron. When the drug entered the picture, the signal lasted longer than it was supposed to, making the effect last longer.
- Ask youth, “What did the drug do to you?” The drug extended the effect you felt. Instead of feeling a little nervous upon receiving a text response from your friend, you get stuck feeling anxious.
- Optional (Slide 24):
 - Explain that some drugs can prevent neurotransmitters from being cleared away, which makes the **signal last longer** and some drugs can increase the amount of neurotransmitters in the synapse, which makes the **signal stronger**. These drugs are called **reuptake inhibitors**. Reuptake inhibitors can create longer, stronger effects than normal.
 - Ask, “What’s an example of a reuptake inhibitor?” Cocaine.
 - Explain, “Like in our Round 4 example, cocaine works as a reuptake inhibitor, extending or prolonging signals, including in our brain’s anxiety systems. So if cocaine were in a person’s system, they might start to feel very anxious, and even paranoid—overthinking the text response from their friend.”
- (Slide 25) Explain the key takeaway:

Key Takeaway: Some drugs can prolong the duration of brain signals, making their effects last longer like amplifying someone’s anxiety. This mechanism can be helpful like we see in antidepressants that are prescribed by a doctor, but it can be harmful when it comes from meds that are being misused or drugs that aren’t designed to regulate the brain.

17. (Slide 26) Conclude the Bean Bag Toss activity by reiterating that drugs change the signals your brain uses everyday and can directly impact how we think, move, feel and perceive things. This matters because your brain is still developing and growing!

Reflection (5 minutes)

18. (Slide 27) Gather youth together to talk about their experience:
 - What are the three ways a drug can change the communication signals in our brain? *Block, mimic and boost.*
 - Why does it matter that drugs disrupt the signals your brain uses everyday?
 - What’s one impactful thing you learned that you didn’t know before?

Lesson 22 References

1. Hart, C. L., & Ksir, C. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw Hill.
2. Ronan, P. J., Wongngamnit, N., & Beresford, T. P. (2016). [Molecular mechanisms of cannabis signaling in the brain](#). *Progress in Molecular Biology and Translational Science*, 137, 123–147.

3. Jäger, G., & Witkamp, R. F. (2014). [The endocannabinoid system and appetite: Relevance for food reward](#). *Nutrition Research Reviews*, 27(1), 172–185.
4. Reichert, C. F., Deboer, T., & Landolt, H. P. (2022). [Adenosine, caffeine, and sleep-wake regulation: State of the science and perspectives](#). *Journal of Sleep Research*, 31(4), e13597.
5. Trifilieff, P., & Martinez, D. (2014). [Cocaine: Mechanism and effects in the human brain](#). In *The effects of drug abuse on the human nervous system* (pp. 103–133). Elsevier.
6. Schank, J. R., Liles, L. C., & Weinshenker, D. (2008). [Norepinephrine signaling through \$\beta\$ -adrenergic receptors is critical for expression of cocaine-induced anxiety](#). *Biological Psychiatry*, 63(11), 1007–1012.
7. Heninger, G. R., & Charney, D. S. (1988). [Monoamine receptor systems and anxiety disorders](#). *Psychiatric Clinics of North America*, 11(2), 309–326.
8. Clark B. (2025, January 15). Neurobiology of substance use disorders.

Facilitator Background Deep-Dive

In [Lesson 2](#), we learned about how neurons communicate with each other via chemical messengers called neurotransmitters. Normally, when a **presynaptic neuron** ("sender" neuron) passes along a message, it releases neurotransmitters into the synapse (space between two neurons), which then bind to receptors on a **postsynaptic neuron** ("receiver" neuron) to pass the signal onward. These neurotransmitters are then cleared from the synapse. [\[1\]](#) Our brains rely on interconnected networks of these neurons to translate a **stimulus** (a signal, like getting pinched) into an actual experience or **effect** (like feeling pain).

However, when substances act on the brain, they tap into these same networks we use every day and either boost or reduce neuron signaling, which changes how we think, feel, and perceive things.¹⁰ Substances are able to alter neuron signaling a few different ways:

1. Mimicking Neurotransmitters

- The most straightforward mechanism is when a drug molecule is structurally similar to a neurotransmitter. This means the shapes of the drug molecule and the neurotransmitter nearly match. These drugs are able to bind to and activate the receptors on the postsynaptic neuron, just like a neurotransmitter normally does. These mimicking molecules are called receptor **agonists**. [\[1\]](#)
- Drug agonists can activate certain parts of the brain without an external stimulus, causing psychoactive effects.
- Example: THC, the psychoactive molecule in cannabis, acts as a CB1 receptor agonist. In other words, THC can activate CB1 receptors like endocannabinoid neurotransmitters normally do. The endocannabinoid system plays a role in appetite, which helps explain why cannabis can make people hungry. [\[1, 2, 3\]](#)

2. Blocking Neurotransmitters

- Some drugs have a few structural similarities to a neurotransmitter, but instead of being able to activate a receptor, they instead sit and block any neurotransmitters from binding to the receptor. These molecules are called receptor **antagonists**. [\[1\]](#)
- By blocking neurotransmitters from sending their signals, antagonists can keep certain parts of the brain from functioning normally, causing psychoactive effects.
- Example: Caffeine is an adenosine receptor antagonist, meaning it blocks adenosine from binding. Adenosine normally plays a role in sleep-regulation, which explains why caffeine can impact people's ability to fall asleep. [\[1, 4\]](#)

¹⁰ Note that even though the bloodstream delivers drugs all throughout the brain, not every part of the brain or every neuron gets affected by a drug—drugs have selective mechanisms of action. Since the brain is made of networks of several different types of neurons that use different neurotransmitters, a drug that impacts one part of the brain might not have an impact on another.

3. Modulating Neurotransmitter Availability

- Instead of interacting with postsynaptic receptors directly, drug molecules can instead change the availability of neurotransmitters in the synapse. [1] Drugs accomplish this by either:
 - Increasing the amount of neurotransmitter that's available in the synapse (*e.g., synthesizing or releasing more of a neurotransmitter*).
 - Prolonging how long neurotransmitters stay in the synapse (*e.g., preventing neurotransmitters from being cleared away*).
- Having more neurotransmitters in the synapse *amplifies* a signal, and having neurotransmitters stick around for longer *prolongs* a signal—resulting in psychoactive effects.
- Example: Cocaine works as a monoamine **reuptake inhibitor**, meaning it can stop serotonin, norepinephrine, and dopamine neurotransmitters from being cleared away from the synapse. This can result in longer and stronger monoamine signals. These neurotransmitters are known to play a role in anxiety, which explains some of cocaine's anxiety-inducing effects. [1, 5, 6, 7]

Across all of these mechanisms, the key takeaway is that drugs enhance/amplify the effects of regular neurotransmitter signaling. In other words, drugs cause their psychoactive effects by utilizing the body's normal, everyday systems and changing how they function. [8]

Drug Roles

 Round 2 Drug Blocker Role: Pick a spot in line and stand between two neurons. <u>Block the beanbags</u> from being passed down the line. (You, “the drug”, are blocking the signal.)	 Round 2 Drug Blocker Role: Pick a spot in line and stand between two neurons. <u>Block the beanbags</u> from being passed down the line. (You, “the drug”, are blocking the signal.)
 Round 3 Drug Mimicker Role: <u>Pass the new bean bags</u> to the first person in line, one at a time. (There will be no stimulus, you, “the drug”, are the stimulus)	 Round 3 Drug Mimicker Role: <u>Pass the new bean bags</u> to the first person in line, one at a time. (There will be no stimulus, you, “the drug”, are the stimulus)
 Round 4 Drug Booster Role: When the neuron team's beanbag pile runs low, <u>add beanbags to their pile.</u> (You, “the drug”, are prolonging the signal.)	 Round 4 Drug Booster Role: When the neuron team's beanbag pile runs low, <u>add beanbags to their pile.</u> (You, “the drug”, are prolonging the signal.)



Lesson 23: Understanding Addiction

What it is

Youth learn that addiction is a brain-based disorder that develops through repeated drug use and leads to biological changes like tolerance and dependence, by building shared language and reducing stigma through discussion and art work.

Why it matters

Framing addiction as a brain-based disorder helps youth understand that it's not simply a behavior that someone chooses. This understanding helps build empathy towards those who struggle with chronic substance use, destigmatizing addiction. Providing youth with space to discuss what addiction does to the brain and body can also empower youth to process a very complex topic in a safe way.

Getting started

Time: 40 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- For facilitation:
 - Means to share [Lesson 23 slide deck](#)
 - Means to play video, [Nuggets](#)
 - Board/easel paper with marker/chalk
 - Optional: music to play while making art on addiction
- Per person:
 - Blank paper
 - Coloring supplies

Facilitator Prep:

- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

Addiction is a word that most of us have encountered in everyday life—maybe you've heard it used when talking about a family member with a gambling addiction, or maybe you've used it casually to talk about how you're "addicted to your phone." More common still, you've probably heard the term when people talk

about drug use, where chronic users are often labelled “drug addicts.” But across these different ways of thinking about addiction, what does it really mean to be addicted to something? Is addiction just a choice, or is it something else?

