

Drugs & Addiction

Background

The aim of this session is to introduce students (aged 15-18) to how drugs affect neuronal communication and how drug abuse can lead to drug addiction. Students will have the opportunity to discuss what they already know about drugs and their consequences, and learn about how neuroscience has helped in our understanding of drugs and addiction. This session should be used in conjunction with the 'Upper Secondary– Drugs & Addiction' PPT and is approx. 50 minutes long.

Introducing Drugs, Abuse & Addiction

Firstly, inform the teacher that this may be a sensitive topic and ask for advice on whether the session should be modified.

- (1) Title slide.
- (2) Contents slide
- (3) Start by asking the students if they know of any drugs, what they are and why people may take them.

A drug is a substance that affects body function.

(4) Ask the students if there are differences between the drugs on the left hand side vs the right hand side of the screen (medicine vs drugs of abuse).

1. **Medicines:** to relieve pain or to treat diseases. E.g. paracetamol, ibuprofen, asthma inhalers
2. **Drugs of abuse:** drugs taken for pleasure (no medical need) e.g. caffeine, alcohol, cigarettes, cannabis, cocaine.

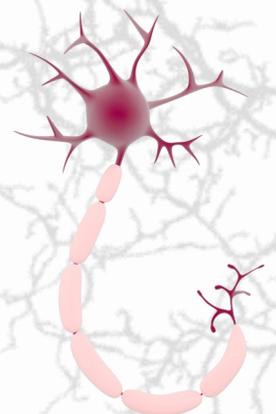
Note, there is a lot of overlap between the two types of drugs described. Prescription drugs can be abused, and some recreational drugs, such as cannabis can be used for medicinal purposes too.

Neuroscience: understanding drugs and abuse

(5) Neuroscience has provided us with the knowledge we have today of the changes that drugs of abuse cause in the brain.

- (6) The brain is made up of cells called neurons and the communication between neurons is key to brain function

- Electrical signals are passed on from one neuron to another
- (7) This is achieved through structures called synapses, which can be found at the junctions between neurons
- When electrical signals reach the end of a neuron, chemicals are released in the synapse, and they are detected by the next neuron, causing the next neuron to also transmit an electrical signal
- The chemicals released into the synapse are called neurotransmitters, and there are many different types
- (8) This is a sagittal section of the brain (use brain model to demonstrate the way the brain is cut)
- When we take drugs, they affect a particular pathway in the brain called the reward pathway (mesolimbic pathway) that is responsible for motivation and reward.
- It reinforces survival instincts such as eating and rewards you by releasing the neurotransmitter dopamine which makes you feel happy
- (9) Ask the students what their favourite food is and what they feel like after they eat it– happy/pleasure
- (10) Drugs hijack the reward system through increasing the release of dopamine in the same way as a survival behaviour would do.
- (11) Over stimulation of the reward pathway from drug taking results in a feeling of pleasure



Optional Advanced info:

- Increased dopamine in the brain can cause changes not only in the reward pathway/ mesolimbic system but in other parts of the brain as well.
- There is a reduction in input from the prefrontal cortex, an area in the front of the brain that controls higher functions e.g. decision making.
- The hippocampus and amygdala form a learning association between the dopamine increase (feeling of pleasure) and drug taking, which causes you to crave more drugs.

Activity: Play the 'Mouse Party' game

(12) Interactive game you can play to show students the effects of different drugs in terms of a simplified synapse. (link in PPT)

Drugs of abuse result in a feeling of pleasure because they **directly or indirectly** increase dopamine levels through different mechanisms such as increasing firing of dopaminergic neurons or reducing uptake of dopamine from the synapse.

(13) Different types of drugs have different effects

Stimulants: energy and excitement

Opiates: pleasure, dreamy state and drowsiness

Depressants: relaxed

Hallucinogens: hallucination, distortions from reality, feeling detached from your surroundings

Some drugs can be in more than one category e.g. cannabis is a depressant, stimulant and hallucinogen, and heroin is both an opiate and a depressant

Drugs of abuse are very addictive and dangerous at high doses and can result in irreversible brain damage, mental health problems and can even be lethal.

