



Submission to the Queensland Parliamentary Vaping Inquiry

Dr Colin Mendelsohn MB BS (Hons)

mendel@bigpond.net.au | 0415 976 783 | www.colinmendelsohn.com.au

20 April 2023

Contents

Executive summary	3
About me	4
Disclosure	4
Public hearing	4
Introductory remarks	5
Does youth vaping increase the risk of becoming a smoker?	5
1. Prevalence of e-cigarette use, particularly amongst children and young people	6
2. Risks of vaping harmful chemicals including nicotine	8
Dependence on nicotine	8
What about young smokers who take up vaping?	9
3. Approaches in schools and other settings relevant to children and young people to discourage uptake and use of e-cigarettes	9
4. Awareness of the harmful effects of e-cigarette use	11
Appropriate risk messages for youth	11
5. Programs to prevent uptake and continuing use of e-cigarettes	12
6. Waste management and environmental impact	13
7. Jurisdictional analysis	14
Recommendations for regulation in Australia	14
References	15
Appendix. International Regulations and recommendations for Australia	20

Executive summary

- Young people should not smoke or vape but risk taking is a normal part of adolescence
- Most vaping by never-smoking adolescents is occasional and transient
- The precise long term risk of vaping nicotine will not be fully known for decades, but it is highly likely that it will be substantially less harmful than smoking.
- Vaping nicotine does not cause EVALI, serious lung damage, seizures or harm to the adolescent brain
- Frequent adolescent vaping is mostly confined to smokers and former smokers
- Rather than being a gateway to smoking, vaping is diverting young people from smoking
- Nicotine dependence is rare in never-smokers
- Youth education should be honest and proportionate and include relative risk to smoking. There is no place for exaggeration or fear mongering
- Environmental impact can be reduced with recycling and education
- A balanced, risk-proportionate approach to regulation is needed to restrict vaping by young people while allowing easy access for adult smokers, for whom it is an effective and popular quitting aid
- It's not vaping itself that is the problem, but the smear campaign and the flawed regulations relating to nicotine vapes that are causing the real harm
- Regulation should be risk-proportionate and follow the models used in New Zealand and United Kingdom

About me

I am an Australian medical doctor who has worked in the field of smoking cessation, tobacco control and tobacco harm reduction for 40 years. I am involved in clinical practice, teaching and research.

I am a member of the Expert Advisory Group that develops the [RACGP Australian national smoking cessation guidelines](#).

I was the Founding Chairman of the [Australian Tobacco Harm Reduction Association \(ATHRA\)](#), a registered health promotion charity dedicated to raising awareness of low-risk nicotine products as a substitute for smokers who can't quit. I stepped down from the organisation in January 2020.

I was a Conjoint Associate Professor in the School of Public Health and Community Medicine at the University of New South Wales from 2016-20.

I was a past Vice President of the Australian Association of Smoking Cessation Professionals, Australia's peak body for experts in the field of smoking cessation.

I have served on the NSW Health Advisory Committee on Electronic Cigarettes, and on the Vaping Cessation Expert Panel for the Canadian [Centre for Addiction and Mental Health \(CAMH\)](#), commissioned by Ontario's Ministry of Health. I am also on the Expert Advisory Group for the [Coalition of Asia Pacific Tobacco Harm Reduction Association \(CAPHRA\)](#).

I am currently an investigator on an NHMRC-funded clinical trial on vaping at the National Drug and Alcohol Centre, University of New South Wales, Sydney: [Adding an electronic-cigarette to standard behavioural treatment for low-socioeconomic status smokers: A randomised trial](#) [link]

I have published extensively on smoking cessation and vaping and my publications are available [here](#).

For information about me is available at www.colinmendelsohn.org.au.

Disclosure

I have no financial or commercial relationship with any electronic cigarette or tobacco company. I have recently published a book on vaping called [Stop Smoking Start Vaping](#).

ATHRA accepted unconditional, publicly declared donations from the retail vape sector for the initial legal and website costs of establishing the charity. These donations ceased in March 2019. ATHRA has never accepted donations from tobacco companies or their subsidiaries.

Public hearing

I am interested in participating in a public hearing, preferably by video call as I am based in Sydney. I am available until 2 June 2023.

Introductory remarks

Does youth vaping increase the risk of becoming a smoker?

The main public health concern about youth vaping is that it may cause young never-smokers to take up regular smoking if they would not otherwise have done so (the gateway hypothesis). However, we now know vaping is having the opposite effect.

It is well established that young people who try vaping are more likely to later try smoking. [7] However, there is weak evidence that this association is causal. [1, 2] A more plausible explanation is that shared risk factors for vaping and smoking, such as genetics [9] and environmental, psychological and social causes [10] create a 'common liability' for risk taking. [11] After rigorous adjustment for these common risk factors, most of the association between vaping and subsequent smoking disappears. [12-15]

In fact, the overall evidence suggests that vaping is **diverting young people away from smoking**.

Population and modelling studies suggest that vaping and smoking are substitutes and that vaping is diverting young people away from smoking and displacing smoking at a population level. [3-6] Increases in youth vaping have been accompanied by an accelerated declines in smoking in western countries, suggesting a diversion effect. [1, 16-18] This is the opposite of what would be expected from a gateway effect.