When experts think about **addiction**, they describe it as a chronic brain disorder where drug use becomes compulsive and hard to stop, even when it causes harm [1]. When doctors and public health officials talk about these behaviors, they refer to them as substance use disorders. When someone repeatedly uses substances over time, that repeated use is able to rewire our brains, changing how our brains and bodies respond to substances. There are two major processes that can be used to describe these changes: tolerance and dependence.

Tolerance essentially means that the more someone uses a substance over time, the less effective that substance becomes [1]. While **dependence** refers to your body physically and psychologically becoming reliant on a substance to function [2]. We will touch more on each of these processes in [Lesson 24](#).

When we think of addiction as changes in how the brain and body respond to substances, it's easier to see how voluntary drug use can turn into compulsive use over time. In other words, biological changes can help explain the behavioral changes we see in people who repeatedly use drugs.

It's important to note that addiction is a very complex disorder that is influenced by a combination of biological changes, genetics, environmental factors, trauma, structural inequities, and more, meaning that the impacts of addiction vary from person to person [2].

What to do

Introduction (5 min)

1. (Slide 1) Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. (Slide 2) Explain to youth that sometimes the things we enjoy turn into habits we repeat (youth may recall this from [Lesson 13](#) where we talked about the brain's habit and reward hubs).
3. Ask youth, “**What are some things you enjoy?**” (a tasty snack, a computer game, movement or exercise). “**Do some of these things turn into habits?**”
4. (Slide 3) Explain that, like with Social Media, a like or comment on a post might make us feel really happy. We feel good, so we want to check our phone more frequently, multiple times a day. After repeated use, comments and likes don't give us the same sense of satisfaction we just felt, but we continue to seek out more time on our screens. **What do you think is happening?**
5. (Slide 4) Explain that some habits can form addictions—like an impulse to do something that you can't control. Ask youth, “**What are some examples of things people can be addicted to?**” *Sample answers: cigarettes, alcohol, gambling, caffeine, social media.*
6. Explain that we're going to explore the concept of addiction to find out—is it a choice, or is it something else? The next activity will help us begin to answer this question.

Activity 1: Nuggets (15 minutes)

7. (Slide 5) Watch the [Nuggets](#) video.
8. Debrief the video as a large group:
 - (Slide 6) **What do you think Kiwi (the bird) felt the first time he ate the golden nugget?**
Key point: Kiwi feels great after he eats the first nugget—the world seems bright and colorful.
 - (Slide 7) **What happens to Kiwi after he eats the second nugget?**
Key point: After the second nugget, he starts running to seek out more nuggets—he wants to feel good!
 - (Slide 8) **What started to happen to Kiwi after eating the third nugget?**
Key point: After the third nugget, he crashes to the ground experiencing some harmful effects. He also starts to turn gray.
 - (Slide 9) **Did the effects from the nugget change over time? How did Kiwi change physically? What do you think Kiwi was feeling by the end?**
Key points:
 - *It seemed like the Kiwi enjoyed the nuggets at first, but then he started to feel some harmful effects from them.*
 - *The nuggets became less effective over time. (Note: This is an example of **tolerance**, which will be explored more in Lesson 24).*
 - *His physical health starts to decline (he starts to look lumpy).*
 - *He starts to look unhappy, and his world starts to darken.*
 - *Towards the end, he doesn't look happy to eat the nugget but he does anyway.*
 - (Slide 9) **When Kiwi started to feel harmful effects after eating the nuggets, why do you think he kept seeking out and eating the nuggets anyway?**
*Key point: Kiwi's body is becoming physically reliant on the nuggets in order to function. (Note: This is an example of **dependence**, which will be explored more in Lesson 24.)*
 - (Slide 10) Explain that Kiwi's priority became about seeking out nuggets, influencing his choices and causing him to lose control. Kiwi got stuck in a repeating cycle of eating nuggets despite their harm, which we can characterize as an addiction.
9. (Slide 11) Explain the key takeaway:

Key Takeaway: A person's brain, mind, and behavior are all interconnected: Using substances over time can rewire the brain, affecting someone's physical and emotional wellbeing, as well as influencing what choices they make.

Activity 2: Addiction Art (15 minutes)

10. (Slide 12) Explain that when experts think about addiction, they describe it as **a long-term brain disorder where drug use becomes hard to stop, even when it causes harm** [33]. Ask youth, **"What are the key parts of this description?"** (long-term, brain disorder, hard to stop).
 - Long-term meaning long-lasting (chronic)—it keeps happening over and over again
 - Hard to stop (compulsive) meaning doing it even when you really don't want to or know you shouldn't

11. When someone repeatedly uses substances over time, that repeated use is able to rewire our brains, changing how our brains and bodies respond to substances. Ask youth:
- What did we see in the *Nuggets* video that showed Kiwi becoming addicted?
 - How did this make you feel towards Kiwi?
 - If Kiwi were a person, and you saw him in a similar state as he was at the end of the video (looking unhappy, unhealthy, slow), what would you think?
12. (Slide 13) Point out that it's easier to empathize Kiwi's situation when we know what happened to him leading up to it. Ask, "What happens when we don't know people's story? What assumptions might we make?" Explain that now we're going to shift gears a bit to think about addiction from a more personal level. Share with youth the following excerpt from an anonymous poem:
- You see heroin, I see low self-esteem.
You see cocaine, I see fear.
You see alcohol, I see social anxiety.
You see track marks, I see depression.
You see self-centeredness, I see the disease.
You see a pill head, I see over prescribing of opiates.
You see someone unwilling to change, I see someone hasn't connected with them yet.
You see denial, I see someone hurting.
You see the end, I see the beginning. You see a dope fiend, I see a future success story.
You see them, I see me.
13. Give youth a moment to digest the poem, and then ask, "Why do you think this person wrote this poem? What's their overall message?" Explain that this poem is a good illustration of the **stigma** that often comes with addiction. They may remember from [Lesson 14](#) that stigma is the disapproval of or judgment placed on someone based on a characteristic or circumstance of that person.
14. (Slide 14) Ask youth to create an art piece that depicts their understanding of what addiction is. The art piece should include words as well as drawing but does not have to be realistic drawing—it can be as abstract as they want. They can use this poem, the *Nuggets* video, and the information we just discussed to help them. Encourage them to work independently so they have an opportunity to explore the concept on their own.
- Optional: Play some quiet music in the background while youth work on their art piece.
15. After about 10 minutes, ask youth to share their art pieces if they're willing, or just describe it. Alternatively, have youth share their artwork with a partner and report back. Use a board or easel paper to write, for all to see, the common themes, words, and ideas that are mentioned.
16. (Slide 15) To make sure that youth walk away with an understanding of what addiction is, use these common themes, words, and ideas to create a definition. Ask youth, "Based on this, what are the most important things to include in a definition of addiction? What is it, and what is it not? What is important to keep in mind?"
- Key points (these exact words do not need to show up in their definition, but the spirit of them):*
- Addiction is not just a behavior—it's a brain-based disorder
 - Addiction doesn't make you a bad person.
 - Recovery and healing is possible.
17. (Slide 16) Explain the key takeaway:

Key Takeaway: Addiction is a long-term brain disorder where drug use becomes hard to stop, even when it causes harm. There is often stigma associated with addiction, but by understanding how substances can rewire the brain, we can better understand and empathize with people struggling with addiction.

Reflection (5 minutes)

18. (Slide 17) Gather everyone together to talk about the collective experience.
- What are some words or visual depictions that people had in common in their art pieces?
 - How would it feel if you were struggling with something that was really difficult to control/that you were unable to control? What kind of support would you need? How would you want people to treat you?
 - If more people understood addiction as a brain-based disorder, how could that change the world?

Lesson 23 References

1. NIDA. (2020, July 6). [Drug misuse and addiction](#). National Institute on Drug Abuse.
2. Hart, C. L., & Ksir, C. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw Hill.



Lesson 24: Tolerance and Dependence

What it is

Youth learn how the brain and body adapt to repeated substance use over time, by exploring biological changes like tolerance, dependence, and the body's attempts to maintain balance through several activities.

Why it matters

By understanding the ways substance use can biologically change the brain and body, youth can begin to grasp how addiction can lead someone to lose control over their life. Learning how tolerance and dependence can pull someone into the cycle of addiction is an important step in raising awareness of risk and prevention of use.

Getting started

Time: 30 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- Optional: Means to share [slide deck](#)
- [Introduction](#)
 - Flipchart paper
 - Writing utensils - group set
- Activity 1: [Tolerance Analogy](#)
 - Painters' Tape- 1 strip per person
- Activity 2: [Dependence Demonstration](#)
 - 1 set of [Wooden Blocks](#)
 - Marker
- Activity 3: [Homeostasis](#)
 - Ruler - 1 for each partner pair
 - Sticky notes - 1 set for each partner pair

Facilitator Prep:

- For the [Dependence Demonstration](#):
 - Pick out 5-7 blocks.
 - Identify one colored block that will represent a "drug" (e.g., red).
 - Then, build a simple tower intentionally placing the identified color "drug" block in one of the middle layers with at least 3 blocks on top (see [slide 5](#) as an example). Set aside for use in the activity.

- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

When someone starts to use substances repeatedly, their brain and body adapt to stay balanced. The body can begin to expect the substance to be present, leading to two major changes: **tolerance** and **physical dependence**.

Like mentioned in [Lesson 23](#), **tolerance** happens when the same amount of substance no longer has the same effect. The body gets better at removing it and the brain adjusts by making neurons less sensitive to its signals.

Because the body is always trying to stay balanced so it can keep working properly, it compensates for the substance's effects, often leading people to take more to feel the same results, which increases risk.

Physical dependence happens when the body gets so used to a drug that it struggles without it, leading to withdrawal symptoms like hallucinations, seizures, headaches,

Tolerance and dependence can **drive** addiction as they both create **the conditions** for someone to use a substance more at higher dosages.

For more information, see the [Facilitator Background Deep-Dive](#).

What to do

Introduction (5 min)

1. Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. If youth experienced [Lesson 23](#), have youth write down some of the words and concepts they remember from on a flipchart paper (or other visual medium). Ask, "Are there repeating themes or concepts?"
3. Ask youth, "What do the terms tolerance and dependence refer to?"
4. (Slide 2) See if they can connect the definitions to the terms:
 - When someone uses a substance regularly, it becomes less and less effective. This refers to ____?
 - When the body has adapted to the point where the absence of a drug causes withdrawal symptoms. This refers to ____?
5. So, what does this look like in the brain and body? Let's explore further!

Activity 1: Tolerance Analogy (5 minutes)

6. Give each youth a piece of painters' tape.
7. Have youth stick their piece onto the back of their hand and then pull it off.
8. (Slide 3) Ask youth, "How did your tape feel when you first used it?" *It felt strong, it felt really sticky, it worked well, was effective, etc.*
9. Explain that when a person first uses a substance, the effects can feel strong or very effective, just as when you used the tape for the first time, it worked really well. If you recall from [Lesson 22](#), this is because drugs can boost the effects of neuron signals.
10. Then, have youth stick their tape onto their hand again and pull it off up to five times in a row.
11. Ask youth, "How does your tape feel now? What do you notice?" *It felt the same, it wasn't as sticky, it wasn't as effective, felt weak, etc.*
12. Explain to youth that over time, tape will wear down and it won't work as well—you would need more of the tape to hang up a piece of paper. Tolerance works in a similar way. When someone uses a substance repeatedly, the effects weaken and it doesn't feel as strong, so they may need more of it to get the same effect. People will often use more of a substance (for example, more drinks of alcohol) to get around tolerance, which can increase the risk of dangerous or harmful outcomes (e.g., greater risk for addiction, or social problems such as legal trouble).
13. (Slide 4) Summarize with the key takeaway:

Key Takeaway: Tolerance happens when a person uses a substance repeatedly and the brain gets used to it, making the effect of the drug lessen. People often use a substance more and more to feel the original effects again, which can be a dangerous cycle to fall into, especially when our brains are still developing.

Activity 2: Dependence Demonstration (5 minutes)

14. Direct youth to the sample block tower (see **Facilitator Prep**). Explain that the red block in the tower represents a drug. If helpful, remind youth about the different types of drugs they explored in [Lesson 19](#), or ask youth to list the different types of substances they know of (alcohol, nicotine, marijuana, opioids, etc.).
15. (Slide 5) Ask, "What do you think would happen if we pulled out the red block from the tower?" *It might fall down, some of the blocks might fall, etc.*
16. Remove the red block from the tower and have youth observe what happens. "What happened when the red block was pulled from the tower?" *Some of the blocks fell down. There was an effect that happened because we removed a block.*
17. Now, pick up one of the fallen blocks and explain that this represents an effect we might experience when a drug is removed from our body (e.g., we stop using it). Similarly to this tower, our body can't have a drug suddenly taken out of our system/body and expect nothing to happen, especially after repeated use.
18. Ask, "What types of effects might a person experience if they stopped using a drug after repeated use?" *They might feel sick, get headaches, they wouldn't feel good, etc.*
19. Rebuild the tower again, intentionally placing the drug block in the middle again with at least three blocks on top and say, "Let's imagine this drug block represents caffeine. If a person drinks caffeine everyday and then suddenly stops (remove the drug block), there is an effect."

20. One by one pick up the fallen blocks and say, “They might get a headache (pick up a fallen block), they might feel jittery (pick up another fallen block) or they might suddenly feel like crashing (grab one last fallen block).”
21. Ask “Can anyone guess what these effects are called?” These effects are called withdrawal symptoms. When we removed the caffeine block, the falling blocks represented the withdrawal symptoms a person *might experience* when the drug leaves their system.
22. Explain that this is because our body has become **dependent** on the drug to function! But when that drug is removed, our body doesn’t know what to do, so it experiences different withdrawal symptoms.
23. Ask youth, “What do you think people might do to avoid feeling these symptoms?” Often, a person will keep using the substance to avoid withdrawal, which can make it harder to stop.
24. (Slide 6) Explain the key takeaway:

Key Takeaway: Dependence happens when a person becomes reliant on a substance, meaning they struggle to function without it. Because substances biologically change the brain, people can experience cravings and withdrawal symptoms (physical and emotional), which drive them to keep using the substance.

Activity 3: Balance (10 minutes)

25. So why do we experience tolerance and dependence? Let’s take a closer look at how this all ties together.
26. Have youth find a partner. Hand each pair a ruler and a set of sticky notes (or any other small item that can fit on the flat side of a ruler such as an eraser, paper clip, etc.).
27. (Slide 7) Assign roles:
 - One person is in charge of the ruler, representing the body. Their goal is to hold and balance the ruler.
 - One person is in charge of the sticky notes, representing drugs. Their goal is to add sticky notes to the ruler when prompted.
28. Start by having the “body” balance the ruler on two fingers. Explain that this represents the body and brain in balance.
29. Have their partner place one sticky note (“drug”) on either side of the ruler. Ask youth, “What happens to the ruler? What do you notice?” *The ruler shifts a little but maintains a fairly well-balanced level.*
30. Now, have them add two sticky notes to the same side of the ruler, while “the body” tries to keep the ruler from tipping over—they can do this either by using their other hand to gently press on the opposite side of the ruler to keep it balanced, or by adding sticky notes to the other side of the ruler. Ask youth, “What do you notice happening to the ruler now? What does the ‘body’ have to do to keep the ruler balanced?”
31. Finally, have them add a third sticky note to the same side of the ruler. Ask youth, “Is it harder to stay balanced? Why or why not?”
32. Explain that the same way the person had to keep adjusting to balance the ruler, our body and brain are constantly making adjustments to try and stay in balance with repeated substance use. Our body and brain need to stay in balance in order to function properly.

33. (Slide 8) Summarize with the key takeaway:

Key Takeaway: Our brains like balance! When we use substances repeatedly over time, our brains compensate by developing tolerance and dependence to create a new balance. Because of these changes, the brain now relies on substances to stay in balance, driving people to continue seeking them out.

Reflection (5 minutes)

34. (Slide 9) Gather everyone together to talk about the experience:

- Why might people fall into a cycle of using substances? Think back to our examples of tolerance and dependence.
- How do tolerance and dependence help us understand that addiction isn't just a choice?
- Remember how we pulled out the drug block from the tower and noted all of the symptoms someone could feel after they stop using. How do you think that affects them? How could it affect their friends and family?
- What questions do you still have?

Lesson 24 References

1. Hart, C. L., & Ksir, C. (2022). *Drugs, society, and human behavior* (18th ed.). McGraw Hill.
2. Turton, S., & Lingford-Hughes, A. (2016). [Neurobiology and principles of addiction and tolerance](#). *Medicine* (Abingdon, England: UK Ed.), 44(12), 693–696.
3. LeWine, H. E. (2024, November 5). [Alcohol withdrawal](#). *Harvard Health*.

Facilitator Background Deep-Dive

As mentioned in the **Background** section, **tolerance** is the body's response to repeated exposure to substances, where the effects of a substance at a given dose weaken over time. This can happen in a couple of ways:

1. **Increased Metabolism:** Over time, the body can get better at getting rid of substances. As mentioned in [Lesson 22](#), the liver makes special chemicals called enzymes that help break down substances in the bloodstream. When someone uses substances repeatedly over time, the liver can start making more of these enzymes, which helps the body break substances down more efficiently. ^[1]
2. **Decreased Neuron Sensitivity:** When certain brain systems get extra signals again and again from using a substance, the brain compensates by making neurons less sensitive to input. For example, alcohol affects neurons that use the neurotransmitter GABA, which helps calm the brain. When someone drinks alcohol often, the brain may try to adapt by making less GABA, or using fewer GABA receptors. This means the alcohol doesn't work as strongly as it used to. ^[1, 2]

These changes happen because our bodies are always trying to stay balanced. This balance is called **homeostasis**, and it helps the body adjust so it can keep working properly. If the body regularly senses higher-than-normal levels of a substance in the blood, it makes more enzymes to bring those levels back down. If a part of the brain notices more activity than usual, it tries to decrease that activity to keep things balanced. Tolerance works as the body's built-in counterbalance to repeated substance use. However, chronic substance users will often try to overcome tolerance by taking higher doses of a substance, potentially increasing the risk of dangerous outcomes.