- Mixing of drugs is very dangerous— do not know what dose you are getting or if the person providing you with the drugs is giving you just one drug and not more mixed together.
- E.g. Heroin is very dangerous and can be lethal when mixed with alcohol because heroin is also a depressant and can cause respiratory failure



(14) Alcohol and the teenage brain

Alcohol is a depressant, so it decreases the communication between neurons.

Short term consequences include: poor decision making and coordination, sedation

Long term consequences include: brain damage, interfering with normal brain developing and problems with learning information later in life

The younger the use of alcohol the more likely one is to develop alcohol addiction later in life.

Tolerance differs:

- The more a person can drink without getting drunk, the more likely they are to become an alcoholic because they are drinking a lot more to get that feeling of being drunk
- More chance for the brain to adapt to the alcohol, get addicted and crave more

Long term effects: increased risk of heart attack, mental health problems e.g. anxiety and depression and psychosis in people with a genetic risk of developing schizophrenia

A chemical from the cannabis plant called CBD has been approved for medical purposes in reducing seizures in children with severe epilepsy.

(15) Cannabis and the teenage brain

A drug that takes you away from reality— it makes you high.

Short term effects: hallucinations (seeing something that is not there, slower ability to think

Optional Advanced info:

- Drug abuse is especially problematic in teenagers as they are more likely to get addicted
- This is because the teenage brain goes through a very distinct and important stage of development, where the brain refines its neuronal networks.
- People who begin using cannabis before the age of 18 are 4–7 times more likely than adults to get addicted, similar findings have been found with other drugs of abuse
- See the session Secondary— Teenage Brain.

(16) Neuroscience: understanding drug addiction

(17) Ask the students if they know what addiction is.

Definition of addiction:

'Addiction is defined as not having control over doing, taking or using something to the point where it could be harmful to you'- NHS

- Addiction is a brain disease in which there is repeated drug taking even though there are harmful consequences.
- Although the individual is usually aware that the drug is having these negative effects, they experience intense drug cravings which makes them keep taking drugs.

(18) How can drug addiction harm you?

Ask students if they can think of any ways that drugs could impact them, whether it is regarding their health and wellbeing or other important things in their life.

- Impaired memory and decision-making will make it hard to go about your every day life
- Organ damage e.g. brain damage, lung disease and kidney disease can be debilitating and make every day life very hard
- If you are addicted, the effects of drugs that you would be experiencing regularly e.g. loss of control, hallucinations, sedation— you wouldn't be able to be yourself

(19-20) Addiction: your brain has changed!

When drug abuse develops into drug addiction, there are permanent changes occurring in the brain, this is called neuroadaptation. The brain has adapted because of the drug taking.

- One way in which this happens in some individuals is through the decrease of dopamine receptors.
- Repeated drug abuse has overloaded the reward pathway with dopamine, so the brain compensates for this by reducing the number of dopamine receptors so that less dopamine is detected. Dopamine receptors are internalised, where they are taken away from the surface
- The reward pathway no longer makes you feel as much pleasure from things that brought you happiness before e.g. your favourite food and so the person experiences intense drug cravings to get the feeling of pleasure
- When a person that is addicted to drugs stops taking them, they experience withdrawal symptoms— very unpleasant things such as panic attacks and seizures/fits.

(21-23) This would be a good point in the session to play the 'Activity— Addiction Card Game'.

Full instructions can be found on the next page of this Information sheet

(24) Treatments for Addiction

Addiction to different drugs needs to be treated differently. There are medications that can be taken and behavioural changes that can be made to manage the condition.

Addiction is a chronic brain disease, meaning it lasts a long time and needs to be managed carefully with regular treatment.

Due to neuroadaptation, even if a drug addict has not taken any drugs in 20 years, they are still vulnerable.

It is important to treat underlying conditions to why an individual may have been abusing drugs, to stop them from turning to drugs again in the future.

