

Adolescent substance use 1: overview of substances used

By Philip James

Introduction

This is the first of three articles that will look at the issue of adolescent substance use. This article introduces different substances and how they are used. The second article will focus on adolescent substance use, the harm it can cause and the best prevention methods available. The final article will focus on treatment of adolescent substance use.

This article starts with an overview of categories of substances followed by a brief overview of how substances interact with the body. Specific substances that are most relevant to those working with adolescents in Ireland today are then discussed. Alcohol and cannabis are the two most frequently used substances, while cocaine and nitrous oxide are also discussed as they have received significant media attention in recent years.

But first, when talking about substance use it is worth thinking about the language that is used; words and phrases such as addiction, addict, alcoholic, drug dependent, drug abuse, drug misuse etc. are used frequently. Addiction, strictly speaking, is not a medically defined term but tends to be used to describe someone who meets the criteria for a substance use disorder (SUD). The criteria for what constitute a substance use (or any mental health) disorder are set out by two organisations: the World Health Organisation (WHO) and the American Psychiatric Association (APA). The WHO publish a book called the International Classification of Diseases which is currently in its eleventh edition (ICD-11) and the APA publish one called the Diagnostic and Statistics Manual, currently in its fifth edition (DSM-5). The DSM-5 tends to be used in North America and Australia while the ICD-11 is used almost everywhere else, including Ireland and so I will focus on this.

Within the ICD-11 system there are four main substance use diagnoses which are summarised in Table 1. These are diagnosed in relation to a particular substance such as an episode of harmful alcohol use, or harmful cannabis use. A criticism that is often made of these criteria is that they do not consider the person's age, so the same criteria are used to diagnose harmful alcohol use in a twelve-year-old as a forty-year-old.

Table 1: the ICD-11 substance related diagnoses

<i>Diagnostic category</i>	<i>Description</i>
<i>Episode of harmful use</i>	A single episode of use resulting in mental or physical harm or behaviour that has harmed others
<i>Hazardous use</i>	A pattern of use that increases the risk of mental or physical harm, but they are not currently evident.
<i>Harmful use</i>	A pattern of use (over 12 months, or 1 month if the use is nearly daily) leading to mental or physical harm, or behaviour that harms others
<i>Dependence</i>	Due to repeated or continual use and presents as a strong drive to use, which leads to neglect and impact on other aspects of life, a lack of control over use and a sense of craving or urge to use. This is

the most severe form of substance disorder and is what people typically refer to as being addicted. Dependence symptoms include psychological (e.g. craving the drug) or physical (tolerance and withdrawal)

It is generally recommended that we avoid using words and phrases such as addict, addiction, drug user and drug problem as these are often seen as pejorative and can elicit a negative and defensive reaction. Thus, they are often counterproductive. When talking to someone about their substance use, simply use everyday language and speak about their use.

Understanding substances

There are many substances that potentially could be used in a harmful way, and certainly more than could be learned off or put into an article. A more user-friendly approach is to understand the broad categories of substances based on their major effect, typically based on the effect they have on the central nervous system (CNS). The CNS comprises the brain and spinal cord and receives and processes information from the body and sends messages to control movement and other functions (Teixeira, 2024). Drugs can either stimulate the CNS (stimulants) or slow or depress the CNS (depressants) (P. James et al., 2014). Drugs that stimulate the CNS tend to make people feel more alert, more awake and that they have more energy and so are synonymous with dance and party drugs such as ecstasy. Depressants, on the other hand, tend to slow the CNS activity, causing the individual to feel more tired, drowsy, and often causing them to fall asleep, with alcohol being a common example. One thing to note is that when people talk about alcohol being a depressant, they tend to mention that this is the effect it has on a person’s mood, which is not fully true. Alcohol is a depressant because it depresses the CNS regardless of the effect on mood. In fact, many people report feeling quite euphoric when they consume alcohol and many people often have mood problems associated with stimulants which are not CNS depressants. Basically, all drugs can negatively affect mental health, regardless of whether they are stimulants or depressants.

