



thinkaHEAD



**Harmful
substance use
and the brain**

thinkaHEAD

Introduction

This resource aims to increase awareness about the impact of harmful substance use on the brain. It urges readers to ‘think ahead’ about the future of their brain health and to recognise that current actions can have consequences in the future.

The resource aims to:

- provide an overview of how the brain works and what happens in the case of dementia
- explore how drugs affect the brain and the consequences they can have in the longer term
- provide links and details to find further information on the topic

In this resource, the term ‘harmful substances’ refers to non-prescription substances such as alcohol, tobacco, inhalants and illicit drugs that are taken to alter mood, cognition and behaviour.

For further information or advice, please consult with your health care professional.

Acknowledgements

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Disclaimer: This booklet is for information purposes. The tips and suggestions provided in this guide are general in nature and do not take into account your specific circumstances. We recommend that you seek professional advice in relation to any specific concerns or issues that you may have.

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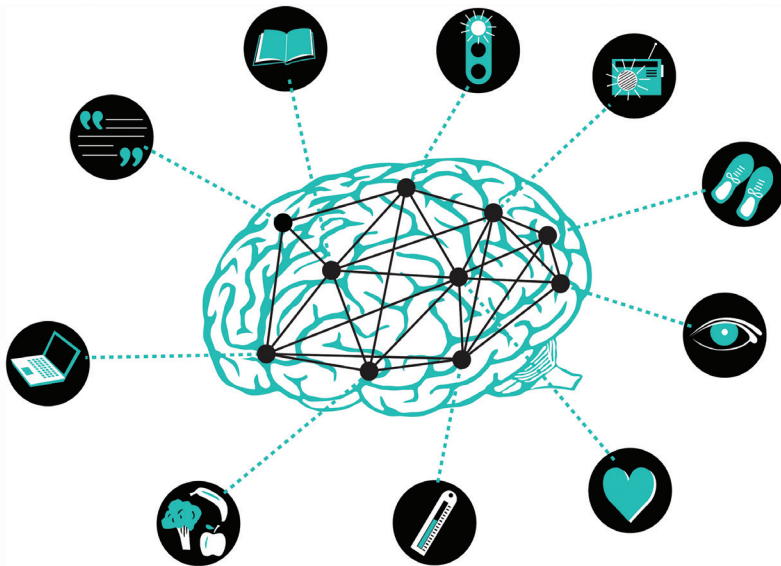
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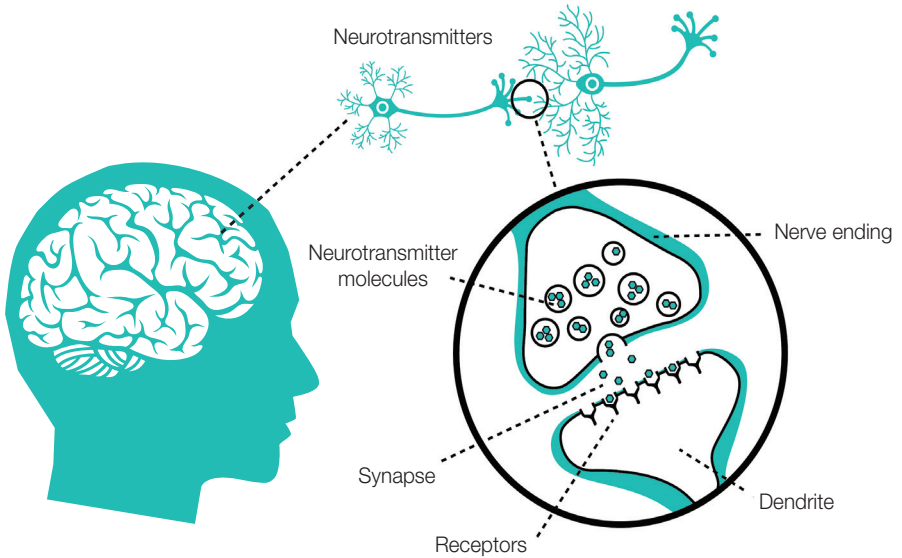
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THE BRAIN

Billions of nerve cells, called neurons, 'talk' to each other, to coordinate our thoughts, emotions, and how we process and respond to information, from our body and the environment. This includes the creation of memories. Communication between neurons controls our movement, behavior and our physical and emotional reactions.



