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# The impact of vaping on adolescent mental health

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## Overview

Vaping, or electronic cigarette (e-cigarette) use, by adolescents and young people has increased rapidly in the last decade. Evidence indicates that vaping has negative impacts on physical health and mental health for people who use e-cigarettes. Consequently, it is of increasing concern for practitioners and other professionals who work with adolescents.

This paper provides an overview of what e-cigarettes are and the prevalence of vaping among adolescents in Australia. It also describes findings from a review of the research evidence aimed at understanding the relationship between vaping and adolescent mental health and wellbeing. Research capturing adolescents' views and attitudes on vaping is outlined and some implications for practice are provided.

### Key messages

- Rates of vaping (e-cigarette use) among adolescents are rising in Australia and internationally.
- Vaping is associated with mental health challenges among adolescents, including depressive symptoms, anxiety, perceived stress and suicide-related behaviours.
- Risk factors for vaping include the use of other tobacco products, depressive symptoms, suicide-related behaviours, friends' positive attitudes towards vaping and parental smoking.
- Families, practitioners and educators need greater awareness of and education about the risks and harms of adolescent vaping.
- Practitioners can work to manage the potential risks of vaping by routinely assessing young clients and their families for e-cigarette use.

## Introduction

In Australia and internationally, youth vaping has increased rapidly over the past decade (Becker et al., 2021; Hammond et al., 2020; National Health and Medical Research Council [NHMRC], 2022). For example, an Australian study found that in 2018 less than 1% of young people aged 14–17 years vaped but this had increased to 11.8% in 2022 (Wakefield et al., 2023). There is also emerging evidence of the negative impacts of vaping on physical and mental health as well as social and educational outcomes for adolescents and young people. As a result, vaping has become a significant public health issue and an increasing concern for health professionals, educators, parents and researchers (National Academies of Sciences, Engineering, & Medicine, 2018; VicHealth, 2022).

There is substantial research evidence on the negative effects of vaping, particularly among adults. Use of e-cigarettes is associated with attention deficit hyperactive disorder (ADHD), post-traumatic stress disorder (PTSD), gambling disorder, anxiety, low self-esteem and traits of impulsivity (Grant et al., 2019). E-cigarette users have also been found to have a higher risk of alcohol use and binge drinking/drunkenness compared with non-e-cigarette users (Rothrock et al., 2020). In addition, there is a positive relationship between vaping and later cigarette smoking (Byrne et al., 2018).

Research focusing on adolescents is still emerging; however, there is evidence of a link between vaping and mental health symptoms including depression, anxiety, perceived stress and suicidality (Becker et al., 2021; Farooqui et al., 2022; Javed et al., 2022).

Australia's policy and regulatory response to e-cigarettes is informed by increasing recognition and understanding of the harms of vaping to the health of children and young people and is therefore a fast-changing area of public policy (Department of Health, 2019). The Australian Government's *National Tobacco Strategy 2023–2030* contains objectives relating to preventing the uptake of e-cigarettes by young people and strengthening regulations on e-cigarettes (Department of Health and Aged Care, 2023).

This paper provides an overview of what vaping and e-cigarettes are and the prevalence of vaping among adolescents. It describes the evidence about the relationship between vaping and mental health and wellbeing for adolescents. It also includes research capturing adolescents' views and attitudes on vaping and some implications for practice.

## Methodology of this review

This paper uses evidence gathered from a range of sources. A comprehensive literature review examined the relationship between vaping and outcomes related to mental health among teenagers and adolescents. Several databases were searched including Academic Search Complete, Australian Family and Society Abstracts, Australian Public Affairs, Cochrane Database of Systematic Reviews, ERIC, MEDLINE, Psychology and Behavioral Sciences Collection, PsycInfo, SocIndex and Google Scholar.