Besides tolerance, homeostasis also plays a role in **physical dependence**, which happens when the body gets so used to a drug that it struggles without it (it experiences withdrawal symptoms). Using the alcohol and GABA example, GABA helps calm the brain. If the brain adjusts by reducing GABA activity, it becomes more active than normal and starts to rely on alcohol to stay calm. Without alcohol, the brain can become overly active, which might cause withdrawal symptoms like hallucinations, seizures, or even problems with autonomic functions (e.g., *breathing, circulation*). ^[1, 3]



Neuroscience Companion Lesson

Lesson 11: Rewards and Decision-Making

What it is

Youth learn how the brain's reward system can motivate behavior and guide decision-making by exploring how dopamine and the presence of peers can influence the choices we make.

Why it matters

Adolescence marks a period of time in which young people are exploring and learning which experiences and decisions are most important to them. The adolescent brain has a highly robust reward system, which responds to unexpected outcomes, social cues and positive social rewards. Understanding how rewards such as peer approval can influence adolescent decision-making helps them make choices that align with their personal goals and values.

Getting started

Time: 40 min

Grade level: 6-8

Delivery mode: In-person

Materials:

- Optional: Means to share [slide deck](#)
- Blank sheet of paper (1 per youth)
- Writing utensil (1 per youth)
- 1 to 3 detachable brain models (e.g., [Zimmer](#) or [Vevor](#))
 - Or provide access for youth to explore an [interactive 3-D online brain model](#)
- [Activity 1: Dopamine at Play](#)
 - Cones- 1 per small group of 3-4
 - Ball (e.g., basketball, foam ball, etc.)- 1 per small group of 3-4
 - Basket (e.g., bucket, box, etc.)- 1 per small group of 3-4
 - Three baskets of rewards (kept up front by the facilitator)- 1 for each round of play
 - Round 1 reward: stickers, temporary tattoos
 - Round 2 rewards: fidget spinners, pens/highlighters, keychains
 - Round 3 rewards: medals
- [Activity 2: Peer Influence](#)
 - Four small plastic cups
 - Sharpie marker
 - One small "reward" (i.e., a piece of candy, sticker, keychain, etc.)

Facilitator prep:

- For the Peer Influence Activity:
 - Number the bottoms of the small plastic cups from 1 to 4 using the sharpie marker.
 - Place the cups upside down in numerical order on a table.
 - Hide the small "reward" under one of the cups.

Background

Our brains change a lot during adolescence—from pruning away unused connections, to strengthening new neural pathways through experiences. One way the brain reacts to meaningful experiences is by releasing a neurotransmitter called dopamine. People often refer to it as the “feel good hormone,” but dopamine is actually a neurotransmitter, not a hormone. (Neurotransmitters are typically localized to the brain/nervous system, while hormones typically travel across the body through the circulatory system.) We talked about this and other chemicals in the brain in [Lesson 2](#).

Dopamine is associated with motivation, learning, and satisfaction and is involved in how the brain places values on rewards and makes decisions. One study suggests dopamine might play a role in both learning (reward prediction) and motivation (how much effort we put into achieving a reward or end result). The study measured the dopamine levels of rats as they learned to complete a task—when they saw a light, they were to press a lever and then they would get a reward. Eventually, when the rats were shown a light cue signaling a lever was ready to be pressed, their dopamine levels spiked, even before they received a reward. The initial spike in dopamine represented the reward prediction; however, dopamine levels also stayed high after the light cue, seeming to indicate dopamine may have a role in motivating the rats to press the lever as well.¹¹ In humans, dopamine works in a similar way in that it helps us learn from experiences and influences how much effort we are going to invest in achieving an end result, such as a goal. When outcomes are better than we expect, dopamine surges, reinforcing learning and motivating future behavior.

Because adolescent brains are sensitive to rewards and social approval, peer influence can play a significant role in decision-making. When around others their own age, their brain's reward system becomes extra active, making them more likely to choose quick or impulsive rewards instead of thinking about long-term results. This shows how peers can change the way the brain values choices by making socially approved actions or outcomes that feel more rewarding.¹²

Words to know

Adolescence: period of time between childhood and adulthood in which the brain experiences a lot of growth and when the person is more prone to take risks and more susceptible to peer-influence

Prefrontal cortex: at the very front of the brain; often considered the “executive center” of the brain and is responsible for things such as judgment, decision-making, planning, and reasoning

¹¹ Netherlands Institute for Neuroscience. (2023, June 7). [How does dopamine regulate both learning and motivation?](#) ScienceDaily.

¹² Chein, J., Albert, D., O'Brien, L., Uckert, K., & Steinberg, L. (2011). [Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry](#). *Developmental Science*, 14(2), F1–F10.

Neurotransmitters: chemical messengers used by neurons to communicate with each other

Dopamine: a neurotransmitter involved in motivation and reward; dopamine teaches our brains what things are worth pursuing, like eating a piece of chocolate

What to do

Introduction (5 minutes)

1. (Slide 2) Ask youth, "What's something you've tried recently that you liked? This could be a new food, a new song, a new activity or game, a problem you solved..." Explain to youth that the fact that they enjoyed whatever it was means that they felt a reward from trying it. Then ask, "What reward did you feel from doing this activity?"
2. (Slide 3) Explain the following:
 - When the rewards system is stimulated, it releases a neurotransmitter (chemical signal) called **dopamine**. Ask youth, "Do you remember what dopamine is?" *Dopamine helps the brain process rewards.*
 - The brain releases dopamine when it thinks there's going to be a reward—something pleasurable. This motivates you to seek the reward. It will also release when a reward is better than expected, which tells your brain "woah, that's worth doing again!" In other words, dopamine plays a role in both learning and motivation.
 - Explain to youth that the reward system helps guide our choices and actions.
 - For example, if you're playing basketball and make a risky 3-point shot, your brain releases dopamine to signal "That worked! Let's do it again!" This teaches your brain to remember and repeat things that feel rewarding.
3. Let youth know that they will be exploring this concept a bit further.
4. (Slide 4) Explain the key takeaway:

Key Takeaway: Dopamine helps our brain learn what's worth going after. When dopamine is released, it makes us want to do that thing again. This means dopamine helps shape the choices we make and the things we do.

Activity 1: Dopamine At Play (15 minutes)

5. (Slide 5) Split youth into teams of 3-4. Each team will have a ball and a basket.
6. Explain that they will be participating in 3 rounds total. Each round will have a similar goal with added challenges. **Facilitator note:** At this time, do not mention any rewards—we want youth to experience an "unexpected reward" and then a "reward prediction" as the rounds continue.
7. Have each team line up behind a cone with the basket directly across.
 - Instructions for Round 1:
 - Each team member gets a turn.
 - The team must get **at least one ball** in the bucket.
 - If successful, the team can pick out a small reward together.
 - Instructions for Round 2:
 - Each team member gets a turn.
 - The team must get **2 consecutive balls** in the bucket.

- If successful, the team can pick out a bigger reward together.
- Instructions for Round 3:
 - **Facilitator note:** Move the buckets further away from each team for this round.
 - Each team member gets a turn.
 - The team must get **3 consecutive balls** in the bucket.
 - If successful, the team can pick out a final reward together.
 - **Facilitator note:** Be sure to give teams lots of verbal recognition (e.g., I noticed lots of team effort—great work!) after the successful completion of Round 3.
- 8. Reflect together as a large group:
 - How did it feel to make a ball in the bucket? Did it motivate you to try again for the next round?
 - What do you think was happening in the brain when you received a reward?
- 9. (Slide 5) Explain the key takeaway:

Key Takeaway: When an experience feels better than we expect, dopamine signals it's worth repeating. In the future, our brains will release more dopamine to motivate us to do it again. This helps explain why we keep doing something even if it doesn't align with our goals and values.