This session has focused on the neuroscience behind the mechanisms by which drugs affect the brain, and how it can lead to drug addiction. It does not go further into research into treatments or existing specific treatments for drug addiction. If this is your field of research or interest, feel free to expand this area of the session when you carry it out.

(25) Summary slide

Where to get help and more information?

The flyer 'Secondary— Drugs & Addiction Help' should be printed out and handed out to the class at the end of the session.

Activity: Addiction Card Game

For this game to be understood by the students, you need to carry out the discussion on the lower part of this page with them after playing the game.

Aim: Your risk card and choice cards must not add up to a higher value than your switch card.

Materials needed:

- Pack of cards

First, remove the jokers. Divide the deck of cards into **two piles**: one containing the cards which have faces on them (jack, queen and king) and the other pile with all the other cards (aces and number cards).

Ask three students to volunteer while the rest of the class gather around their table and watch. All students play individually but use the same card piles. With multiple packs of cards, you could have the whole class play.

Each student picks a card from the smaller pile (faces pile) and this is their **switch card**, they should put it down on the table face down.

Value of switch card:

- **Jack: 15 points**
- **Queen: 25 points**
- **King: 35 points**

Next instruct the students to pick a card from the larger aces and numbers pile, and place it face down below the switch card on the table. This is their **risk card**.

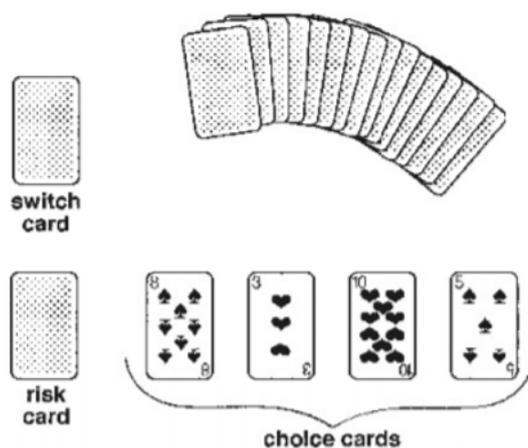
Again from the larger aces and numbers pile, ask the students to pick up as many cards as they want, they can put these face up and they are their **choice cards**. Remind them that the risk card and choice cards must not add up to be higher than the switch card.

Value of ace and number cards:

- **Ace: 1 point**
- **Number cards: the number on the card**

When the students have all finished picking up their choice cards, turn over the risk card and see if they have gone over the value of the switch card by adding up the risk card and choice cards.

Ask the students if they know what each card represents (remind about context of addiction).



Discussion following Addiction Card Game

- Choice cards each represent an episode of drug abuse.
- The risk card represents the risk of them becoming addicted.
- The switch card represents the point at which, if exceeded, changes will occur in the brain which cause drug abuse to turn into drug addiction.

If the total of the choice cards and the risk card is above that of the switch card, this means they have become addicted.

Why were you allowed to choose how many choice cards you wanted?

Because everyone has the power to control their own actions and choose if they want to abuse drugs or not, and how many times.

Why does each individual have a different switch and risk card?

We are all unique and different, and so everyone's brain and body work in slightly different ways.

Some people may get addicted after taking drugs of abuse a couple of times, and some may have a large amount of drugs before becoming addicted.

Each individual's brain will have a different point at which changes will occur in how their brain functions to result in drug abuse becoming drug addiction.

Important to remember: although it is unlikely you will get addicted to drugs after taking it just once, some people can die from one episode of drug abuse e.g. from not being able to breathe (respiratory failure).

Why were the risk and switch cards face down?

We don't know what risk factors we carry e.g. some people may have genes that make them more vulnerable to become addicted to drugs than others, which is why you must always be cautious about the decisions you make.

Summary of addition game discussion:

- Everyone has a choice in abusing drugs or not
- We all have different risk factors and points at which our brains will change and become addicted, but we don't know what these are.
- One episode of drug abuse is unlikely to result in addiction, but it can be lethal for some.