Grey literature and online resources from Australian governments (federal and state/territory), peak bodies (e.g. Cancer Council Victoria, Alcohol and Drug Foundation) and other organisations (e.g. Royal Children's Hospital, World Health Organization) were obtained from sources including the Australian Policy Observatory and Google.

## What are e-cigarettes?

Box 1 describes what e-cigarettes and vaping are and what they look like.

### Box 1: Definitions of e-cigarettes and vaping

#### What are e-cigarettes (or vapes)?

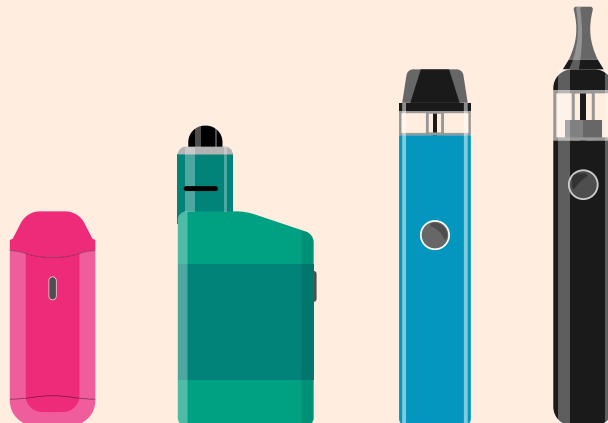
- E-cigarettes (or vapes) are battery-powered devices that heat cartridges of liquid into an aerosol. That aerosol is then inhaled by the user, into their lungs. The liquids are flavoured with various scents/tastes that are appealing to users, such as menthol, lollies, strawberry or vanilla.
- The cartridges may be called 'pods' or 'blanks' when empty. The liquid is commonly referred to as 'e-liquid' or 'juice', and the aerosol as 'vapour'.
- E-cigarette liquids can contain toxic particles (such as formaldehyde, acrolein or propylene glycol) and nicotine (Chivers et al., 2019).
- Although vapes may be labelled as 'nicotine-free', testing of nicotine-free vapes has found that some do, in fact, contain nicotine (Chivers et al., 2019). Therefore, it is difficult to know exactly what is in vaping devices, partially because there is little to no regulation of their manufacturing and the ingredients disclosed on packaging are often vague (Chivers et al., 2019).
- Some alternative names for e-cigarettes are: vapes, vape pens, electronic nicotine delivery systems (ENDS), mods, Tanks and stig. They can also be referred to by their brand names, such as JUUL, nic stick and VUSE.

#### What is vaping?

- Vaping is the act of using, or 'smoking', an e-cigarette.
- It is a common misconception that e-cigarettes produce smoke or vapour; the vapour-like substance is actually an aerosol.
- A single inhale from an e-cigarette can be referred to as a 'hit', 'dab', 'rip' or 'drag'.

#### What do they look like?

- E-cigarettes vary in design and the range on the market has grown rapidly in recent years. There are multiple types of e-cigarettes, including disposables and rechargeables.
- They are small enough to be hand-held and generally look similar to a metallic pen, USB flash drive or small portable charger. The style differs based on brand and type of e-cigarette.



## How common is vaping among teenagers in Australia?

In Australia, research has measured the proportion (i.e. prevalence) of e-cigarette use among adolescent populations. Studies have usually measured e-cigarette use by asking participants whether they had ever used or tried an e-cigarette or if they had used e-cigarettes in the past 30 days (i.e. current user).

Cancer Council Victoria conducted a nationally representative survey of 20,000 12–17 year olds in 2017 and found that 4.5% of participants were current e-cigarette users and 14% had tried e-cigarettes (Guerin & White, 2020). In comparison, 18% had previously tried smoking conventional cigarettes (i.e. tobacco) and 5% were current smokers. The survey also found that males were more likely to have tried vaping than females across every age, and younger teenagers (12–15 years) were more likely to have used e-cigarettes at least once in the past month and to have used e-cigarettes more often compared to older teenagers (16–17 years) (Guerin & White, 2020).