Activity 2: Peer Influence (10 Minutes)

10. Share with youth that another key factor in the adolescent reward system comes from peer influence and social approval.
11. Remind youth that the reward system helps influence and reinforce our behaviors. Because adolescent brains have a heightened sensitivity to social approval, peer influence can play a major role in activating the reward system. Let's see how our peers can shape our decision-making.
12. Ask for a volunteer. Instruct the volunteer to leave the room for a few minutes while you provide some directions to the rest of the group:
 - I have a set of four cups here. There is a small reward hidden underneath one of the cups.
 - The volunteer is going to return to the room and try to identify the cup with the reward beneath it.
 - Your goal is to try and influence the volunteer to select one of these four cups. As a group, decide on which cup you're going to try and influence them into picking.
 - Feel free to use words or non-verbal cues such as pointing to influence the volunteer's decision-making.
 - **Facilitator note:** Both the volunteer and the remaining group of youth should not be told which cup contains the reward. This is intentional as it's meant to symbolize the uncertainty in following peer pressure.
13. Once the large group understands the instructions, bring the volunteer back in the room and share the following instructions with them:
 - *There is a small reward hidden underneath one of the cups.*
 - *Your job is to identify the cup with the reward underneath it.*
 - *You will have about one minute to make your decision.*
 - *Once time is up, I'll ask you to share your final decision with us.*

- *If you pick the cup with the reward, you get to keep the reward.*
- 14. Allow the volunteer to begin their decision-making while simultaneously cueing the large group to utilize their powers of influence.
- 15. Once a minute has passed, ask the volunteer to share their final decision and reveal what is underneath the cup.
- 16. Repeat the process once or twice more with another volunteer.
- 17. (Slide 7) Spend a few minutes reflecting as a group:
 - For the volunteer:
 - Why did you choose that specific cup?
 - How did your peers influence your decision?
 - How did it feel to have peers watching your decision-making?
 - Did any emotions come up for you when you were listening to the group? What about as you were making your decision?
 - For the large group:
 - How did it feel to have a role in influencing someone else's decision?
 - Since no one but the facilitator knew where the reward was, what were the chances that the volunteer would pick the right cup? What does this tell you about peer influence? *It's unpredictable.*
 - How do you think dopamine plays a role in the decisions we make when we're around our friends?
- 18. (Slide 8) Explain the key takeaway:

Key Takeaway: Your peers can play a big role in your decision-making process, whether you realize it or not! When friends are watching, the brain's reward system becomes more active, which can change how we evaluate choices. When we feel approval from our friends, it's easier to go along with decisions that may or may not align with our personal goals and values.

Reflection (5 minutes)

- 19. (Slide 9) Gather as a large group to talk about the experience:
 - What was something new that you learned today?
 - What did you learn about dopamine that you did not already know?
 - How does something being enjoyable or rewarding influence the decisions you make?
 - How do your friends or peers affect the decisions you make?
 - What questions can we ask ourselves to make sure we are making choices that align with our goals and values?
 - What is one question you still have?

Peer Influence Activity was adapted from the [Overcoming Obstacles Lesson 2: Handling Peer Pressure](#)



Lesson 25: Hijacking the Reward System

What it is

Youth learn how drugs can hijack the brain's reward system by exploring how dopamine influences what we prioritize and applying that learning through real-life scenarios.

Why it matters

Addiction isn't about willpower—drugs can hijack reward learning and reshape the habit systems that guide everyday behavior.

Getting started

Time: 35 minutes

Grade level: 6-8

Delivery mode: In-person

Materials:

- Means to share [slide deck](#) and accompanying videos
- [Sample priority list](#) - 1 per person
- 1-inch pom-poms - about 20-30 per person
- 8-ounce cup - 1 per person
- Several large containers to hold pom-poms (e.g., baskets or large bowls) - enough for every person to have access
- [Hijacked Reward System Scenario](#) - 1 copy for facilitator
- [Tairen's priority list before fentanyl](#) - 1 per person
- Writing utensils - 1 per person

Facilitator Prep:

- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.
- Fill the containers with pom-poms.

Background

One of the brain's primary jobs is to keep us alive. To do that, we're driven to feed ourselves, to keep ourselves hydrated, to seek out social connection, and a whole host of other behaviors that help us meet our survival needs. The system responsible for teaching us what actions and behaviors are worth pursuing is called the reward system. When the reward system is operating normally, it provides us with motivation to seek out the "natural rewards" it finds important, and it learns whether a natural reward is worth pursuing

again in the future. Like we learned in [Lesson 11](#), both of these jobs rely on dopamine to work.

However, because this system relies on dopamine, substances are able to override and "hijack" the reward system. Most psychoactive substances sharply increase dopamine levels in the reward system—sometimes far more than natural rewards do. ^[1, 2] In other words, drugs can effectively teach the brain that drug use is highly rewarding and worth repeating. For adolescents, this effect is especially concerning because their impulse-control and reward systems are both still developing, making it difficult to slow down and think through the consequences of substance use.

For more information, see the [Facilitator Background Deep-Dive](#).

Words to know

Dopamine: a chemical in your brain that helps your brain decide how valuable a reward is, and also how much motivation we feel to seek that reward

Priority: the daily activities that are most important for meeting our needs and that we are motivated to make time for

What to do

Introduction (5 min)

1. (Slide 1) Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. (Slide 2) Explain that our brain's main job is to make sure we're able to survive. The brain teaches us what actions and behaviors are important for survival using a chemical called **dopamine**.
3. Ask youth if they've ever heard of dopamine and ask for volunteers to share their understanding of what it is. Then explain that despite popular belief, dopamine is not the "happy chemical" or the "feel-good chemical"—it's really the "motivation chemical". Dopamine has two main jobs: motivating us to take an action, and teaching us whether that action is worth doing again. It helps your brain say, "Let's do this!" and later, "That was worth-it—remember that!"

Activity 1: Dopamine and Priorities (5 minutes)

4. (Slide 3) Explain that this is how dopamine helps us survive: it motivates us to take actions that are meant to meet our needs. Ask, "**What do we need to survive?**" *We need food, water, shelter, air, sleep, social connection, and emotional stability (safety, play, creative expression, purpose).*
5. Explain that some of our survival needs are physical, and others are social and emotional. Since we can't meet all of our needs at once, our brains use dopamine to help us understand which daily activities are most important for meeting our needs. These are called **priorities**, or the things we are motivated to make time for.
6. For example, we need to sleep and eat for our most immediate survival, so we're likely to make those a priority. But we also need social connection and emotional stability, so spending time with

friends or listening to music might also be priorities. Which of these activities take precedence may depend on my day!

7. (Slide 4) Have youth look at the [sample priority list](#) and consider their day today. What are their own priorities? Have them add their own or take away those they don't like, and they can select 5 they consider high priority, 5 they consider medium priority, and 5 they consider low priority.
8. Have them turn to one or two people near them to share.
9. (Slide 5) Explain the key takeaway:

Key Takeaway: Dopamine plays a role in helping us prioritize activities that help us meet our physical, social, and emotional needs.

Activity 2: Healthy Reward System (10 minutes)

10. (Slide 6) Pass out the pom-pom containers and place them so that everyone has easy access to them throughout the activity. Pass out the cups—each person should have one cup.
11. Explain that the pom-poms represent dopamine, and the cup represents the brain's reward system.
12. Let youth know you're going to play the first minute of a song, such as [Superbloom by MisterWives](#).
 - Without offering them context, ask youth to raise their hand if they are excited to listen.
 - What makes you excited? Is it because you know the song? Because you just love music? Just excited to do anything that doesn't involve work?
 - If they are excited, direct them to put one pom-pom in their cup. Explain that this pom-pom represents the dopamine their brain released to make them feel motivated to listen.
13. Play the song.
14. Ask youth to raise their hands if this is something you would want to listen to again. Have them add one pom-pom to their cup if their answer is yes.
15. Ask them to notice how many pom-poms are in their cup. These pom-poms represent the dopamine their brain released, teaching them that the activity is something worth experiencing again. Note that if they weren't excited to watch it, AND they hated it, their brain will remember that too and want to steer clear of the activity in the future (no pom-poms in the cup)!
16. (Slide 7) Repeat the activity with a TikTok video, such as [Zack King's "Unexpected Hiding"](#) (links to YouTube).
17. Ask youth, "How was the experience different?"
 - Point out that we're all motivated by different things. Our motivations are shaped by our needs and preferences.
 - Ask youth, "You tell me—what is dopamine? What does it do?"
18. (Slide 8) Explain the key takeaway:

Key Takeaway: Dopamine has two main jobs: motivating us to take an action, and teaching us whether that action is worth doing again.

19. (Slide 9) Share that what they experienced with the song/video represents how the brain's reward system normally functions. The image on slide 10 can help them visualize this concept. But what happens to this reward system when drugs come into the picture? We'll find out with the next activity.

Activity 3: Hijacked Reward System (10 minutes)

Note: This activity is designed for youth to add pom-poms to their own cups, but you may also facilitate it as a demonstration depending on your group size or other needs.

20. (Slides 11-15) Follow along the [Hijacked Reward System Scenario](#). As you read out the scenarios, hold up a cup with one pom-pom in it (like in **Activity 2**) to use as a side-by-side comparison to the cups that youth will fill for this activity. This will illustrate that they only needed 1 pom-pom's worth of dopamine to have motivation to listen to the song or watch the TikTok video.
21. (Slide 16) Debrief the activity.
 - What differences did you notice between the music and video scenario (healthy reward system scenario from **Activity 2**) and the fentanyl scenario (hijacked reward system scenario)? Normal number of pom-poms with the healthy scenario vs. a flooding of pom-poms with the hijacked scenario.
 - What is happening to Tairen's reward system? The brain's reward system is reinforcing fentanyl as something it wants and then eventually needs in order to function.
 - What happened to Tairen's motivation to do normal activities as he kept using the "drug"? Eventually he can't think of anything but getting more of the drug.
22. Remind youth that addiction is when a person's brain and behavior are driven to seek it out even if it's disrupting or harming their daily life. For example, they might lie or steal to obtain the drug, isolate themselves from others to use it, or they might get into legal trouble or lose their job as a result of feeling like they just can't stop.
23. (Slide 17) Ask youth to look at their priority lists from **Activity 1**. Point out that Tairen had similar priorities before he started taking fentanyl. Pass out [Tairen's priority list before fentanyl](#).
24. Ask, "What happened to Tairen's motivation to do these types of natural activities?" Tairen ends up prioritizing the drug over other things. He does it not for the high, but to feel normal, even if it's only for a short time.
25. (Slide 18) Share the hijacked reward system image. Explain that the drug in Tairen's scenario has not only made him prioritize the drug over other activities. Have them cross out Tairen's priorities and write "fentanyl."
26. (Slide 19) Summarize with the key takeaway:

Key Takeaway: Psychoactive drugs often raise dopamine levels higher than natural rewards, reprogramming the brain to pursue the drug over other priorities we need for survival.