For example, as you read this booklet, the words and pictures are captured by sight and sent through the brain's neuronal pathways as information. Electrical charges pass along each neuron and release chemicals, called 'neurotransmitters', which cross the gaps between one neuron and another (known as the synapse). This is how neurons communicate with each other. They allow information to be processed, coordinated, given meaning and formed into a memory that can be retrieved when needed. Our cognitive skills (thinking, learning and understanding), and our emotional and physical reactions all result from this process.



There are many different neurotransmitters that are produced naturally in our bodies. Some well-known ones are listed below. They all have different roles to play in how our brain and body performs, and they all have different chemical structures.

For example:

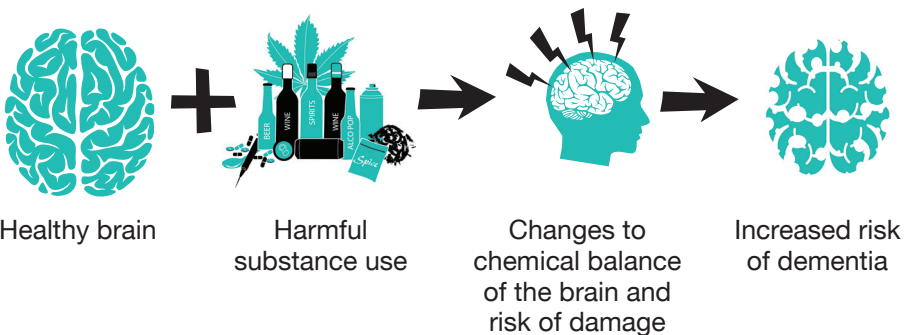
Neurotransmitter	Associated activities
Dopamine	Reward and pleasure , movement, attention, memory
Serotonin	Sleep, mood, well-being, appetite
Noradrenaline	Processing sensory information, fight or flight response, alertness, movement, retrieval of memory
Opioids (natural) (e.g. enkephalins)	Sedation, mood, pain control
Acetylcholine	Learning and memory, logic, alertness and motivation

DID YOU KNOW?

The brain is not fully developed until around the age of 25¹

The brain can be altered by harmful substance use:

- ➔ Drugs change the chemical balance of your brain
Some drugs can cause direct damage to the nerves
- ➔ The change in chemical balance can damage the brain
The damage to the neurons can be permanent
- ➔ A damaged brain increases your risk of developing dementia
- ➔ Currently there is no cure for dementia



¹ National Health and Medical Research Council (2009)
'Alcohol guidelines: reducing the health risks'

DEMENTIA

DID YOU KNOW?

244 Australians are diagnosed with dementia every day²

What is dementia?

Dementia is the name given to a range of symptoms that are caused by disorders affecting the brain. There are many types of dementia, the most well-known of which is Alzheimer's disease.

Dementia impacts upon different areas of the brain which are responsible for a range of functions, such as thinking, behaviour and memory. It is degenerative, which means that symptoms will worsen overtime and tasks that were once familiar such as cooking, shopping or getting dressed, may become challenging.