In addition to the CNS depressant or stimulant categories, some drugs have a hallucinogenic effect; that is, they can alter the users’ perceptions through their senses causing them to feel, taste, see, hear, or smell things differently. A classic example might be someone who takes LSD, also known as acid, and perceives that they can “see” the music. For LSD and magic mushrooms, their major effect is a hallucinogenic one. Other drugs such as cannabis, cocaine and alcohol (particularly in alcohol withdrawal) can also have a hallucinogenic effect, in addition to their effect on the CNS. Common drugs in each category are summarised in Table 2.

Table 2: 3 major drug categories.

CNS depressants	Hallucinogens	CNS Stimulants
Alcohol	LSD / Acid	Cocaine
Pain medications / opiates	Magic Mushrooms	Ecstasy / MDMA
Sleeping pills		Speed
Benzodiazepines		Caffeine

Cannabis Nitrous Oxide		Nicotine
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Understanding how substances cause their effects

Separate to the individual substance being consumed, it can be useful to understand the science behind how drugs cause their effects. The first thing to recognise is that drugs cause their effect by interfering with the normal operation of neurochemicals (sometimes called neurotransmitters), such as dopamine, serotonin, and noradrenaline, within the CNS. By interfering with neurotransmitters, drugs can change the messages that are received by the brain. Some drugs interfere with the operation of neurotransmitters within the brain and consequently effect emotions, alertness, perception, thoughts, and behaviours. Drugs that do so are typically referred to as psychoactive or psychotropic and have the potential of being used misused for this effect. Drugs that do not act directly on the brain are not psychoactive. A good example is pain mediation where medications such as opiates can cause significant effects on the brain while other pain medications such as ibuprofen do not. Different drugs affect different neurotransmitters and in slightly different ways leading to the typical effects associated with different drugs.

When a drug is consumed it needs to cross the barrier between the blood and the brain to become psychoactive. Three factors significantly influence this effect:

1. **Route of administration:** when a drug is swallowed (e.g. alcohol or a tablet), it enters the digestive system where it needs to be broken down and the chemicals extracted and absorbed into the blood stream. This takes time and explains why people do not feel the effects of alcohol or tablets straight away. By contrast, smoking a substance leads to it being transferred to the blood stream almost immediately from the lungs giving an almost instantaneous hit.
2. **Interactions:** when a drug is consumed, it interacts with the body and other drugs in the system. This interaction can boost or inhibit the effects of the drugs. Taking two CNS depressants, such as pain medication and alcohol together, can make someone drowsier than either drug alone would do. Likewise taking a stimulant while drinking may reduce the drowsiness typically caused by alcohol. Drug interactions are sometimes desirable to people taking drugs but can make effects harder to predict and lead to increased risk of overdose.
3. **Elimination:** the body breaks down substances and flushes them out, typically via the kidneys and into the urine. Certain substances are eliminated quicker than others and this affects how long the drugs will be detectable in the system and how long the intoxication may last. Illnesses can affect how efficiently the body removes a substance from the body too.

We also need to consider some individual factors that may influence how a drug affects someone and two important factors are the size and composition of the person's body and, their experience of the drug. As mentioned above, the drug is broken down and absorbed into the blood system. The level of the drug in the blood system correlates to how intoxicated someone is, hence, drink driving limits are expressed as an amount of alcohol in the blood – 50mg per 100ml of blood. People are not the same size and we have approximately a pint of blood per stone weigh. So,

someone who is 15 stone will have much more blood than someone who is 9 stone and so three pints of beer will probably not lead to the same blood alcohol level. Be warned, that this is not an exact science, as other factors such as hormones, illness, and body composition (muscle tends to have more blood than fat) can also affect the level of a drug in the body.

When we use a substance regularly, our body learns to adapt to it, usually by releasing hormones to counteract the effect of the drug. Thus, we need to take more of the substance to get the same effect and this is referred to as tolerance. Many people will recall when they first started drinking alcohol and two or three bottles of beer may have led to them being quite intoxicated but, over time, they could consume perhaps twice as much and still not feel as intoxicated. This principle applies to many substances including medications, but it is not permanent. If you stop taking the substance for a few weeks or more, your body's tolerance for that substance will reduce and if you start drinking again you will notice you get intoxicated much quicker than you used to do. This is an important principle when people are giving up substances as people who stop substance use and relapse back to using are at an increased risk of overdose and of death due to their reduced tolerance.

