Webinar: Alcohol, MDMA and cannabis use- Impact on the adolescent brain

Speaker Key:

SN Dr. Smriti Nepal

JD Jennifer Debenham

Time code	Speaker	Text
00:00:00	SN	Good afternoon everyone, and thank you for joining us on the Positive Choices webinar series. My name is Smriti Nepal, and I will be chairing this session today. We have a wonderful speaker for you today. She will be talking to us about the impact that alcohol, MDMA and cannabis have on the adolescent brain. Before I introduce our speaker, I would like to give you some details about this webinar session. You are currently on listen-only mode, which means that we will not be able to hear or see you.
00:00:34		We are open to questions. So as the session progresses, please feel free to add your questions to the question and answer panel. We will address the questions at the end of this session. We will be recording this session and it will be made available through the Positive Choices website along with the handout from the presentation. If you're new to Positive Choices, let me give you a quick introduction.
00:01:00		Positive Choices is an online portal that aims to provide alcohol and drug information that is up to date and accurate, and this can be used by parents and teachers and students. I would encourage you to visit our website to access a range of evidence-based resources, our webinar series is a part of this. You will be able to access previous webinars on the website.
00:01:28		We welcome any feedback that you might have on the website. And additionally, if there's anything you would like to see on Positive Choices or if you have any suggestions for future webinars, then please feel free to send us an email on info@positivechoices.org.au. Moving on, let me introduce you to our speaker, Miss Jennifer Debenham. She's a PhD candidate here at the Matilda Centre for Research in Mental Health and Substance Use based at the University of Sydney.
00:02:00		Her research project involves translating evidence around the impact of illicit substances on the adolescent brain into effective

Time code	Speaker	Text
		harm minimisation programmes for young people. I will hand over to you now Jen, we're looking forward to your presentation.
	JD	Thank you, Smriti. In the short time that we have today, we're going to look beneath the surface of social drug use and focus on adolescent brain development.
00:02:34		Namely, first up, we'll look at alcohol, then we'll look at cannabis and then finally MDMA, and then we'll explore some overall harm reduction strategies. To kick off, let's have a look at how the brain functions and develops throughout adolescence, and then we'll introduce drugs into the system. We used to think that the brain was nothing more than this marshy clump of cells inside our head that didn't change much throughout all of life.
00:03:02		Then CT scans came in, and we started to link brain regions with different brain functions. Then MRI taught us about brain structure. And this is a functional MRI, which actually shows us the brain in action. And that's symbolised by these warm and cool colours. Then PET scans came along, and we started using dyes to observe different neurotransmitters and their targets in the brain.
00:03:28		Then 3D imaging came along, and we can see the density of different cells and how the brain changes over time. And now we're using machine learning to map neural networks and discover new insights about the brain. It's safe to say the brain is frigging extraordinary. It's the absolute best tool that we'll ever have. But we've only scratched the surface and we have a lot to learn about it. I have a question for you guys, to kick off.
00:03:58		What do you think? The brain finishes developing around the age of 18 and remains the same for the rest of life, true or false? And I'll hand over to Smriti to launch the poll.
	SN	Okay, I've launched the poll now. We'll give you a few seconds to answer this question. I will let you know when we are about to close the poll.
00:04:30		Okay, last chance to provide your answers. Closing the poll now. I will share the answer with you.
00:04:58		According to our audience members, only 1% answer true to the question and 99 answered false. Back to you, Jen, tell us what's the right answer.
	JD	Awesome. We've got quite a knowledgeable audience. The