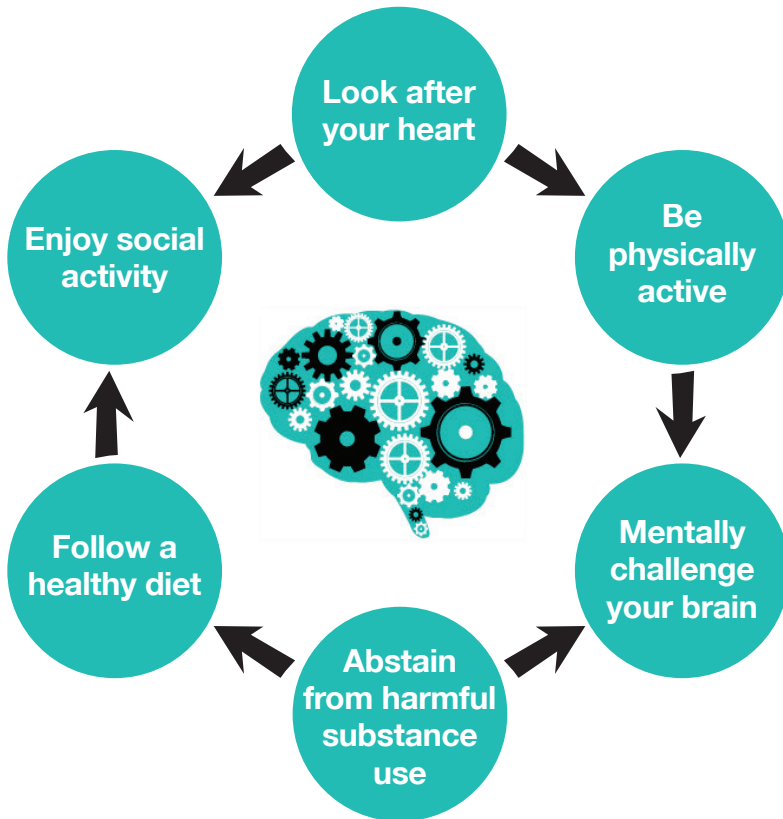
Dementia is not a normal part of ageing, although it affects many people in their later years (aged 65 years and older). However, people under 65 may also get dementia. This is known as younger onset dementia. There is currently no cure for dementia, however there are ways to reduce the risk of dementia.



2 IGPA University of Canberra (2017) 'The economic cost of dementia in Australia 2016-2056'

How can you reduce your risk of dementia?

There are a number of lifestyle choices that can help keep your brain healthy and reduce the risk of dementia:

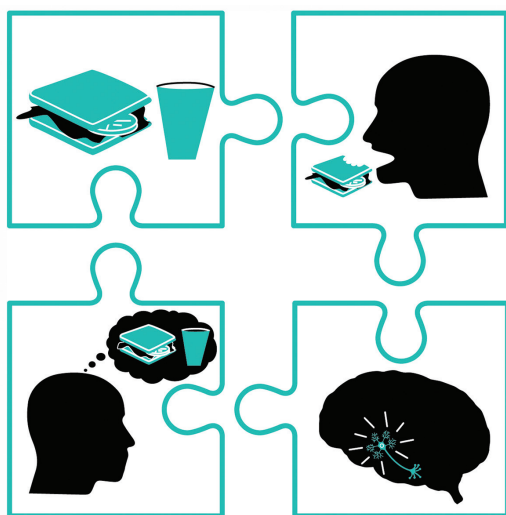


THE NATURAL FEEL GOOD SYSTEM

The body has a natural feel good system which is a network of neurons that produce a pleasant feeling when basic needs (drives) are met such as hunger, thirst and sex.

For example, when we are hungry, we are driven to take action and eat. When we eat, the natural feel good system will lead to the release of dopamine which gives the experience of pleasure.

This feel good system drives us to meet our basic needs and achieve a balance in our body.



HARMFUL SUBSTANCE USE AND THE BRAIN

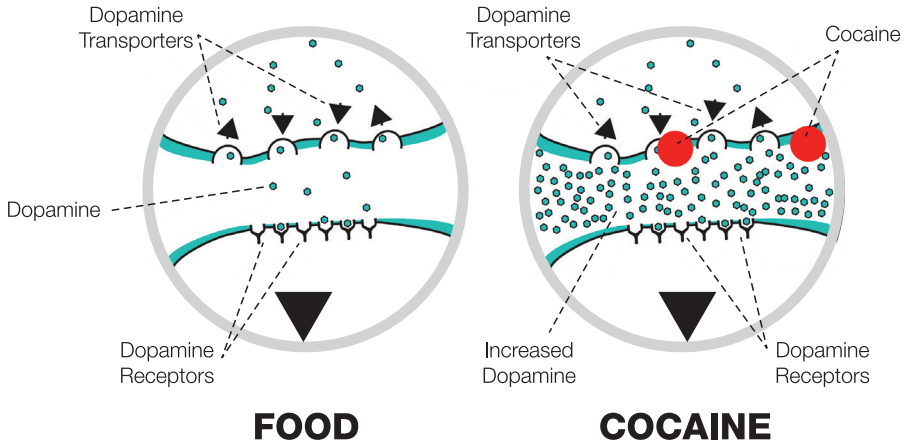
In this resource, a 'harmful substance' refers to a non-prescription psychoactive substance that is damaging to health. Psychoactive substances are those that alter mood, thinking and behaviour. These substances can change and damage the normal brain communication processes. This affects the way our neurons send, receive, process, store and retrieve (memory) information.