So, to put this all together, the message is that the drug use involves a complicated interaction between the drug and the person and how they use it. Just as different beers or wines contain different amounts of alcohol, other drugs can also vary in strength and the change might be very substantial and hard to determine before you take them. How you take the substance (smoke or swallow) and if you take it with other substances will also alter the effect. Individual factors such as whether you have used this drug before, how tired you are, if you are unwell, if you have eaten etc. may also influence the drugs effect.

In the rest of this article, I will discuss some specific drugs that are relevant to adolescents in Ireland today. Across the EU, the European Schools Project on Alcohol and Other Drugs (ESPAD) is a large study completed every four years with school students in the calendar year of their 16th birthday (The ESPAD Group, 2020b). It was first completed in 1995 and the last published data is from 2019, with the data collected in 2023 due to be published later this year. The ESPAD study data is freely available online and contains a wealth of information. The 2019 iteration surveyed almost 2,000 15- and 16-year-olds in Ireland and is probably the most robust measure of adolescent substance use we have, so I will primarily use this data when discussing adolescents. One weakness is that it does not provide a regional breakdown, only a national average. In my experience of doing presentations and talks around adolescent substance use, adults tend to overestimate or normalise the extent of adolescent substance use. Jigsaw, the National Centre for Youth Mental Health has also carried out some useful research on teenagers that covers substance use and mental health (Dooley et al., 2019).

Alcohol

Alcohol is the most common substance misused in Ireland, regardless of age group. Approximately three-quarters of those aged over 15 years in Ireland drink. Among Irish 16-year-olds, about 72% have tried alcohol and 41% have drunk in the last month and there is little difference between boys and girls (The ESPAD Group, 2020a). The other interesting fact is that the drinking patterns of Irish teens is pretty similar to the European average. However, despite this, there are

significant levels of alcohol harm among Irish teens, with about 4% of students from second year upwards being alcohol dependent which is roughly one per class (Dooley et al., 2019). Likewise, half of 6th years are suffering some form of alcohol related harm, with depression and anxiety problems significantly increasing among those who have an unhealthy pattern of alcohol use. Alcohol tends to disinhibit the user, making them more likely to do and say things they would not normally do or say, often leading to bad decisions. Consequently, alcohol plays a significant role in public order, domestic violence, and sexual assault cases. For example, in experiments, even modest amounts of alcohol (about the amount of alcohol in two bottles of beer) resulted in female college students slower to identify sexual assault risk (Loiselle & Fuqua, 2007). Also, males were slower to detect unwanted sexual advances after consuming alcohol (Gross et al., 2001).

What is worrying, is the tolerance in Irish culture for unhealthy alcohol use. As the figures above demonstrate, it is the most commonly used substance by teenagers with nearly 3,000 alcohol dependent 6th year students alone but, typically, only about 120 under 18s entering treatment for it per year over the past decade (Health Research Board, 2024). Typically, alcohol use in teenagers involves a binge pattern where they may drink one or two days a week and not consume any alcohol for the rest of the week. Medications are therefore rarely required, and it would be unusual for adolescents to drink in school.

Cannabis

Cannabis is the most frequently used illicit substance in most western countries including Ireland and causes the most substance use disorders (UNODC, 2023). Irish research suggests that 27.9% of Irish adults (aged 15-64) have tried cannabis with 7.7% and 4.4% reporting last year and last month use respectively (NACDA, 2018). From 2016 to 2019 cannabis was the main drug among all those seeking substance use treatment for the first time, but, since 2020, it was overtaken by cocaine (O'Neill et al., 2023). However, cannabis is consistently the main reason for referral to treatment for under 18s, accounting for over 84% of referrals in 2022 (Health Research Board, 2024). Cannabis, typically called marijuana in the USA, is a drug derived from the cannabis plant. There are many chemicals found in the plant but tetrahydrocannabinol (THC) is widely recognised as the psychoactive component, while other chemicals, such as cannabidiol (CBD) are not viewed as psychoactive and are often available in many products including vapes, cosmetics and food supplements (Kumar et al., 2021).