Time code	Speaker	Text
		correct answer is false. To answer the first part of this question. The brain continues to develop past 18, and actually doesn't finish major structural integration until around the age of 25.
00:05:31		Take a look at this graphic. What you can see here is that the brain change is occurring from age six to 20, with the warmer colours symbolising less developed areas and the cooler colour symbolising more developed. What's really going on here is that we're born with a massive number of jumbled brain cells and connections that aren't necessarily working together. Over time, our brain tosses away what it no longer needs, and it strengthens the connections that we use the most.
00:06:00		And this allows for a leaner and meaner, more efficient brain activity. We can call this the use it or lose it principle, and it underlies neuroplasticity. Here is another example of this kind of neuro-remodelling that occurs in response to the outside world. To answer the second part of this question, whether the brain remains the same after the age of 25, not completely. In fact, it retains its plastic malleable quality for the rest of your life, but just to a much smaller extent.
00:06:33		This means that although adults can't learn as quick, they're actually more protected against some of the damaging effects of drugs compared to young people. This brings me to the next point. Our central nervous system is extremely complicated, but all we really need to understand are these two basic principles. First up, our neurons are responding to the environment, and second up, our neurons are adapting to the environment.
00:07:01		When it comes to drugs and alcohol, the brain isn't this passive recipient of drug action. In fact, it changes a lot in response to drugs. Most of the time it's trying to compensate to maintain a constant state. That's to say that the relationship between drugs and the brain is bidirectional. There's no such thing as a free lunch. And I think a really basic example of this is caffeine. Naturally when I wake up in the morning, my nervous system has its own arousal mechanisms to wake me up.
00:07:30		But if I drink coffee every day, which I do, my brain adapts to that flood of a stimulant by suppressing the natural arousal system. That means when I take coffee out of the picture, I actually feel more tired than before because my brain isn't producing that natural arousal. So I think that I don't drink coffee because I'm tired, I'm tired because I drink coffee. That cause and effect. The last point I want to make is brain development.

Time code	Speaker	Text
00:08:00		And that’s that the brain actually develops from back to front. For the sake of the next 20 minutes, let's understand this through three basic parts. First up, you've got your hind brain. This is responsible for basic survival functions like breathing and heart rate. It's going to keep you alive. Next up, we have the midbrain. That's like that sub-cortical region. It's being dubbed the animal brain. It's responsible for instincts and urges, desires, emotion, memory.
00:08:31		It's going to help us survive. And then the final part to develop is the forebrain. And basically, it's responsible for the most sophisticated high level thinking, thought to be the seat of personality, and it's really going to help us to thrive. It's quite easy to remember because it goes from basic to the most complex. In particular this prefrontal cortex region, it doesn't finish major structural integration until the age of 25.
00:09:00		Basically, the most important part of the brain develops last. Let's get into alcohol and other drugs. This is a beautiful drug colour wheel made by the Australian Drug Foundation. We're often told that drugs are either stimulants or depressants. However, if you look at this, you can see that there are so many other categories. You can see cannabinoids, opiates, empathogens.
00:09:29		And that's because drugs have much more varying effects on the body than simply up or down. The first thing that I want everyone to move away from is this idea that the drugs have fixed and predictable effects, because this is so far from the truth. And you can see in some of those symptoms in the middle part of the wheel, take cannabis, it makes some people feel relaxed but others quite anxious. For alcohol, it makes some people withdrawal, whilst others might get withdrawal and go to sleep, whilst others might get violent.
00:10:00		There's so many unhelpful stereotypes out there. Let's take a closer look at what's going on. First up, the drink of the nation, alcohol. What happens when people binge drink? Drink one, alcohol inhibits the forebrain. That's the part of the brain that… Basically, we're going to feel more relaxed. Our prefrontal cortex isn't triple checking everything we're saying. You're freer with your words and the like.
00:10:28		A couple more drinks, and alcohol is going to reach the mid part of the brain, so the animal brain. Our emotions can go unchecked, our urges enhanced, our language not as good. Memory, ever wondered why people black out and don't