Psychoactive substances act in the same way as our natural neurotransmitters because they are similar in their chemical structure. They have the ability to lock onto a neuron's receptor molecule and 'fool' it into action. However, because these drugs are not our natural neurotransmitters, they send abnormal communications that can be damaging to our brains.

Other substances work by hijacking the natural feel good system of the brain that floods our brain with dopamine which makes us feel good and is associated with feelings of reward and pleasure. Normally dopamine gets returned and recycled back into the neuron and this process ends the pleasurable feelings associated with dopamine release. Some drugs aim to prevent dopamine being returned to the nerve which allows more dopamine to be available for longer times and able to lock on to the receptors of the surrounding nerves.



Example of the natural versus the substance use reward system:



What are the effects of different substances on the brain?

Substances can be divided into categories based on how they affect the body:

- **Stimulants** increase the activity of the brain and the body's state of alertness (e.g. amphetamines and nicotine)
- **Depressants** decrease the activity of the brain and the body's state of alertness (e.g. alcohol, opioids, inhalants)
- **Hallucinogens** alter perception and may cause people to see or hear things that are not there (LSD)
- **Other substances** may have properties that include a combination of the effects above (cannabis for example has a range of stimulant, depressant and hallucinogenic properties)

STIMULANTS

DID YOU KNOW?

Studies of chronic methamphetamine abusers show changes to the structure and function of the areas of the brain that are associated with emotion and memory³

Amphetamines

Amphetamines include methamphetamines such as ice and ecstasy. Even occasional use can have adverse health effects.

Acute effects	Potential adverse health effects
<ul style="list-style-type: none">• Rapid heart rate and irregular heart beat• Increased blood pressure• Increased body temperature• Increased alertness• Suppress appetite• Psychotic episode• Disorganised hyperactivity	<ul style="list-style-type: none">• Anxiety and confusion• Sleep disturbances• Mood swings and violent behaviour• Skin sores• Psychosis• Severe weight loss• Heart problems• Strokes• Problems with thinking, emotion and memory

Nicotine

Nicotine is the main chemical in tobacco, along with hundreds of other chemicals that are harmful to the body. Nicotine is a stimulant at low doses, whilst in high doses it can act as a depressant on the central nervous system.

Acute effects	Potential adverse health effects
<ul style="list-style-type: none">• Headache• Insomnia• Nausea and vomiting• Heartburn• Diarrhoea	<ul style="list-style-type: none">• Increased risk of cardiovascular diseases such as heart disease and stroke• Increased risk of cancers• Increased risk of chronic obstructive airways disease (COAD)• Increased risk of dementia

DID YOU KNOW?

Smokers have a greater risk of cognitive decline and dementia⁴

DEPRESSANTS

DID YOU KNOW?

1 in 5 Australians drink at levels that put them at risk of alcohol related harm⁵

Alcohol (e.g. beer, wine, spirits)

Alcohol may be consumed within the levels outlined in the national guidelines with few adverse effects. However, with each drink the risk of ill-health and injury increases, especially in the long term.