Higher rates of e-cigarette use have been reported in 2 more recent but smaller studies. A 2022 survey of 950 13–19 year olds in South Australia found that 2 in 3 participants had tried vaping and, of those who had tried e-cigarettes, 1 in 4 vaped most days (Connolly, 2022). In this study, females were more likely than males to have tried e-cigarettes and vape more regularly (Connolly, 2022). A 2021 study of 721 14–17 year olds in New South Wales found that close to 1 in 3 (32%) had tried vaping and 16% of participants were current users (Watts et al., 2022). Further, Aboriginal and/or Torres Strait Islander young people were 35% more likely to have ever used an e-cigarette than non-Indigenous participants (Watts et al., 2022).

E-cigarette use by adolescents is encouraged through the commercial marketing of vaping and the design of e-cigarettes. E-cigarettes are promoted as a safe smoking cessation tool for adults and are often marketed to adolescents by tobacco and related industries (e.g. using social media and influencers) as being less harmful than conventional cigarettes (Freeman, 2023; Grana & Ling, 2014; Greenhalgh & Scollo, 2021). E-cigarettes are available in a range of sweet flavours, which appears to increase their appeal and may decrease perceptions of their harm (Meernik et al., 2019).

## Relationship between vaping and conventional cigarette use

There are some concerns that vaping may act as a gateway to smoking cigarettes among teenagers and young people (Byrne et al., 2018; Chatterjee et al., 2016). A recent study of Victorian students aged 12–17 found that previous vaping was a strong risk factor for later cigarette smoking (Scully et al., In press). A systematic review and meta-analysis of 17 studies found a strong association between young people who vaped but didn't smoke (up to 30 years of age) and the later use of conventional cigarettes (Khouja et al., 2021). The association was stronger when the analysis included studies with participants under the age of 18, compared with studies only involving adults.

This suggests that young people who take up vaping earlier may be more likely to smoke cigarettes in future than those who start vaping later as adults. However, the authors concluded that more evidence is needed to establish whether there is a cause-effect relationship between vaping and subsequent smoking (Khouja et al., 2021).

# What is the relationship between vaping and mental health symptoms?

This section explores what the research evidence says about the relationship between vaping and mental health symptoms among adolescents.

Our review found that the majority of studies on vaping and mental health were undertaken in the United States of America (USA). The most frequently studied mental health conditions in relation to vaping were depression, stress, anxiety and suicide-related behaviours. They are described in more detail below.

Many existing studies on vaping are cross-sectional (collect data at a single time point) and short-term. The majority of studies reviewed for this paper examined the association between mental health symptoms and vaping; that is, whether adolescents who vape have greater mental health symptoms than adolescents who do not vape. Evidence on the cause-effect relationship is currently limited. This makes it difficult to assess the nature of the relationship between vaping and mental health symptoms; that is, whether experiencing mental health symptoms leads to vaping behaviours or vaping leads to greater mental health problems.

## Depression

Depressive symptoms were the most frequently studied mental health condition. Several cross-sectional studies have established a link between depressive symptoms and vaping among adolescents (Baiden et al., 2022; Cambron, 2022; Clendennen et al., 2023; Gorfinkel et al., 2022; Jacobs et al., 2023; Patanavanich et al., 2022; Sumbe et al., 2022), with all studies finding an association between higher rates of depressive symptoms and vaping.

Studies that followed participants over time have found that teenagers with higher initial depressive symptoms were more likely to start using e-cigarettes; including in a study that followed up participants 1 year later (Lechner et al., 2017) and in a study following them over 3 years (Moustafa et al., 2021). Additionally, sustained vaping was found to be associated with a greater increase in depressive symptoms over time compared with teenagers who did not vape (Lechner et al., 2017).