Time code	Speaker	Text
		remember parts of the night? It's not because they don't remember. It's actually because the brain isn't active enough in the hippocampus, so memories aren't being laid down in the first place. Alcohol is also in… Sorry, in the midbrain also it's a pleasure centre.
00:11:00		You tend to feel pretty good, pretty confident and less concerned about consequences. And then finally, if you keep going and going and going, alcohol is going to travel into the hind brain. This is the danger zone as alcohol can reduce breathing rate and our heart rate. If you drink really quickly to get to this stage, then you're probably going to pass out. And if no one's looking after you, then you can also OD.
00:11:29		Now a lot of people run into problems when they're using alcohol when they mix alcohol with other depressants like benzodiazepines, GHB, opiates and the like, because you can get that compounded neural inhibition and this can shut down the breathing centre in the brain. To show you what this can look like in real life. This is a study carried out by NIDA, a body in the US. What you're looking at are brain scans of 20 healthy volunteers.
00:11:59		And we've got progressively deeper neuro slices as you move from left to right. The warmer colours indicate higher activity and the cooler colours indicate lower activity. We've got the controls at the top, and the intoxicated down at the bottom. And basically, the intoxicated individuals were given quite a moderate dose of alcohol, about 0.5g per kg. For someone of my size, it's about 30 something drinks.
00:12:28		And what you can see here is that basically alcohol decreases neural activity. And this is what's going on over the short term. Over the longer term, so there is really conclusive research out there showing structural, functional and cognitive changes associated with binge drinking during brain development. Sometimes it's the structure. Once a teenager starts binge drinking, their brains tend to grow more slowly.
00:13:00		There's reduced volume in the frontal lobes and the hippocampus, so that memory centre and that sophisticated brain area at the front, and this can really affect how we learn for the rest of life. We also see functional changes. Binge drinkers often need more brainpower to do the same task as those who haven't binge drank. And then finally, we also see associated cognitive changes, so that's the way we think.

Time code	Speaker	Text
00:13:28		Often people who have binge drank during adolescence have reduced inhibitions and reduced decision-making. Checking out the seemingly complex feature on the right, basically, you're looking at two angles of a brain with a yellow scale showing regions where binge drinkers have smaller brain volumes than non-binge drinkers. Not non, although drinkers. The brighter orange is representing a faster rate of volume decline than the yellow.
00:14:00		Basically, we can see that it's this whole cortex area, so this whole part of the brain responsible for being aware and cognition is affected. And in particular, there's a lot of orange in this prefrontal cortex. This is a decent study. It's longitudinal, so it's looking at about 483 adolescents over time between the ages of 12 and 21. And we're looking at when they started drinking, and we're following them up afterwards.
00:14:28		Basically, that goes to say that alcohol is a powerful steriliser and an inhibitor, and it really can disorder normal growth trajectories in the brain. What do we do about that? Let's talk a bit about harm reduction in alcohol. One way of framing harm reduction is through this set, setting and drug framework. If you haven't heard about it, basically the set refers to everything about the individual, so their agenda, their genetics, their physical state, their mental state and the like.
00:15:02		The setting, so that refers to the way the drug's been taken. What environmental factors are contributing to harm. And then finally the drug, that's the action of the drug, the potency, the dose, the purity, what other drugs have been taken, etc. I've put a couple of options up here, and there'll be much more, so feel free to comment then if you have your own harm reduction strategies.
00:15:26		But first up, if yes… First up, learn the stages of drunkenness. Remind young people that there are many stages of drunkenness and we can track our behavioural symptoms in relation to the dose of alcohol. And we know that nothing sobers you up more than time. Putting someone in the shower or force feeding them bread or whatever is not going to sober them up. And yes, it's important to go through this with young people. Make sure that they know the signs of overdose.
00:15:59		Here's a couple of points here like slow or irregular breathing, pale skin, lower body temperature, someone can't be awaken. All these points are really important. Remind young people that they can always call an ambulance. The police do not come, and that