Intoxication	Regular excessive use	Dependence
<ul style="list-style-type: none"> • Hangovers • Insomnia • Reduced work performance • Motor vehicle accidents • Disinhibition (e.g. unsafe sex) • Violence • Loss of coordination • 'Blackouts' 	<ul style="list-style-type: none"> • Altered sleep • Anxiety • Depression • Hypertension • Impotence • Fatty liver • Memory loss • Weight gain/loss • Impaired nutrient absorption • Appetite disturbance • Irritability • Gastritis 	<ul style="list-style-type: none"> • Cirrhosis • Pancreatitis • Anxiety • Depression • Withdrawal symptoms • Brain injury • Thiamine deficiency

Source: National Centre for Education and Training on Addiction (NCETA) Consortium, 2004

Note: There is some evidence to suggest that in small amounts (e.g. half a standard drink) alcohol may reduce the risks of cardiovascular and brain disorders. However this appears to be limited to certain age groups and people of particular health status (NHMRC 2009).

3 National Institute on Drug Abuse (2013) 'Methamphetamines'

4 Anstey, von Sanden, Salim & O'Kearney (2007) 'Smoking as a risk factor for dementia and cognitive decline: a meta-analysis of prospective studies'

5 Australian Institute of Health and Welfare (2014) '2013 National Drug Strategy Household Survey Detailed Report'

Alcohol related dementia (alcohol related brain injury/impairment)

- Drinking alcohol in excess over a long period of time can cause damage to the brain.
- Damage may result in symptoms of dementia including changes to memory, learning, reasoning, personality, mood and social skills. Symptoms may develop over time and may get progressively worse if alcohol continues to be used in large quantities.
- Abstaining from alcohol may allow for some improvement in symptoms.

Note: the terms ‘alcohol related brain injury’ or ‘alcohol related brain impairment’ may be used instead of ‘alcohol related dementia’ as alcohol can cause symptoms that are not always consistent with other forms of dementia.

Wernicke encephalopathy-Korsakoff Syndrome

- Alcohol abuse can lead to a deficiency in thiamine or vitamin B1, which is needed to support brain function.
- A lack of thiamine can cause brain damage.
- Wernicke’s encephalopathy and Korsakoff’s syndrome are two conditions caused by brain damage due to thiamine deficiency.
- Alcohol abuse is the most common cause.

Wernicke’s encephalopathy can have consequences for vision, balance and coordination and may cause confusion. Left untreated, it can lead to permanent brain damage and symptoms of Korsakoff’s syndrome.

Symptoms of Korsakoff’s syndrome include memory loss (particularly of short-term memory), inability to form new memories, changes to personality, confabulation (making up stories), hallucinations and a lack of insight.

- Abstinence from alcohol, as well as a healthy diet and vitamin supplementation (particularly thiamine) can prevent further brain damage from occurring.
- Even after treatment, loss of memory and thinking skills may be permanent.



GEORGE'S STORY

Alcohol and the gradual decline

George[#] began drinking when he was 16 years old and was doing his carpentry apprenticeship. He would go on big 'benders' (drink excessively) with his mates on the weekend. Gradually he began drinking every day after work and would regularly bring home beer to drink. George's wife Susan[#] tolerated his alcohol use as he was a hard worker and a good provider initially.

By the time George was in his mid-40's he started missing meals and work, began drinking more beer, and also started drinking wine as he found it more affordable.

After George's children had left home, Susan gradually developed a separate lifestyle, although she remained in the family home as it was more financially viable. She then started part-time work as a sales assistant. This led to her broadening her social network while George became more socially withdrawn and was finding holding a conversation a struggle, even in familiar environments such as work. George's memory for names and faces was gradually deteriorating. He also was finding the words he wanted to use and his short term memory was hindering his work performance with regard to learning new information and adapting to changes.

George visited his GP due to severe vomiting of blood in the morning. His liver function tests returned abnormal, the CT scan of his head indicated brain shrinkage and certain areas of his brain were consistent with dementia changes.

[#]names have been changed to protect identity

DID YOU KNOW?

Damage to the brain from inhalant use can be irreversible⁶

Inhalants (e.g. aerosols, gases, volatile solvents)

Inhalants or 'volatile solvents' are chemical compounds that become vaporised when exposed to air. They are inhaled to alter consciousness. Many inhalants are absorbed from the blood and into tissues such as nerves within the brain which are damaged in the process.

