

Alcohol and the **developing brain**

In recent years we have learnt a great deal about the developing brain. It was once believed that this complex organ finished developing around the age of 15 years, but we now know that it takes much longer and that during adolescence the brain undergoes many important changes. As it is still developing, it is more sensitive and drinking alcohol can seriously damage short and long-term growth processes.

Key messages for parents

- Alcohol and the developing brain do not go together
- Although subtle in many cases, the impact of alcohol on the developing brain can be permanent and lead to young people not reaching their full potential
- If a young person is going to drink during this period they should not drink much and they should certainly not drink regularly. However, the evidence clearly indicates that they should not, if possible, drink alcohol at all. Parents should try to delay their child's first drink of alcohol for as long as possible
- If a parent believes that alcohol should be provided to their child in a family context with a meal, it should not be provided regularly and careful consideration should be given as to what age this practice should be started

The developing brain

Adolescence is a difficult time for both parents and their teenage child. Where we once believed that it was simply raging hormones and puberty causing the problems, we now know that it also has to do with their developing brain.

Certain parts of the brain are underdeveloped during this time, particularly the prefrontal cortex (the part that deals with judgement, decision-making, planning and impulse control) and when teens make decisions they tend to use an alternative section - the amygdala (the emotional part of their brain). This results in a decrease in reasoned thinking and an increase in impulsiveness. Even when teens are aware of the potential risks of activities, they are ruled by their emotions, put simply – 'if it feels good, they'll do it!'

What often defines adolescence is increased risk-taking behaviour. In recent times we have come to understand what is actually happening here and why it occurs. Young people don't take part in risky behaviour because they want to hurt themselves and it's not that they don't understand the dangers - it's just that they weigh risk versus reward differently. This has been found to be particularly true when adolescents are around their peers – i.e., if their friends are around, the reward is greater.

This 'risky behaviour' contradicts basic human behaviour of survival so why do teens behave in this way? Well, it's an evolutionary feature – young people are 'wired' to engage in risky behaviour during this period of their life so that they 'leave the village and find a mate'! This behaviour is not exclusive to humans, with rodents, primates and even some birds demonstrating behaviour such as seeking out same-age peers and fighting with parents during their 'adolescence'.

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Like other drugs, alcohol produces its effects by affecting the brain and the actions of particular neurotransmitters. Two major neurotransmitters are affected and they are:

- GABA
- glutamate

As these are found throughout the brain, alcohol has widespread effects on the drinker. For example, when you drink the cerebellum is affected, causing changes to balance and movement, and changes to the frontal lobe can cause your speech to become slurred. In adulthood, these changes to the brain are not usually permanent as the brain has fully developed, but this is not the case during adolescence.

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Two parts of the brain are particularly vulnerable to the effects of alcohol during this time:

- the prefrontal cortex
- the hippocampus, which plays an important role in learning and memory

In these two particular areas, brain development is still taking place and this has three stages:

- **proliferation of pathways** – often referred to as the ‘growth spurts’ stage, this is where the brain is creating many new neurons and synapses. This makes the brain versatile and able to adapt to different environments
- **pruning of these pathways** – the brain does not need to keep all that has been produced and so, with experience, the unused pathways are eliminated. This is often referred to as the ‘use it or lose it’ stage
- **myelination** – a process where a fatty layer called myelin accumulates around neurons, enabling them to transmit information faster and more effectively

Unfortunately, research has shown that drinking alcohol during adolescence affects two of these vital stages. Firstly, it inhibits the growth of neurons and secondly, it decreases the process of myelination (vital during adolescence as it enables teens to plan, reason and make decisions more effectively), therefore having a much greater effect on a developing brain than that of an adult.

In addition, research has found that adolescent drinking may cause severe changes in the formation of adult personality, as well causing up to a 10 per cent reduction in the size of the hippocampus, reducing memory and learning capacity. It is now believed that young people who drink regularly and who are affected in this way may never be able to catch up in adulthood.

Studies now suggest that drinking alcohol at intoxicating levels during adolescence may produce permanent brain changes. ‘Plasticity’ is the term used to describe the brain’s ability to physically change its internal structure when learning new things. During peaks of plasticity the brain must make key neural connections to wire us to become fully-functioning adults. It is now believed that drinking alcohol during peak periods of plasticity may damage this ‘brain wiring’.

What does this mean?

The message is clear – alcohol and the developing brain do not go together. Unfortunately, many in the community have difficulty accepting this information and continue to provide alcohol to their teens, often believing that this may ‘protect’ their child in some way.

In addition, many Australian parents drank alcohol during their adolescence and as far as they are concerned it has not caused them significant problems in their adult life. Most are fully-functioning adults, they have positive relationships with family and friends and they have a good job – drinking alcohol when they were a teenager certainly did not appear to affect their brain development.

It is important here to clarify what we mean by ‘affect their brain development’.

Certainly, heavy regular drinking during adolescence could cause permanent brain damage, serious enough that it could leave the young person with an inability to learn, problems with verbal skills, depression and alcohol dependence. For most, however, the ‘damage’ is likely to be far more subtle and most importantly lead to the teen ‘reducing their potential’. They may still be extremely successful and able to function, but their alcohol use during adolescence could result in them not ‘being the best they could be’.

What about the ‘Mediterranean Model’?

Some parents believe that it is important that they introduce alcohol to their child in the home, preferably with a meal, to promote responsible drinking. This is commonly referred to as the ‘Mediterranean Model’, due to the prevalence of this practice within certain cultural groups.

The evidence is mixed on this practice and the recommendations from research vary considerably and are quite contradictory. On the one hand, there is research to suggest that parents can have a positive influence on their child’s drinking behaviour by allowing them small amounts of alcohol and trusting their child’s ability to act responsibly and drink in moderation. That said it is important to bear in mind that if parents do not set boundaries around drinking, their child is likely to drink more. On the other hand, recent studies suggest that introducing

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your child to alcohol at an early age, even in a family context, could lead to future binge drinking.

Of course, what this research does not take into account is the effect of alcohol on brain development. If the 'Mediterranean Model' is going to be used by parents, clearly alcohol should not be provided to the very young (as is often the case) and it should not be provided on a regular basis.