Time code	Speaker	Text
		is a standard in Australia, which is awesome. Don't mix alcohol with other drugs, particularly other depressants.
00:16:29		For a lot of people planning, planning is so important when it comes to alcohol. Remind someone to have a pre plan of how many drinks they're going to have, what time in the night are they going to stop or they're going to have a cut off. That can really help. I really like this point, reminding someone of the rules of consent. A lot of young people drink for a bit of a social lubricant or confidence, but you can't get consent when you're intoxicated. That's a good one.
00:17:00		I guess, I want to add a point that's often ignored or maybe forgotten is exploring these underlying reasons behind binge drinking. We know that alcohol reduces brain activity, but for many people that might be the attraction. For many people, they're drinking to cope with some kind of negative emotion. That's really important when it comes to drinking. Because we know that healthy relationships with alcohol really can exist, but we've got to nurture those in young people.
00:17:32		Next question, what are some of the motives behind young people binge drinking, to feel good, to improve confidence, peer influence, feeling better, all of the above? And over to Smriti to launch the poll.
	SN	Launching the poll now. We'll give you a few seconds to answer this question as before, and we'll share the answers with you at the end.
00:18:00		Okay, last call. Feel free to put in your answers to this question
00:18:30		Because we're going to close the poll now and share this result. According to our audience, the answer is all of the above. What do you think, Jen?
	JD	Yes, we all know that it is a mixture of the above. There's many reasons why we do what we do. A big one is actually peer influence, particularly for young people. A lot of national data sets say that peer influence is the number one reason.
00:19:00		But yes, I really just think when we're trying to minimise harm particularly with young people, we've got to explore these and we've got to address If someone is drinking to feel better, to cope with negative emotions, then we've got to address that to solve the problem with binge drinking. Awesome, so moving on. Next, we're going to look at the most widely used illicit drug around the

Time code	Speaker	Text
		world, and that's cannabis. And it's actually the drug that most Australians seek help for.
00:19:32		The cannabis bud is typically cut up and it's smoked, or sometimes it's used in cooking as well. And the active ingredient that makes you high is called THC. And basically, THC mimics our bodies naturally occurring neurotransmitters such as anandamide.
00:19:56		If we were to get a THC molecule like the one we have here and label it with a yellow dye and give it to someone, we'd see that once they've inhaled it, we would see the THC crossed from the lungs into the bloodstream and then quickly carried to the brain. And here in the brain, the THC molecule would target all the places with the yellow dots in the brain that you can see. It came as a shock to researchers to say that these little yellow dots are basically in every brain structure.
00:20:30		We can see it's all throughout the cortex responsible for thinking and awareness. In the midbrain, so memory, emotion. And also in the hindbrain, so coordination. Basically, instead of having specialised effects, the effects of cannabis are far reaching. I think it's particularly interesting to note here the pink part of the brain at the back responsible for vision. You can't really see any yellow dots there.
00:20:55		And that's because contrary to popular belief, most people don't experience hallucinations or any trippy effects from cannabis. And that's because they don't have receptors in that part of the brain. However, an extremely rare small amount of people do, and they might experience it. It turns out that the cannabinoid system that we naturally have in our brain is particularly important to young people's brain development.
00:21:28		And that's because it's basically coordinating the integration of different parts of the brain. Think of it like the occupational health and safety team with heaps of little workers facilitating structural integration. And these little workers are basically choosing which neurons to prune away and which neurons to keep, basically. You can imagine if a young person smokes regularly and they're continuously flushing the system with heaps and heaps of workers in that OHS team, there's going to be an excess of workers.
00:22:01		And basically what we theorise is that with too many workers, more work gets done. We actually end up pruning away more than we might need or might want. But then to continue this little