Acute effects	Potential effects at higher doses
<ul style="list-style-type: none">• Nausea and vomiting• Headaches• Diarrhoea• Abdominal pain• Slurred speech• Poor body control• Dizziness• Hallucinations	<ul style="list-style-type: none">• Damage to organs (e.g. brain, heart, lungs, liver, and kidneys)• Risk of losing consciousness• Risk of suffocation as inhalants reduce oxygen to the lungs• Chronic headaches• Cognitive abnormalities

DID YOU KNOW?

Opiate abuse can reduce the amount of oxygen to the brain, which can lead to brain injury⁷

Opioids

Opioids are a class of drugs (e.g. codeine, fentanyl) that includes both prescription drugs and illicit drugs. Heroin for example is a potent drug that is derived from morphine. Opioids slow down the central nervous system.

Acute effects	Potential adverse health effects
<ul style="list-style-type: none">• Nausea and vomiting• Drowsiness• Slower breathing• Itching• Cold skin• Constricted pupils• Constipation	<ul style="list-style-type: none">• Brain damage due to hypoxia, as amount of oxygen to the brain is reduced• Liver damage• Development of tolerance• Dependence• Increased risk of hepatitis C or HIV

HALLUCINOGENS

Hallucinogens can be natural (e.g. magic mushrooms) or synthetic such as LSD or acid.

Acute effects	Potential adverse health effects
<ul style="list-style-type: none">• Dilated pupils• Increased heart rate and blood pressure• Increased temperature• Hallucinations• Dizziness• Drowsiness• Nausea• Impaired coordination• Time distortion• Anxiety	<ul style="list-style-type: none">• Flashbacks• Increased risk of developing mental disturbance• Impaired memory and concentration• Psychological dependence

6 Marel C, MacLean S & Midford R (2016) 'Review of volatile substance use among Aboriginal and Torres Strait Islander people'

7 National Institute on Drug Abuse (2017) 'Heroin'

OTHER SUBSTANCES

DID YOU KNOW?

Cannabis use during adolescence can impact on brain⁸

Cannabis

Cannabis includes products from the cannabis plant such as marijuana (the dried flowering tops). It contains hundreds of different chemicals, of which THC is the main one responsible for altering mood, thoughts and perception.

Acute effects	Potential adverse health effects
<ul style="list-style-type: none">• Anxiety• Paranoia• Hallucinations• Impaired coordination• Disturbed appetite	<ul style="list-style-type: none">• Increased risk of some cancers (e.g. lung)• Subtle cognitive impairment (e.g. effect on memory and attention)• Adverse respiratory effects (e.g. chronic bronchitis) dependent on route of administration• Reduced sperm count• Negative effects on developing foetus

Note: Research suggests that medical cannabis may be of benefit in specific situations where conventional treatments are unsuccessful, such as cancer and neurological disorders including multiple sclerosis. (Cancer Council, 2015). Natural and synthetic forms of cannabis are currently illegal in Australia.

8 National Institute on Drug Abuse (2017) 'Heroin'



BRAD'S STORY

From drugs and destruction to health and success

Brad's youth was spent misusing and abusing alcohol and other drugs that brought him into both law enforcement and health agencies constantly. He began drinking and smoking cannabis when he was 13. This led to Brad regularly getting drunk and stoned from an early age and he was regularly arrested or locked up overnight in the holding cells. By the time he was in Year 11, Brad had already made a number of court appearances, and he turned 18 facing a jail sentence in an adult facility.

Upon his release, Brad was regularly taking drugs such as cannabis, speed and pills, and by his 23rd birthday he was starting to get involved in injecting heroin. Brad's substance abuse started getting out of control with more encounters with law enforcement. Brad's lawyer suggested he get help for his problem, a problem he hadn't noticed, as almost everyone else he was in contact with was also into heavy substance abuse.

Brad sought treatment for the first time and went into a detox and maintenance unit for 4 weeks, and then to a half-way house for 3 months. Whilst in treatment, Brad realised that a lot of his problems, whether it was being arrested repeatedly, having accidents, or no real personal relationships, were all due to his substance abuse.

Brad spent another 10 years relapsing and recovering until finally he was able to get on with his life with the help and support of his wife (who he met in the halfway rehab house), his kids, and ongoing extensive counselling and support.