So, when we talk about cannabis, we are focusing on those products containing THC. Traditionally cannabis use in Ireland involved cannabis resin (hash), where the plant was processed into a resin that looks like a peat briquette. This was broken up and rolled with tobacco into a cigarette and smoked. Today, cannabis mainly comes in herbal form, looking a little like chopped herb (called grass or weed) and is still rolled with tobacco and smoked. In Ireland, a mixture of cannabis (herb or weed) and tobacco in a cigarette is called a joint while a “blunt” is a joint that has only herbal cannabis and no tobacco. While cannabis can be consumed in many ways, such as added to food and eaten, smoked in pipes or prepared as an oil and vaped, the vast majority is herbal and consumed in joints with tobacco.

Many people state that cannabis is “non addictive” which is countered by a considerable body of research that shows that when people stop cannabis they may experience both physical

(sweating, tremors, poor sleep, appetite changes) and psychological (irritability, mood swings, anger, anxiety, low mood) symptoms which are not pleasant and can last for a few weeks after smoking cannabis (Allsop et al., 2012; Budney & Hughes, 2006). The good news is that these withdrawal symptoms are not dangerous, but many people do not recognise them as an effect of the cannabis. For example, a young person may report that he feels restless, agitated, and anxious when he does not have cannabis and perceives that he has an anxiety disorder which cannabis helps him to manage, rather than withdrawals from the cannabis. Teasing this out can be complicated and probably warrants specialist intervention which the person may be reluctant to attend, as they do not perceive themselves as having a substance use problem. Short term risks associated with cannabis use in adolescence include increased risk of psychiatric symptoms including psychosis and suicidality and increased risk of being in a traffic accident (Hall et al., 2020). Heavier use of cannabis, particularly daily use and of higher strength forms appear to impact negatively on cognitive functioning, developing cannabis dependence and, these in turn can impact negatively on educational attainment and employment (Hall et al., 2020). Cannabis is also expensive and typically sold in €20 bags, each containing about 1-2g, enough for 2-4 joints. Unfortunately, many teens who smoke cannabis treat it similarly to tobacco and smoke daily and, as their tolerance increases, so does the cost. It is common for teenagers who present for cannabis treatment to consume more than €50 daily (P. D. James et al., 2019).

Cocaine

Cocaine is a white powder that is ubiquitous in movies and media. It is a stimulant that is typically consumed by snorting. This method gets it into the blood quickly, typically within a few minutes and starts to wear off after 30-40 minutes (Ryan, 2019). As a result, those taking it often end up taking repeat doses throughout the night with jokes often made about frequent visits to the bathroom. As a stimulant, cocaine tends to induce a euphoric feeling, leading to increased energy and sociability while also reducing appetite and need for sleep. It also increases blood pressure, heart rate and body temperature and these effects can lead to cardiac emergencies including the feeling that someone is having a panic attack. Cocaine is also becoming a more common feature in overdose deaths in Ireland; it was involved in just 7.6% of overdoses in 2011 but almost 32% in 2020 (Health Research Board, 2023). While Irish 16-year-olds have the second highest rate of cocaine use in the EU (3.3% compared to an EU average of 1.9%), this is still a small number compared to 70% drinking alcohol and 19% using cannabis (The ESPAD Group, 2020a).

So, cocaine use is relatively rare among under 18s and is likely to present in conjunction with other substance use. It ought to be considered a significant reason for referral to treatment, particularly if it appears to be more than a once off “experimentation”. Cocaine is very expensive, contrary to media claims that people use cocaine because alcohol is so expensive. Cocaine is typically sold by the gram, with one gram costing up to €100. It is not unusual for people, even teenagers, to use several grams in one day of use. Unlike cannabis, cocaine tends to be consumed in a binge pattern, like alcohol. It is very rare for teenagers to present with daily cocaine use and it would be rare for students to present to school under the influence of cocaine.