Time code	Speaker	Text
		analogy, at some stage the boss is going to be like, okay, we've got an excess of workers, let's fire all these people. And then we're going to get basically not enough work being done. And that's just that bidirectional relationship between drugs and the brain.
00:22:32		The brain is going to compensate and down regulate certain things to cope with excess of a drug. Basically, we think that THC used during brain development can disrupt this process of pruning and it can lead to abnormal brain connectivity. And theoretically, the parts of the brain that at least developed, so that prefrontal cortex might be the most sensitive to cannabis exposure.
00:23:00		But that's to say, after the age of 25 when the brain is finished developing, maybe we won't see these effects and this impact on brain structure and function. To show you what this might look like, and I don't want to be part of this, the stereo of this is your brain on drugs, but this is some brain scans of young people who have chronic exposure to cannabis use. This is the MRI scans of 48 regular cannabis users and 62 control brains.
00:23:31		And basically, what you can see is that the yellow regions in the frontal part of the brain is where regular users of cannabis had lower brain volumes than nonusers. And in the bar graph you're just seeing that same data. And what we saw in this study is at the age of onset of use correlated with the harms. That's quite interesting. But we also do see that the longer the period of abstinence, then the reduced size of these effects.
00:24:00		That indicates there is a degree of recovery after abstinence. That's brain structure. Moving on to brain function. This is a PET scan showing brain activity, and that's measured through blood flow, basically. And this is a study carried out by NIDA in the US. And what we're seeing here is the brain scans of eight healthy men aged about 35 years old who started smoking cannabis during adolescence. Again, the warmer colours represent higher activity and the cooler colours represent lower activity.
00:24:31		And you can basically see the front of the brain in these upper most scans, basically you're seeing progressively deeper slices again. And you can see that there's reduced activity in the cerebellum, and that's the part of the brain responsible for coordination. Often heavier cannabis users become slightly uncoordinated.

Time code	Speaker	Text
00:25:00		Just to summarise cannabis and brain structure. We know that cannabis is neurotoxic for growing brains. We know the earlier you start, the more damage you can do. And we think that really reduces the plasticity of neurons. And usually in normal brain development we see a reduced cortical thickness, so that’s at the surface of the brain it gets a bit thinner as things are pruned away.
00:25:29		We see gray and white matter contrast, so that's types of different parts of the cells in the brain. And we see increased brain folds. However, in multiple studies we see that when adolescents engage in heavy, so not low or medium, but heavy cannabis use during adolescence, we pretty much get the opposite effect in all these brain regions. However, a really, really important point that needs to be made is that the current state of the evidence with cannabis is really mixed.
00:26:02		We see a lot of studies showing just this. Then we also see studies showing no change. And that means that these findings are really inconclusive. And I want to explore why this might be the case. Why you hear such different things when it comes to cannabis. Basically, first up, we've got a big issue with potency. THC, that psychoactive component. The potency of cannabis has changed immensely over the past 30 years.
00:26:33		We started off with about 1% to 2% THC, and now we're up 10, 20, 30, 40, 50% THC. That has a massive change on the impact on the brain. Second up, a lot of studies use different methods to assess brain activity, and a lot of them assess different regions of the brain. And so it's quite hard to compare the results across studies. Then we've also got the issue of poly drug use.
00:26:59		A lot of people who use drugs don't just use one in isolation, so it can be hard to account for that in research. And there's so much research coming out about nicotine, about alcohol changing brain structure and function, so this could really compound our results. And then finally, the study design. Often, we see what we call cross-sectional studies. That's looking at one point in time, a snapshot of a whole cohort and what's going on, and basically how we draw correlations between behaviours and effects.
00:27:35		Instead of longitudinal studies, which is where we follow a cohort over time and we can deduce causality. There's a real lack of longitudinal studies, so a lot of work needs to be done. But nonetheless, when it comes to young people, there's so much harm reduction strategies that we can all learn and implement.