Without the involvement of treatment and ongoing counselling Brad would have drifted back into a life of drug abuse and crime, and put his brain at greater risk of damage. Instead, he is now leading a healthy lifestyle and is a successful business man.

#name has been changed to protect identity



SUPPORT AND INFORMATION

Dementia Australia

dementia.org.au

National Dementia Helpline 1800 100 500

Alcohol and Drug Foundation

adf.org.au

Australian Drug Information Network

adin.com.au

Family Drug Support Australia

fds.org.au

1300 368 186

Lifeline

lifeline.org.au

13 11 14

Quitline

quitbecauseyoucan.org.au

13 18 48

National Drug Research Centres

Centre for Education and Information on Drugs and Alcohol (CEIDA)

ceida.net.au

National Drug and Alcohol Research Centre (NDARC)

ndarc.med.unsw.edu.au

National Drug Research Institute

<http://ndri.curtin.edu.au/about/index.cfm>

GLOSSARY

Addiction: Includes the physical and psychological cravings for a drug/s.

Alcohol related dementia: A type of dementia diagnosed when alcohol abuse is the most likely cause of the dementia symptoms.

Central nervous system: Part of the nervous system which includes the brain and spinal cord.

Dementia: A term used to describe a range of symptoms that are caused by disorders affecting the brain.

Depressants: A category of drugs that slow down the central nervous system. This can result in a reduced level of consciousness, awareness and coordination. Examples of depressant drugs include alcohol and cannabis (at low doses).

Dopamine: A type of neurotransmitter (chemical messenger) that is associated with reward and pleasure, movement, attention and memory.

Harmful substance use: Non-prescription psychoactive substance use that is damaging to health.

Inhalants: Also known as volatile substances or solvents are chemical compounds that become vapour when exposed to air that are inhaled to alter consciousness. Inhalants generally act as depressants on the central nervous system. Examples include petrol, lacquers and varnishes, paint and glue.

Neurons: A nerve cell that sends and receives signals around the body.

Neurotransmitters: The chemical messengers that are released by neurones to communicate with other neurones in the brain.

Neurotoxic: Poisonous to nerve tissue, brain and spinal cord. For example substances used as 'fillers' in illicit drugs may include neurotoxic e.g. drain cleaner, acetone etc.

Opioids: A category of drugs that stimulate opioid receptors and reduce the perception of pain. Examples include opium and heroin.

Stimulants: A category of drugs that increase the activity of the central nervous system. Examples of stimulant drugs include amphetamines and methamphetamines, cocaine and caffeine.

Tolerance: A state in which repeated drug use reduces the response to a drug, therefore meaning that a larger dose of a drug is needed to produce the same effect as was initially produced at a lower level.

DRUG GLOSSARY

There are many different street names used for drugs. Some of the following include:

Alcohol: grog, booze

Amphetamines: up, fast, speed, uppers, whiz

Crystal methamphetamine: ice, crystal, shabu

Cocaine: blow, Charlie, coke, crack, snow

LSD: acid, trips

Cannabis: marijuana, pot, grass, dope, hooch, hash

MDMA (Methylene dioxymethamphetamine): ecstasy, eccy, E, pills

Inhalants: poppers or the words used to describe using inhalants may include sniffing, chroming or choofing.

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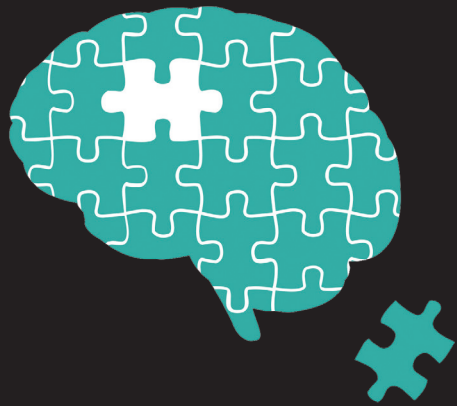
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National Dementia Helpline
1800 100 500

The National Dementia Helpline is funded by the Australian Government

dementia.org.au