Reflection (5 minutes)

27. (Slide 20) Reflect as a group
 - Have you ever done something in your life that you didn't like but later felt rewarding? What might have been happening in your brain?
 - What activities in your own life give you a sense of satisfaction, enjoyment, or joy?
 - How are those rewards different from the drug rewards as simulated in the activity?
 - Why do you think the brain keeps wanting the drug even when it doesn't feel as good anymore?

References

1. Di Chiara, G., & Imperato, A. (1988). [Drugs abused by humans preferentially increase synaptic dopamine concentrations in the mesolimbic system of freely moving rats](#). *Proceedings of the National Academy of Sciences of the United States of America*, 85(14), 5274–5278.
2. Office of the Surgeon General (US). (2016). [The neurobiology of substance use, misuse, and addiction](#). *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health*. US Department of Health and Human Services.

Hijacked Reward System Scenario

Directions: Read each scenario below aloud and have youth place the number of pom-poms in the cup you indicate. Remind youth that just like with the healthy reward system scenario, the pom-poms represent dopamine. Explain that the scenario uses fentanyl because as a highly potent and addictive drug, it's an effective way of demonstrating how substances hijack the brain's reward system.

1. Tairen is suffering from anxiety and heard through social media about a pill that claimed to help.
 - **Start with 1 pom-pom in his cup**, because he's motivated to try the pill.
 - Tairen takes the pill, not realizing that there's fentanyl in it, and gets high.
 - **Add 5 pom-poms to the cup**, because the fentanyl caused a big wave of dopamine to wash over his reward system. His brain learned, "Wow, I want more of this!"
 - **What will adding 5 pom-poms do to Tairen's motivation to try it again?** *Sample answer: Tairen will likely want to do it again.*
2. Tairen realizes that the pill might have had something else in it, and he probably shouldn't take anymore, but he can't get it out of his mind. He decides to take another one.
 - **Notice how many pom-poms are in his cup.** Tairen has a lot of motivation to take the pill again because of how much dopamine washed over him last time.
 - Tairen tries the pill again but the second high doesn't feel quite as good as the first high.
 - **Add another 5 pom-poms to Tairen's cup** because fentanyl still caused a big wave of dopamine to wash over his reward system again. Tairen's brain reinforces what it learned last time: "Wow, I want this again."
 - Tairen's reward system now has an even stronger drive to try the drug again.
3. Tairen now can't think of anything but the pill, so he decides to take another one.
 - **Notice how many pom-poms are in his cup.** Tairen is motivated to take the pill because dopamine keeps teaching his reward system that this is worth doing again.
 - Tairen takes the pill again, but this time he doesn't feel much of a high at all.
 - **Add another 5 pom-poms to Tairen's cup.** Even though he didn't feel high, his reward system still got flooded with dopamine, further reinforcing fentanyl as a reward.
 - Using this drug has become one of Tairen's top priorities.
4. Tairen can't stop thinking about using this drug, and he feels horrible when he isn't taking it. His anxiety is now worse than before.
 - **Notice how many pom-poms are in his cup.** Tairen's reward system has taught him he needs this drug to survive, causing him to do anything to get more.
 - Tairen takes a couple pills. He doesn't get high anymore, and the drug only brings him temporary relief from withdrawal.
 - **Add another 5 pom-poms to Tairen's cup.** Even though Tairen feels miserable, dopamine still teaches his reward system this is something he needs to keep taking.
5. Tairen feels very depressed. All he can think about is getting high and feeling better. He has no motivation to play basketball or draw, or even hang out with his little brother or best friend.

Sample Priority List

What are your top priorities for today? Of those, which are highest, medium, and lowest?

High Priorities <i>Very important to you</i>	Medium Priorities <i>Important to you</i>	Low Priorities <i>Somewhat important to you</i>
1.	6.	11.
2.	7.	12.
3.	8.	13.
4.	9.	14.
5.	10.	15.

- ☐ Breakfast
- ☐ Lunch
- ☐ Dinner
- ☐ Exercise
- ☐ Hang out with friends
- ☐ Catch up on social media
- ☐ Homework/study
- ☐ Sports practice/play
- ☐ Music practice
- ☐ Art projects
- ☐ Helping family
- ☐ Chores
- ☐ Job/earn money
- ☐ Take care of pet
- ☐ Look after sibling
- ☐ Listen to music
- ☐ Game time
- ☐ Spend time with favorite person
- ☐ Bike/walk for fun
- ☐ Read book for fun
- ☐ Try something new
- ☐ Watch a show
- ☐ Sleep
- ☐ Others?

Tairen's Priority List Before Fentanyl

High Priorities <i>Very important to you</i>	Medium Priorities <i>Important to you</i>	Low Priorities <i>Somewhat important to you</i>
1. Basketball; staying fit 2. School 3. Helping/time with little brother 4. Time with best friend 5. Art	6. Friends 7. Good night sleep 8. SnapChat 9. Physical appearance 10. Daily walk with grandma	11. 3 meals a day 12. Getting outside 13. Gaming 14. Chores 15. Chess

Facilitator Background Deep-Dive

In addition to its role in motivation and reinforcement learning, dopamine also has a role in associative learning, where our brains learn to connect the environment and conditions where we use a drug with its rewarding effects. When this happens, something as simple as music, a hangout spot, a specific activity, or even a certain mood-state can become cues that trigger someone to experience drug cravings.^[2] This means that when someone uses drugs regularly, their brain isn't just learning that a drug is worth pursuing, it's also experiencing intense cravings whenever they encounter a drug cue in their environment.

These changes in motivational importance and cravings—as well as changes like tolerance and dependence covered in [Lesson 24](#)—can all drive someone to continue using a substance repeatedly. Over time, these repeated dopamine reward signals will also train the brain's habit system, shifting someone's drug use from a goal-directed action to an automatic action.^[2] In other words, instead of a drug cue making you just want a drug, your brain might automatically begin seeking out a drug without you even realizing it. This type of compulsive drug use is what often sucks people into cycles of addiction, which we will explore more in [Lesson 26](#).



Lesson 26: The Addiction Cycle

What it is

Youth learn about the stages of the addiction cycle through a storyboard activity and explore how understanding addiction as a cycle shapes their assumptions and thinking.

Why it matters

Understanding the cycle of addiction helps us see how over time, voluntary drug use can shift into developing overwhelming cravings and uncontrollable drug-seeking behaviors that can take over someone's life. When youth understand how the brain gets rewired to compulsively seek out drugs, they can view others struggling with addiction through a lens of empathy, compassion and support rather than judgment.

Getting started

Time: 45 minutes

Grade level: 6-8

Delivery mode: In person

Materials:

- Optional: Means to share [slide deck](#)
- [Introduction](#)
 - Black/white board or easel paper
 - One black marker and one blue marker
- [Activity: The Cycle of Addiction Storyboard](#)
 - Means to display the [Addiction Cycle image](#)
 - [The Cycle of Addiction handout](#) - 1 copy per group
 - [Storyboard Templates](#) - 1 copy per group
 - Tape
 - Posterboard
- Optional: [Take it Further: Addiction Art Revisited](#)
 - Butcher paper
 - Markers - group set

Facilitator Prep:

- Optional: Roll out a long sheet of butcher paper on a table or flat surface.
- Discussions about substance use and addiction can be triggering for some youth, especially if they or someone they know has struggled with these issues. The introduction to the lesson includes a trigger warning for youth. Before facilitating the lesson, decide what grounding options you can provide for participants, such as taking a short break, journaling quietly, or talking privately after the lesson.

Background

As discussed in Lesson 23, addiction is defined by compulsive drug use that's hard to stop, even when it causes harm.^[1] People who get to this point aren't choosing to let drugs take over their life—they're working with a brain that has been rewired to compulsively seek out drugs.^[2]

Throughout this unit, we've outlined some specific ways that repeated drug use can rewire the brain, but these aren't the only changes that we see. When we zoom out and think about how addiction impacts a person, we see changes across three of the brain's behavior-regulation systems: (1) our reward and habit systems (*controlled by the basal ganglia region of the brain*), (2) our stress-response system (*controlled by the extended amygdala*), and (3) our decision-making systems (*controlled by the prefrontal cortex*).^[2, 3]

Drugs tend to disrupt all three of these systems in a three-stage process that cycles, repeats, and intensifies over time—we call this the **addiction cycle**.^[2, 3] The addiction cycle includes the following stages: **"Use & Feeling Better," "Withdrawal & Feeling Worse,"** and **"Intrusive Craving & Anticipation."** Often, addiction begins with voluntary drug use, but repeated use reinforces the behavior through dopamine-driven reward signals that teach the brain to crave more. This cycle shows how, over time, tolerance develops, stress sensitivity increases, and the body begins to rely on the drug to feel normal.