Time code	Speaker	Text
		First up, avoid, avoid, avoid, avoid all use during adolescence and early adulthood.
00:28:02		We know it's neurotoxic, particularly for developing brains. We know that the age of onset matters. We know that the frequency matters. We know that the potency matters so we need to educate young people about potency, how it's changed, how it's linked to higher rates of psychosis and mental illness. Cannabis has addictive potential.
00:28:28		I think a lot of people think that, no, it's not addictive. No one's died from it. It's fine. Actually, 17% of young people get addicted to it. And now that we're seeing more potent strains coming out, it's actually cranked up to 20% to 30%. In some ways, cannabis can be more addictive than tobacco. I think addiction is quite an interesting concept because often we have this physical addiction, but then we also have the psychological habit.
00:28:58		And that's what you really see in chronic cannabis users, that you have this real behavioural addiction. That's important to track use. If you know someone's using, ask them how much they're using, are they on top of that? Definitely don't drive, we know that it impairs coordination and reflexes. And once again coming back to the underlying reason why, we need to address the underlying reason why. Next up, MDMA. I've got another question for you.
00:29:30		What do you think? MDMA increases the activity of the following neurotransmitters, dopamine, serotonin, noradrenaline, endorphins, or A, B and C, what do you think? Over to you, Smriti.
	SN	Thanks, Jen. Launching the poll now. We'll wait for a few seconds for your answer.
	JD	Hopefully this is a little bit more challenging than the previous questions.
	SN	I think it will be.
00:30:00		Okay, last chance to answer this question. And I'm going to close it now.
00:30:30		Sharing the results. Jen, most of audience members think it's A, B and C. You tell us what the right answer is.
	JD	In a way, everyone who didn't pick endorphins is correct. MDMA causes, not the release, but increases the activity of dopamine,

Time code	Speaker	Text
		serotonin and noradrenaline. Dopamine is that pleasure chemical.
00:30:59		Serotonin elevates mood and it's responsible for that increase empathy that we commonly see with MDMA users. And then noradrenaline, so that's those stimulating effects, that fight or flight response. Endorphins, that's the opioid system, so that's more of a depressive kind of effect. But well done everyone, a lot of people have clearly heard of these neurotransmitters, which is really cool. When it comes to MDMA, and for the sake of time, I'm just going to make one point basically, and that's around heat.
00:31:32		Basically, MDMA's toxic effects have to do with temperature. Brain tissue is exceptionally sensitive to heat. And we often see structural changes associated with the three or four degree increase above our normal baseline. Usually, the brain sits at about 37.5 degrees. Anything more than about 39 to 40 degrees, you really structural damage in brain cells.
00:32:00		Let's have a look at how the brain maintains a normal state. Basically, it has these two main mechanisms. First up, we've got the hypothalamus. That's in subcortical part of the brain, the animal brain. And it maintains homeostasis by detecting heat changes and also controlling heat production. Secondly, we've got the brain loses a lot of heat through blood flow. We know that when we're hot, our veins dilate. They come to the surface of our skin and we lose heat to the external environment.
00:32:30		MDMA compromises both of these mechanisms. Being a stimulant, it increases brain metabolism. MDMA also prevents the hypothalamus from being able to detect these changes in the brain. Let me just bring it up. And it also impairs circulation because it causes vasoconstriction. Instead of our blood vessels dilating and losing heat, they constrict and we don't lose heat to the external environment very well.
00:33:02		Just to show you what this can look like, and you don't have to get this exactly. But basically this is an animal study, because we can't do this in a controlled way with humans, of course. But basically, on the left we have normal heat loss. When the brain temperature increases your metabolism for whatever reason, we get a circulatory change and we start to lose heat through the skin. You can see that comes up and they intersect.
00:33:29		However, on the right when we've introduced MDMA, we can see that the brain increases in temperature, but the skin barely changes and we don't actually end up losing heat. You see the

Time code	Speaker	Text
		blue line is the nucleus accumbens, so that's the pleasure centre in the brain. And then the red is the brain muscle, and that's in the cortex compared to the green skin. We know that damage to your brain cells, particularly your serotonin neurons, progresses a lot with a slight temperature increase.
00:34:00		And we know that sustained hypothermia, which does only happen to a small number of users, but we can get neurochemical structural changes. And we can, yes, we don't have to go into it too much, but the brain is extremely sensitive to heat damage. If we compare, if we combine this knowledge of the way MDMA acts and the way it works in our brain with the context of social use.
00:34:30		Often how people use at festivals where it's overcrowded, elevated temperatures, there's dehydration, sorts of physical and emotional activity, all of these things increase heat. And I do a bit of volunteer work at festivals. And what we see is that most hospitalisations happen because of heat exhaustion and dehydration. And I really think that this is preventable. And this happens also without MDMA a lot of the time.
00:34:57		In terms of harm reduction with MDMA, the safest thing by far and what we recommend to all developing brains that are vulnerable and under construction, is don't take MDMA. Don't do it whilst your brain's developing. But next up, if you're around people who might be using, do you guys know…? Speaking to young people, do they know the signs of overdose, of stimulant overdose? High temperatures, headaches, confusion, agitation, these are a couple of them.
00:35:30		If they're out at festivals or clubs or whatever, do they know the location of a medical unit? Because a lot of the treatment of overheating, that requires prompt medical attention, like seconds matter. Low purity is a big issue with MDMA, and the dose varies widely. Small amounts are really important. Avoid booster doses.
00:35:58		I think a really important thing is that there are police units at every single festival. A lot of the time we see that young people might be waiting in line to enter an event and they see police and they panic, and they might take a few pills at one point. And that is so, so dangerous and can often lead to quite tragic outcomes. Remind people that the police will be there, expect them to be there, don't try and take anything into a festival. Don't let that be you.