A study of 16–24 year olds found those with increased depressive symptoms were almost 40% more likely to have tried vaping for the first time and 42% more likely to have vaped in the past 30 days than those without depressive symptoms (Clendennen et al., 2023). Another study found that adolescents with higher levels of depressive symptoms who already used e-cigarettes were more likely to increase their e-cigarette use over time but these symptoms did not increase the likelihood of vaping (30 days later at follow-up) for those who had never used e-cigarettes (Audrain-McGovern et al., 2021).

## Stress

Higher perceived stress levels have been found to contribute to increased lifetime and current vaping (Clendennen et al., 2023). Further, perceived stress can be a risk factor for continued and increased vaping. A study of 16–22 year olds found that although stress may not lead people to start using e-cigarettes, those with greater perceived stress were more likely to continue to vape and increase their frequency of vaping over time (Mantey et al., 2022).

In a study that interviewed adolescents about vaping, some participants mentioned stress relief as a motivating factor for trying vaping and then continuing to vape (Wagoner et al., 2021). In another study, participants from a high school said that vaping helped teenagers manage stress and anxiety and described the experience of a 'relaxing buzz' from vaping that made them feel good (Less et al., 2022).

## Anxiety

Vaping may also be linked to anxiety disorder symptoms among adolescents. A study of 16–24 year olds found those with increased symptoms of anxiety over time were almost 20% more likely to have tried vaping for the first time and about 30% more likely to have vaped in the past 30 days than those without anxiety symptoms (Clendennen et al., 2023). However, vaping may have a weaker relationship with anxiety symptoms than depressive symptoms. Furthermore, the association between vaping and symptoms of anxiety are stronger when young people experienced symptoms of both anxiety and depression (Sumbe et al., 2022).

## Suicide-related behaviours

Emerging research has also found an association between vaping and symptoms of suicidal ideation, suicide planning and suicide attempts. A study conducted in the USA found that current e-cigarette users were more likely to report having suicidal ideation, making a suicide plan or attempting suicide compared with those who had never vaped (Baiden et al., 2022; Jacobs et al., 2023). This is supported by similar findings among adolescents in Korea (Kim & Kim, 2021; Lee & Lee, 2019). However, these studies were not able to explore the direction of causation in these studies (i.e. whether vaping was a consequence of or an exacerbating factor in circumstances underlying suicidality)

## Other mental health related symptoms

There is emerging but limited research on links between vaping and other mental health related symptoms among adolescents. These include:

- conduct problems (Leventhal et al., 2020; Tokle et al., 2022)
- psychiatric symptoms and traits (e.g. ADHD, positive and negative urgency, anhedonia; Leventhal et al., 2020)
- mood disorders (Nguyen & Mital, 2022)
- internalising and externalising problems (Riehm et al., 2019)
- psychological wellbeing (i.e. relatedness, autonomy, competency, prosocial behaviour, social responsiveness; Shan et al., 2020).

## Associations between vaping, conventional cigarettes and mental health

Similar to vaping, there is an association between conventional cigarette smoking and depression and anxiety (Fluharty et al., 2016). There is also emerging research examining the relationship between both vaping and cigarette use and mental health among adolescents (Cambron, 2022; Clendennen et al., 2023; Gorfinkel et al., 2022; Kechter et al., 2021; Lechner et al., 2017; Riehm et al., 2019). These studies reported a higher prevalence of vaping compared with cigarette smoking among study populations.

A study of US adolescents found a higher prevalence of vaping than cigarette smoking among adolescents both with and without depressive symptoms (Gorfinkel et al., 2022). The study also reported that adolescents with depressive symptoms were more likely to vape, either by itself or in addition to using conventional cigarettes, than their peers who did not have depressive symptoms. Further, there is some research suggesting that adolescents who use both e-cigarettes and conventional cigarettes may have poorer psychological wellbeing than those who engage in only one form of cigarette use (Shan et al., 2020).