Though addiction can cause lasting changes in the brain, there are promising treatments—from medications and brain stimulation, to psychosocial support—that offer hope for recovery.

For more information, see the [Facilitator Background Deep-Dive](#).

What to do

Introduction (5 min)

1. Begin the session by normalizing that topics on substance use and addiction can bring up strong feelings. Offer grounding options such as taking a short break, journaling quietly, or talking privately after the lesson.
2. Have youth number off, one to six. Then one by one, have each person come up to a board or easel paper and draw a stick figure. Everyone numbered 1 through 5 should draw their stick figure in black; everyone numbered 6 should draw theirs in blue.
3. (Slide 2) Read the statement on the slide and explain that the blue stick figures represent one person out of every six people over age 12 who are affected by an addiction to substances in the United States.^[9]
4. Ask youth to help with the math: "If your school's grade had 150 students, how many of them, statistically speaking, could be affected by an addiction to substances?" *About 25.*
5. Ask youth, "How might knowing this information make someone affected by addiction, either directly or indirectly, feel less isolated?"
6. Explain that addiction is a brain-based medical disease and not by a personal failing or a lack of willpower.

7. Give youth a moment to pause and quietly reflect and then ask, “Why might a person struggling with an addiction be afraid to ask for help?”
8. (Slide 3) One reason could be the **stigma** people often place on drug use. Stigma is when people put labels on others, make judgements, or think negatively about them, rather than showing understanding, compassion, or empathy.
9. Factors such as stigma, peer influence, brain changes, and environment (among others), can make someone feel trapped in a cycle of addiction. Let's explore this further!

Activity: The Cycle of Addiction Storyboard (20 minutes)

Introduction

10. (Slide 4) Ask youth, “What are some habits you have that are hard to break?” Answers might include: *Staying up too late, putting off homework, checking notifications on our phones.*
11. Let's take the example of staying up too late. When you stay up too late, you might feel tired the next day, it might feel harder to focus and concentrate on school work or activities.
12. Now, let's say you have a big presentation in school the following day. If you had a habit of staying up too late, do you think you could plan for going to bed a bit earlier that evening? *Yes, even if it might be a little bit hard.*
13. Even though habits are part of our routines and might cause us some issues, we have some level of control over them thanks to our prefrontal cortex, which allows us to pause and plan out our actions. We can decide to stop or change direction, even if it's hard.
14. (Slide 5) When it comes to someone struggling with addiction though, drugs can shut down the part of the prefrontal cortex that helps us pause and plan. Unlike you deciding to go to bed early, people with an addiction to substances might not have much ability to pause and plan at all, even when they want to.
15. Ask youth, “How do you think someone gets to this point of losing control?”
16. (Slide 6) Share the Addiction Cycle image. Explain that the image summarizes the three stages a person cycles through during addiction, and it shows which areas of the brain are responsible for this cycle. For example, you'll notice the prefrontal cortex—the decision-making part of the brain—is highlighted in the image, showing that a person's ability to pause and plan is disrupted.
17. While every person and body is unique, this is what research tells us can happen when brain systems are disrupted and rewired to compulsively seek out drugs. Say: “*People who get to this point aren't choosing to let drugs take over their life—they're working with a brain that has been rewired to compulsively seek out drugs.*”
18. Emphasize that addiction does not happen overnight—it is a cycle that progresses over time, repeats and intensifies. Each stage feeds into the next and it grows stronger over time. And different parts of the brain are disrupted at each stage in the process. Let's take a closer look!

Activity Instructions

19. (Slide 7) Split youth into three equal-sized teams. Distribute [The Cycle of Addiction handout](#) and assign each group one of the stages.
20. (Slide 8) Hand each group a [Storyboard Template](#) (depending on their assigned stage) and ask them to work together as a team to create a story that represents their understanding of that stage

in the cycle of addiction. If youth are unfamiliar with a storyboard, simply explain that it is a visual representation that maps out key moments, or in this case stages, of addiction.

21. Have groups share back their storyboard piece with the larger group. If needed, use the [Facilitator Background Deep-Dive](#) to fill in any gaps.
22. Once complete, recreate the cycle concept by taping the templates from each team on a posterboard (or other visual medium) in a circular shape.
23. (Slide 9) Discuss as a large group:
 - Does seeing addiction as a cycle change the way you think about it? Why or why not?
 - How do you think someone breaks the cycle of addiction?
24. (Slide 10) Explain the key takeaway:

Key Takeaway: Drugs disrupt our brain in a pattern that cycles, repeats and intensifies over time. People who are trapped in the cycle of addiction aren't choosing to let drugs take over their life—they're working with a brain that has been rewired to compulsively seek out drugs.

Reflection (5 minutes)

See [Take It Further](#) section for an alternative reflection activity.

25. (Slide 11) Gather everyone together to talk about the experience:
 - Has my understanding of addiction changed? In what ways?
 - How does an understanding of the brain help us better understand addiction? How does it help us better understand each other?
 - Why is an understanding of the brain important? How might knowing this information help keep you safe?
26. (Slide 12) Share some of the key points from the lesson (as well as [Lesson 23](#)) regarding addiction. Ask, "Is anything missing? Based on your understanding of addiction, what would you add?"
 - *Addiction is a brain-based medical disorder, not just a behavior or lack of willpower.*
 - *Stigma can prevent people from seeking help, but we can break it by educating ourselves and sharing what we've learned with others.*
 - *Every person struggling with addiction deserves support. We can help by practicing empathy.*
 - *The cycle of addiction can be broken. Recovery and healing are possible.*

Take it Further

As an alternative 15-minute reflection, revisit the Addiction Art youth created in [Lesson 23](#):

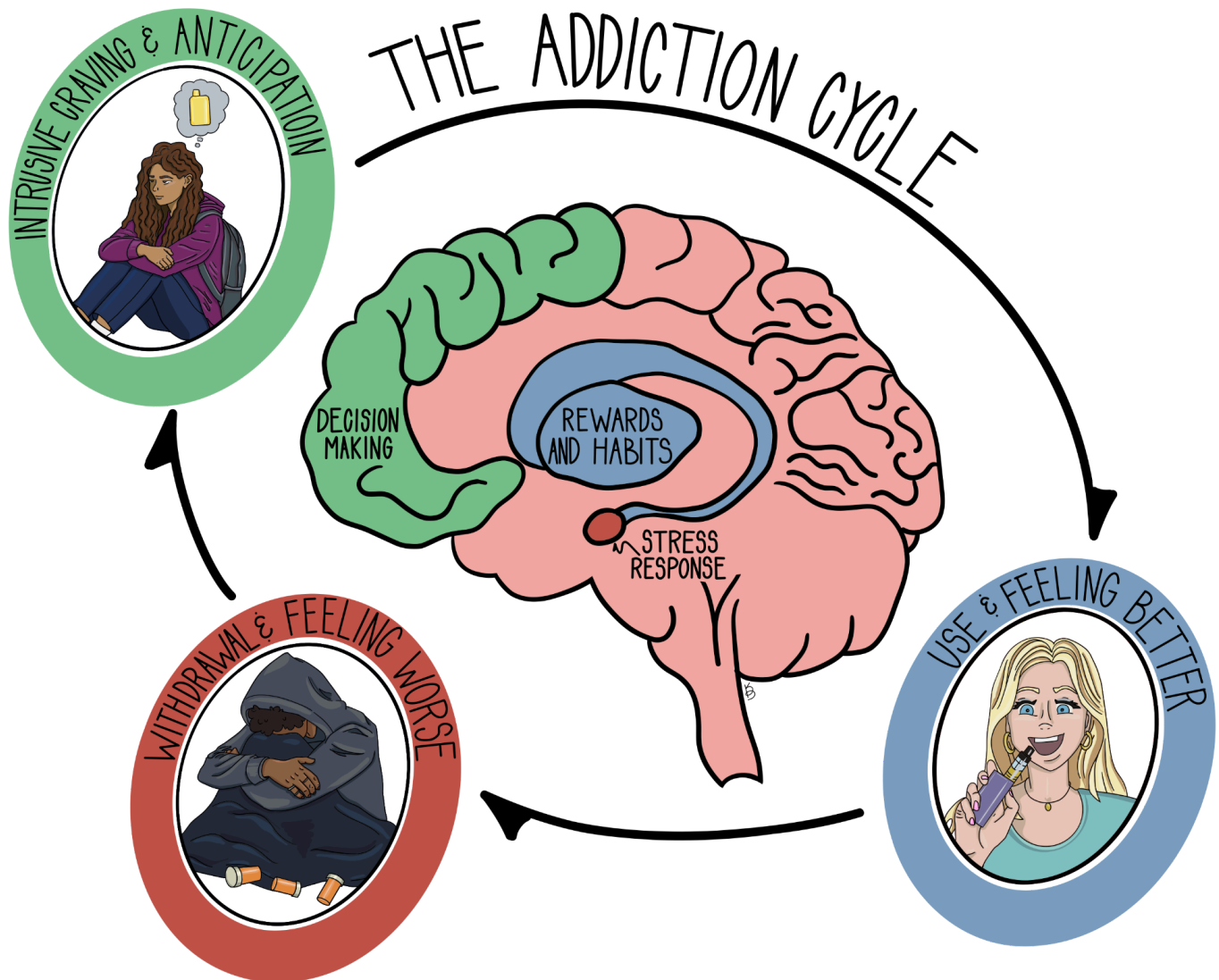
- Ask youth to recall the art pieces they created that depicted their understanding of addiction.
- Explain that they are going to recreate their art piece, but this time, they are going to create a collective piece that pulls together all of their learning. Encourage them to think about what they included in their original art piece and take a few moments to reflect quietly to themselves:
 - Has my understanding of addiction changed? In what ways?
 - What do I know now that I didn't know then?
 - What would I change or add to my art piece that I didn't include before?
- Then, direct their attention to the butcher paper rolled out (on the floor or on a table). Using the following prompts below, ask youth to add words and drawings to the butcher paper depicting their collective understanding of addiction.
 - Addiction is...
 - Addiction is not...
 - Ways we can help...
- Optional: Play some quiet music in the background while youth work on their collaborative art piece.
- After about 10 minutes, ask youth to identify some of the common themes, messages, drawings or words they observe. Guide youth to some of the key points learned in [Lesson 23](#) and this one:
 - *Addiction is a brain-based medical disorder, not just a behavior or lack of willpower.*
 - *Stigma can prevent people from seeking help, but we can break it by educating ourselves and sharing what we've learned with others.*
 - *Every person struggling with addiction deserves support. We can help by practicing empathy.*
 - *The cycle of addiction can be broken. Recovery and healing are possible.*