Time code	Speaker	Text
00:36:28		Next, don't mix MDMA with other drugs. You can really dramatically increase your chances of having an adverse drug event. And finally, stay hydrated, have long breaks, sleep well, eat well and the like. To wrap up, just to conclude. We know that the earliest you start, the greater the neurocognitive deficits. And we really do know that now. We know alcohol reduces brain activity over the shorter term.
00:37:00		This can lead to reductions in volume and function over the longer term. Cannabis impairs brain connections. That pruning process, so connectivity is most important. And then with MDMA, it really compromises heat loss. And we do see that damage after sustained high temperatures. However, a real disclaimer is, the issue of causality is far from resolved.
00:37:27		There is a lot of study out, research out there, getting across it can be quite confusing. But we do have a lot more work to be done in terms of longitudinal studies. And yes, just to end on some overall harm reduction strategies. For a lot of parents and teachers out there, have the conversation, first up. It shouldn't be a taboo topic. Ask plenty of questions, ask people are they using, are any of their friends using, do they have any concerns about that?
00:38:02		Just really try and have a non-judgmental conversation. Nurture protective factors for young people, broad circle of friends and exercise and hobbies and all this kind of thing, really try and encourage that. And discuss risk factors, what do their friends think about substance use?
00:38:25		I think every parent has a responsibility to discuss genetic predispositions towards a mental illness and the like, and really explore family heritage. It's really important. Negative communication patterns, actually having that close relationship and a lot of trust with young people. School commitment, all that kind of thing. And finally, always explore that underlying reason why. If we want behaviour change, we have to address that underlying reason why. I think that concludes all we had for today. Thank you so much for listening.
00:39:00		And if there are any questions, I'll hand over to Smriti now.
	SN	Awesome. Thank you Jen, for that really informative presentation. I learnt a lot of things, and I'm sure our audience members did too. This is for our audience members. If you have any questions, please feel free to add them to the question and

Time code	Speaker	Text
		answer panel.
00:39:30		In the meantime while I wait for questions to come through, I will ask you a question that I have, Jen. I was wondering, when someone's been taking drugs consistently, do the drugs cause permanent damage to their brains or is there a point of return?
	JD	Great question. Basically, the brain's capacity to learn, adapt, recover is basically infinite.
00:40:00		In terms of how long does it take to see some bad effects of alcohol and cannabis and MDMA? We do believe that there's no such thing as a free lunch, particularly for young people. And that's because the brain changes so much in response to drugs coming in, and it's such a complex time of development. With binge drinking actually, with it, we do see changes. I think it's up to… Binge drinking once a month is enough to show these structural brain changes.
00:40:32		It's scary. But yes, we see some really promising results in animals to suggest that there's never a point of no return, basically. You can always increase your neuroplasticity. You can grow your brain and reverse damage. We don't know exactly to what extent, but some really cool research actually coming out around exercise increasing neuroplasticity.
00:41:00		It really increases synaptogenesis, so the connections between brain cells, and also yoga and meditation. Those activities that basically just silence the brain a little bit can really harness the power of neuroplasticity. To answer your question, there's a lot of optimism. And I think it's really important we tell young people this, it's never too late. You can always introduce more healthy, positive activities in your life.
00:41:30	SN	That's awesome news, Jen. Thanks for that. I'll get to a couple of audience questions that we have. The first question from the audience is, what is considered heavy cannabis use among young people?
	JD	Again, it varies a little bit. But once a week is considered heavy. Once a month is moderate.
00:42:00		And daily is obviously very heavy. But you want to look at the frequency, but you also want to look at the volume. And that's one thing that we haven't got much consistency of throughout across studies.