Nitrous Oxide

Nitrous Oxide (also known as N_2O , laughing gas, whippets and fast gas) is a colourless and odourless gas that was discovered in the late 1700s and has been used as a pain medication since the 1840s (Garakani et al., 2016). Many people will have experience of it as it is often used in dentistry and during childbirth and is typically delivered using a mask placed over the face and attached to a gas cylinder. In addition to reducing pain, it tends to give brief feelings of euphoria when inhaled with reports of it being used as a recreational drug going back over 200 years. It has other uses including in the catering industry where it helps reduce bacterial growth and so is used in aerosols such as whipped cream, hence the colloquial name “whippets”. If you have seen the “*Fast and Furious*” movies you will have seen it used to boost the power of the engines in the cars, hence the name fast gas. With so many uses it is therefore accessible and, because it is old technology, it is cheap. Thus, many young people continue to use to get a brief high. Walking around many music festivals or locations where young people gather, it often does not take long to spot discarded cannisters – see Fig. 1.

Fig. 1: a “whippet” nitrous oxide cannister



Nitrous oxide is inhaled by breaking the seal on the cannister and capturing the escaping gas in a balloon which allows the person to inhale it at their leisure. Because it is inhaled, it has a very quick onset of action – typically peaking within a minute of inhalation and wearing off after a few minutes, leading to people repeatedly dosing to maintain a high. The desired effect for users is the euphoric and relaxed feelings it induces; they tend to feel giddy and giggly. There is some debate about how big an issue the use of nitrous oxide is, but it appears to go in and out of fashion. The Health Research Board gathers statistics on those seeking substance use treatment that give some insight into this. They have a category called “volatile inhalants” which includes nitrous oxide as well as inhalation of other substances such as aerosols and glue. Figures are available from 2004 onwards and from 2004 to 2008 there was an annual average of 21 under 18s seeking treatment for these substances with some of those likely to be nitrous oxide (Health Research Board, 2024). By comparison, the most recent data available is for 2022 when 15 under 18s were treated for these drugs and the four years previous to that had 6 or less presentations suggesting a significant decline in those presenting for treatment (Health Research Board, 2024). These figures suggest that nitrous oxide is not the most significant issue compared with over five hundred presentations for cannabis use each year. In my experience nitrous oxide is typically used in an infrequent pattern, typically at parties or raves, by someone who is already using other substances and the other substances are often the ones that lead to them entering treatment.

That being said, use of nitrous oxide can have some unpleasant side effects with systematic review of case literature identifying 91 cases with 72 reporting neurological problems, followed by psychiatric (11 cases) and medical (8 cases) problems (Garakani et al., 2016). This study further reported 29 deaths worldwide related to nitrous oxide which is small compared to well over 100 deaths annually from alcohol poisoning in Ireland. A large study of experienced drug users reported hallucinations (27.8%), confusion (23.9%) and less than 6% reporting nausea, fainting, accidents or numbness as the unwanted side effects of nitrous oxide (Kaar et al., 2016). Some of these deaths appear to be related to cardiac reactions but most are due to lack of oxygen which is linked with using masks or bags which reduce oxygen supply (Garakani et al., 2016). The most common effect is caused by chronic use of nitrous oxide, interfering with the absorption of vitamin B12 which interferes with normal nerve functioning, leading to related complaints such as tingling, pins and needles, weakness and numbness (Garakani et al., 2016). In severe cases, this interfering with neurological functioning can affect muscle control, leading to problems with gait, bladder control and sexual functioning.

Summary

As this article highlights, substance use is complicated. There are many substances available, but most of adolescent substance use consists of alcohol and cannabis. It is rare to encounter someone who is using another substance and not also using alcohol or cannabis. While alcohol use is common, it does not mean that drinking every week is the norm. Likewise, cannabis has only been tried by about one in five teenagers and so we should avoid an overly accepting or normalising view. The next article will discuss a little more about why adolescent substance use is so concerning and then talk about how substance use can be prevented.

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