Lesson 26 References

1. National Institute on Drug Abuse. (2020, July 6). [Drug misuse and addiction](#). National Institute on Drug Abuse.
2. Office of the Surgeon General (US). (2016). [The neurobiology of substance use, misuse, and addiction](#). In *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health*. US Department of Health and Human Services.
3. Koob, G. F., & Volkow, N. D. (2010). [Neurocircuitry of addiction](#). *Neuropsychopharmacology: Official Publication of the American College of Neuropsychopharmacology*, 35(1), 217–238.
4. Volkow, N. D., Koob, G. F., & McLellan, A. T. (2016). [Neurobiologic advances from the brain disease model of addiction](#). *The New England Journal of Medicine*, 374(4), 363–371.
5. Koob, G. F. (2021). Drug addiction: [Hyperkatifeia/negative reinforcement as a framework for medications development](#). *Pharmacological Reviews*, 73(1), 163–201.
6. Compton, W. M., Wargo, E. M., & Volkow, N. D. (2022). [Neuropsychiatric model of addiction simplified](#). *The Psychiatric Clinics of North America*, 45(3), 321–334.
7. Volkow, N. D., & Boyle, M. (2018). [Neuroscience of addiction: Relevance to prevention and treatment](#). *The American Journal of Psychiatry*, 175(8), 729–740.
8. Office of the Surgeon General (US). (2016). [Early intervention, treatment, and management of substance use disorders](#). In *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health [Internet]*. US Department of Health and Human Services.

9. Substance Use and Mental Health Services Administration. (2024). [2024 National Survey on Drug Use and Health](#). [Report]. U.S. Department of Health and Human Services.

Cycle of Addiction Handout



Stage: "Use & Feeling Better"

A person tries a drug and feels a rewarding effect.

The brain might think:

- "That felt really good!"
- "This felt better than I expected!"
- "This is worth doing again!"

How the cycle progresses:

As drug use repeats, it shifts from something a person does to feel good, to something they do to stop feeling bad.

What changes in the brain:

Drugs take over the brain's reward system, making the brain think the drug is really important! Over time, the brain forms strong habits around using the drug, which makes it hard for someone to stop even if they want to.

Stage: "Withdrawal & Feeling Worse"

A person begins to experience negative emotions or physical withdrawals without the drug.

The brain might think:

- "I feel really low."
- "I was feeling good, but now I'm feeling anxious."

How the cycle progresses:

Withdrawal symptoms become more distressing; it feels harder for a person to return to what used to be a "normal mood."

What changes in the brain:

Drugs can make the brain's stress-response system more sensitive, causing a person to feel more stressed, sad, or upset, especially without the drug.

Stage: "Intrusive Craving & Anticipation"

A person experiences intense, overwhelming cravings to use a drug again, and they may obsess and constantly think about how to get it.

The brain might think:

- "I need this in order to survive."
- "How can I get this drug?"
- "I can't stop thinking about it."
- "I'll feel better once I have it."

How the cycle progresses:

Drug use progresses from small cravings a person can tune out to intense cravings and uncontrolled thinking about how they're going to get the drug again.

What changes in the brain:

Drugs can make the brain's reward system more motivated to crave and seek out a drug, especially when a person sees or thinks about the drug.

Drugs weaken our "pause signals," making it hard to stop and easier to fall into automatic, habit-like drug use.

Storyboard Templates

Storyboard

Task: Work together as a team to create a storyboard that represents your understanding of this stage in the cycle of addiction. Use images, symbols, words or drawings that can help explain what someone might experience in this stage.

"Use & Feeling Better"

Storyboard

Task: Work together as a team to create a storyboard that represents your understanding of this stage in the cycle of addiction. Use images, symbols, words or drawings that can help explain what someone might experience in this stage.

“Withdrawal & Feeling Worse”

Storyboard

Task: Work together as a team to create a storyboard that represents your understanding of this stage in the cycle of addiction. Use images, symbols, words or drawings that can help explain what someone might experience in this stage.

"Intrusive Craving & Anticipation"

Facilitator Background Deep-Dive

As mentioned in the **Background** section, The addiction cycle includes the following stages: “**Use & Feeling Better**”, “**Withdrawal & Feeling Worse**” and “**Intrusive Craving & Anticipation**.” Here’s a closer look at each of these three stages:

1. **“Use & Feeling Better”** (*also called binge/ intoxication*):
 - a. **Description:** The stage where a person consumes a substance and experiences its rewarding effects, including pleasure and/or relief. ^[2]
 - b. **Progression:** Over time, the primary objective of drug use can shift from seeking pleasure to escaping internal distress. ^[4]
 - c. **Brain Changes:** Drugs hijack the reward system, assigning motivational importance to drugs and drug cues. ^[2] Drugs also strengthen the habit system over time, which can make someone progress from voluntary drug use to compulsive drug-seeking. ^[4]
2. **“Withdrawal & Feeling Worse”** (*also called withdrawal/ negative affect*):
 - a. **Description:** The stage where someone begins to experience negative emotions and/or physical withdrawal symptoms in the absence of a drug. ^[2]
 - b. **Progression:** Over time, withdrawal effects can progress from reductions in energy to symptoms of depression. ^[4] A person’s baseline mood state can also decrease over time. ^[5]
 - c. **Brain Changes:** Drugs can increase the sensitivity of the stress-response system, increasing the feelings of stress and negative emotions. ^[2, 6]
3. **“Intrusive Craving & Anticipation”** (*also called preoccupation/ anticipation*):
 - a. **Description:** The stage where someone experiences intense, overwhelming cravings to use a drug again and feels driven to seek it out. ^[2, 6]
 - b. **Progression:** Over time, someone may shift from looking forward to using a drug, to feeling an urgent, compulsive need to use. ^[4, 6]
 - c. **Brain Changes:** Drugs can increase the strength of the reward system’s motivational importance signals, increasing cravings in response to drug cues. ^[4, 6] Drugs also make the decision-making system’s “stop signals” decrease and its “go signals” increase; this means people engage in less planning-directed actions, and more automatic, habit-like drug-seeking. ^[4, 6]

So how does this play out? A person may begin using a drug voluntarily—maybe to seek out social connection or to find relief from pain. Each time they use the drug, that behavior is reinforced by surges of dopamine in the reward system, teaching the brain that the drug is something they want. ^[2] As a result, a person can start to crave drugs and feel a stronger urge to seek them out.

Over time, (1) the drug can become less effective due to tolerance, (2) the brain can become more sensitive to stress and negative emotions, and (3) the body can begin depending on the drug to feel normal, lowering a person’s baseline mood. ^[2, 5] Because of these changes, when the drug wears off, a person may feel intense distress that triggers strong urges to use again, fueling a repeating cycle. ^[5] With every round of this cycle, a person’s self-control weakens while habitual responses grow stronger—so even if they try to “pump the brakes” on drug use, their rewired brain keeps the car moving. ^[2]

This is what makes the cycle of addiction so insidious and difficult to break out of—people lose control over their drug use and their brains have adapted to pull them back into using the second they stop. Although addiction can cause devastating and long-lasting changes to the brain ^[2], there are several promising avenues for treatment and recovery—including new medications, brain stimulation technologies, and clinical or community-based psychosocial interventions. ^[7, 8]