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	SN	Okay. And another interesting question is, is dopamine reabsorbed into the system after MDMA use, and does MDMA use cause any extra pyramidal side effects?
00:42:30	JD	Yes, basically like the way MDMA works is, in the come up, it basically prevents the re-uptake of dopamine. You basically, you've got two neurons and you get the dopamine released from one neuron and it will come on to the other neuron. But in normal brain function, we recycle dopamine so it doesn't stay in the synapse for very long, and we recycle it so it can be used again.
00:42:59		But MDMA stops that recycling, so you get a build-up of dopamine in the synapse and you get that real big cascaded effect and lasting effect. That's once the drug's in your system. But then when you're coming down, basically you've got depleted dopamine reserves. Now that there's none in the synapse, there's actually none also in that pre-synaptic neuron. Meaning, when the next day or the next week, it's actually quite hard to release any dopamine because you don't have that much.
00:43:33		You don't really have any in storage, so to say. And in terms of extra side effects, yes, every drug has side effects. Particularly with ecstasy, you get disruptions in sleep and diet and concentration. We see cognitive changes after about two years of MDMA use.
00:44:00		You see cognitive brain changes. As you saw before, the drug doesn't just go to one spot in the brain, often it goes throughout the brain and the whole body. Depending on where its target is, it will have quite broad effects.
	SN	We have time for one last question. And the last question is, so there's been a lot of debate recently around legalising cannabis.
00:44:31		And there are people who often say that cannabis is not as harmful as alcohol. What would you say to people like that? How do you think people should talk to young people about these things?
	JD	Yes, I think this is something that you hear a lot of young people say in particular that, it's legal in the US. It's never killed anyone. Maybe alcohol causes more harm.
00:45:00		And that generation really doesn't think cannabis is that dangerous. What I would say to that is that, yes, whilst cannabis is used medicinally here and in some states in the US it is legal recreationally. The big point to make about medicinal use is that

Time code	Speaker	Text
		cannabis has 100, thousands of chemicals, and so you have the psychoactive ingredient, THC. But in the medicinal drug there's no THC in there, so patients aren't having a high, basically.
00:45:32		They're just given other cannabinoids. That's really important. Medicinal cannabis is very different to what people smoke recreationally. And yes, over in the States it is legal for people over 21 years. And yes, there's an increase in use, and that we don't have really long term data to know the real impact on that. I think when your brain is fully developed after the age of 25, maybe there isn't that negative impact on brain development.
00:46:01		But it's a bit of an experiment at this stage. And I think you said, yes, cannabis hasn't killed anyone. That's quite a funny way of thinking in a way. It's like as long as you're not dead, it's fine. Although you can't overdose on cannabis or people don't tend to overdose, that's not to say it's not neurotoxic. And it's not to say that it's not implicated in mental illness. It's not very addictive. It's linked to psychosis, anxiety, all these things, particularly for young people.
00:46:32		Does that answer the question?
	SN	Yes. Thank you, Jen. And yes, that's the end of the question and answer session. And before we go, I would like to remind everyone to log on to Positive Choices in order to get more evidence based information on alcohol and drugs. And also, please feel free to send us feedbacks that you might have.
00:47:02		And before I end, I would also like to let you know that the webinar will be made available online within the next 48 hours along with the handout from the presentation. I'd like to thank you again, Jen. And I would like to thank our audience for tuning in today. Thank you.
	JD	Thanks.
	SN	Bye.