## Risk factors associated with vaping

The existing research identifies various risk factors associated with vaping. A review of 85 articles identified various individual, interpersonal, organisational/community, societal and policy factors that may influence e-cigarette use among adolescents and young people (Han & Son, 2022). Across the evidence reviewed by Han and Son (2022), it appears that the following individual characteristics may be risk factors for vaping: male gender, use of other tobacco products, depressive symptoms and suicide-related behaviours.

Studies examining associations between gender and e-cigarette use have had mixed findings. While there are generally higher proportions of males than females who have tried e-cigarettes or are current users, there may be other factors that increase risk of use among young females (Guerin & White, 2020; Kong et al., 2017; Lucas et al., 2020). For example, perceived stress had a stronger association with vaping among young females than with young males (Leventhal et al., 2017). Another US-based study, consisting of 13,677 students, focused on the effect of gender on the associations between mental health, conventional substance use (cigarettes, alcohol, binge drinking and marijuana use) and vaping (Kim, 2021). It found that current male cigarette smokers or

marijuana users were more likely to vape than their female counterparts. However, females who had depressive symptoms were more likely to vape than male students with depressive symptoms (Kim, 2021).

At the interpersonal level, the influence of friends who vape, friends' positive attitudes towards vaping and experiences of bullying victimisation may increase the risk of vaping (Han & Son, 2022). Parental smoking, parents' tolerance of vaping and living with smokers may also increase risk (Han & Son, 2022).

At the broader societal and policy level, regulations around the selling of e-cigarettes (e.g. minimum legal sale age for e-cigarettes) and rules in educational environments (e.g. school smoking bans) also appear to have an impact on vaping risk (Han & Son, 2022). A study of e-cigarette regulations in the USA found that increased regulation (e.g. increasing the minimum legal sale age) was associated with lower rates of vaping (Jun & Kim, 2021).

## What do teenagers say about vaping?

This section provides an overview of research that explores adolescents' attitudes and beliefs about vaping. The majority of research reviewed in this paper comes from populations in the USA, with few studies to date conducted in Australia.

### Reasons for vaping

Existing research exploring adolescents' views on vaping have identified the following main reasons for vaping (Chaplin et al., 2020; Evans-Polce et al., 2018; Fairman et al., 2021; Less et al., 2022; Lucas et al., 2020; van Bueren et al., 2022):

- to fit in with peers and social groups or because they enjoy the social element of vaping with friends
- to reduce or manage stress and anxiety, unwind or 'escape their problems'
- to experiment or rebel
- for the taste, fun and entertainment.

A study involving 92 Western Australian teenagers found that the social aspect of sharing a vape with others was a significant motivator, with first experiences of vaping mostly at parties, in school bathrooms and with friends (van Bueren et al., 2022). In peer-group settings, participants described e-cigarettes as being easily accessible and that teenagers may find it 'too hard' to say no to vaping offers.

### Adolescents' knowledge of vaping harms

Some studies indicate that adolescents have some awareness of the negative effects from vaping; they cited acute effects such as coughing, wheezing and headaches and longer-term impacts such as asthma and lung cancer (Fairman et al., 2021; Wagoner et al., 2021). There was also an awareness that vaping could be addictive (Fairman et al., 2021; Wagoner et al., 2021). However, while participants in a Western Australian study acknowledged that vaping was 'bad for you', some viewed vaping as a safer alternative to drinking, smoking cigarettes or using other drugs (van Bueren et al., 2022).

In contrast, another study reported both peer normalisation and invincibility beliefs regarding harms in addition to generally positive perceptions of vaping among participants, particularly in relation to e-cigarettes' appealing flavours (Less et al., 2022). Studies exploring reported reasons for wanting to stop vaping found 'health' to be the most common motivation, with financial cost and freedom from addiction also drivers to quit (Amato et al., 2021; Bold et al., 2022; Chaplin et al., 2020).

## Limitations of existing research

While existing research has found a strong relationship between vaping and depressive symptoms, the cause-effect relationship is still unclear. As the majority of research is cross-sectional (meaning it only examines a single point in time), it is not possible to assess if vaping behaviours or mental health symptoms came first. Assessment of the direction of cause and effect is also complicated by other factors that may impact an individual's e-cigarette use and mental health, such as interpersonal stress, family disruption, peer pressures and other substance use (e.g. traditional cigarettes and marijuana; Farooqui et al., 2022)

More high-quality, long-term research continues to be needed about the safety and health effects of e-cigarettes and their appeal, particularly among adolescents and other priority groups (NHMRC, 2022). Further, there is a lack of research on prevention and vaping cessation strategies and programs specifically designed for adolescents, especially in the Australian context.

## What are the implications for practice?

There is growing awareness of the various physical, behavioural and mental health risks associated with vaping. Practitioners can work to manage the potential risks of vaping by routinely assessing young clients and their families for e-cigarette use. Increasing awareness and education of the risks and harms of vaping among clients and families is an important first step (Becker & Rice, 2022).

There is limited research evidence on what strategies work to help reduce vaping by adolescents; however, the following recommendations are drawn from the existing research (Bold et al., 2022; Less et al., 2022; van Bueren et al., 2022):

- Provide adolescents with alternative strategies to cope with stress and deal with negative moods, poor concentration and anger.
- Design cessation programs that incorporate peer support, are goal oriented and provide confidentiality.
- Deliver credible and non-judgemental public health messaging about the health and addiction harms of vaping through platforms used by adolescents, so they can make better informed decisions.
- Increase awareness and knowledge among trusted people (such as parents, school nurses or sports coaches) who may be able to provide interventions to adolescents who vape.
- Support adolescents' nicotine cessation goals, manage symptoms and prevent relapse through the provision of evidence-based therapies used for other forms of addiction.

## Conclusion

This paper has reviewed the evidence on the mental health impacts of vaping on adolescents. Research indicates that vaping is associated with various mental health related conditions including increased depressive symptoms, perceived stress, anxiety disorder symptoms and suicide-related behaviours. Adolescents may start vaping for a range of reasons including to fit in with peers and to reduce stress. As the rates of vaping are rising among adolescents in Australia, greater awareness of the risks and harms of vaping among practitioners, educators, young people and their families is needed in order to reduce the harmful effects of vaping on adolescent health. Recommendations for how practitioners can minimise e-cigarette use among Australian adolescents include supporting adolescents with other strategies to cope with stress and designing evidence-based cessation programs that consider the needs of young people.

## Further reading and related resources

- [Tobacco in Australia: Facts and issues – Cancer Council Victoria](#)

A comprehensive online resource on the major issues in smoking and health in Australia compiled by Cancer Council Victoria. Chapter 18 focuses on e-cigarettes and other alternative nicotine products.
- [Vaping evidence summary – NSW Government](#)

An extensive, user-friendly evidence summary on the chemicals and nicotine content found in e-cigarettes, health effects and other information.
- [E-cigarettes and teens: Health information – Royal Children’s Hospital](#)

A fact sheet, video interview and podcast about e-cigarettes from a health perspective, including recommendations for parents and tips on talking to young people about vaping.
- [Vaping and young people: Fact sheet for parents and carers – Lung Foundation](#)

A fact sheet aimed to give parents and carers information about vaping use among young people.
- [Talking about vaping with young people – Alcohol and Drug Foundation](#)

Information about what attracts young people to vaping and tips on how to talk about vaping with young people.
- [The facts about vaping for young people – NSW Government](#)

A fact sheet designed for young people, to inform them about e-cigarettes and their risks.
- [Vaping lingo dictionary – Truth Initiative](#)

A dictionary of popular phrases, products and general language used in relation to vaping.
- [Facts about vaping \(e-cigarettes\) – Tackling Indigenous smoking](#)

Online resources and tools to support activities that address vaping among Aboriginal and Torres Strait Islander communities.

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