Studies of the effects of tax increases on vaping products indicate that vaping and smoking are economic substitutes. Higher taxes on vapes are associated with increased youth cigarette smoking while higher cigarette prices are associated with increased vaping. [7-10]

Bans or purchasing restrictions on the sale of vapes to teens are also associated with increased adolescent smoking. [11-14]

Approximately 25-50% of adolescents who experiment with vaping are non-smokers at the time. [15-18] There is growing evidence that those who vape first (before smoking) are less likely to later be smokers, compared to those who smoke first. [16-20] Importantly, it does not appear that youth vaping leads to sustained increases in cigarette use, which is the major public health concern. [2, 3, 6, 21-23]

1. Prevalence of e-cigarette use, particularly amongst children and young people

Youth vaping increased dramatically in Australia since vaping was made a prescription-only product in October 2021. These regulations made vapes very inaccessible for adult smokers (only 8% of adult vapers in Australia have a nicotine prescription [24]) and created a thriving black market which also sells freely to children. There are no reliable estimates of prevalence of youth vaping in Queensland at present.

Concerns have been greatest about vaping by young people who have never smoked ('never-smokers'). The fear is that vaping in this group may cause potential new harms, such as nicotine dependence, effects on the developing brain and a transition to cigarette smoking, the most harmful way of obtaining nicotine.

The key measure of potential harm is **frequent vaping by never-smoking youth**. Occasional use and experimentation involve little exposure to toxicants and is unlikely to have a significant public health effect.

In a recent Australian study of 1,006 young people aged 15-30 years, only 8 out of 1,006 (<1%) were never-smokers who had vaped once or more in the last month. [25]

In other western countries, **most vaping by never-smoking adolescents is occasional and transient**. Frequent vaping by never-smokers is rare and is mostly <2%. (Table 1) Vaping rates are substantially higher in current or former smokers. Vaping among young people who are already smokers is likely to be beneficial if it diverts them away from cigarette smoking.

Country	Vaping frequency	Year	Never smokers	Current smokers	Age	Ref
England	≥ once weekly	2021	1%	61% of regular smokers were regular vapers	11-15	[26]
	> once weekly	2022	0.5%	55.4% of current smokers were current vapers	11-17	[27]
	≥ 15 days in the last 30	2018	0.1%	13.4% of current smokers vaped frequently	16-19	[28]
United States	≥ 20 days in the last 30	2018	0.4%	88.9% of frequent vapers were current or past smokers	9-19	[29]
		2019	2.1%	48.8% of frequent vapers had smoked >100 cigarettes	14-18	[30]
	≥ 15 days in the last 30	2018	1.5%	23.4% of current smokers vaped frequently	16-19	[28]

Canada	≥ 15 days in the last 30	2018	0.6%	18% of current smokers vaped frequently	16-19	[28]
New Zealand	Daily	2022	4.3%	86.6% of daily smokers vaped daily	15	[31]

Table 1. Frequent or daily vaping by never-smoking youth

The most detailed data are available from England and demonstrate a strong association between vaping and smoking. [1] (Table 2) In 2021, only 1% of 11-15-year-old never-smokers in England were regular vapers, whereas 61% of regular smokers were regular vapers.

		E-cigarette use				
		Never used	Only tried	Former vaping	Occasional vaping	*Regular vaping
Smoking	*Regular smoker	8%	5%	14%	12%	61%
	Occasional smoker	4%	11%	7%	25%	53%
	Ex-smoker	12%	10%	22%	25%	30%
	Tried smoking	21%	35%	9%	19%	15%
	Never-smoker	87%	9%	1%	2%	1%

Table 2. Nicotine vaping product use by smoking status, ages 11-15 years, England 2021 [26]

2. Risks of vaping harmful chemicals including nicotine

Vaping by young never-smokers exposes them to harmful chemicals, but there are substantially fewer toxicants in vapour than in tobacco smoke and those that are present occur at far lower concentrations. [32] There are also low levels of other chemicals in vapour that are not found in tobacco smoke, such as flavouring chemicals, but so far there is “no clear evidence that specific flavourings pose health risks”. [33] Most use by never-smokers is infrequent and short-term and is therefore associated with lower exposure and risk than regular or sustained vaping.

The precise long-term risk of vaping nicotine will not be fully known for decades, but it is highly likely that it will be substantially less harmful than smoking. [32-36] Most harms from smoking are proportionate to the level of toxin exposure. [37] The level of toxins in vapour is substantially lower than in smoke and in most cases is below the threshold known to cause harm. [38-40]

The most commonly reported adverse effects of vaping are throat and mouth irritation, headache, cough and nausea which tend to dissipate with continued use. [41] Ongoing monitoring is essential to detect any problems that may arise in the future.

Vaping has been associated with respiratory symptoms in young people in cross-sectional studies, but many vapers have smoked tobacco. [42-44]. Other studies have found no functionally-important respiratory symptoms in young people who vape after taking account of past cigarette smoking. [45, 46] A meta-analysis of ten studies found an association between vaping and asthma in young people but a causal link could not be demonstrated. [47] A recent large, longitudinal study found that exclusive e-cigarette use was not associated with the onset of youth asthma. [48]

There is weak evidence that nicotine causes harmful effects on the human adolescent brain. Adverse effects have been found in animal studies but extrapolation to humans is speculative. [49] Studies of young people who smoked have not found any difference in IQ [50], educational achievement [51] or cognitive abilities [52] in adulthood in smokers compared to non-smokers.

There is no evidence that vaping causes poor school performance or mental health issues. Instead, nicotine has been found to improve attention, memory [53] and cognitive function [54] and to relieve anxiety [55] and improve mood. [56]

To date, there have been no identified health risks of passive vaping to bystanders. [33, 34]

Nicotine “represents minimal risk of serious harm” in the doses used in vaping. [32, 33] Nicotine does not cause cancer [57] or lung disease [37] and it has only a minor role in cardiovascular disease. [58] A recent meta-analysis found with ‘moderate certainty’ evidence there are no significant associations between the use of nicotine and the risk of clinically diagnosed adverse cardiovascular events. [59]

There is no evidence that vaping nicotine causes the serious lung disease E-cigarette or Vaping Associated Lung Injury (EVALI) [60] or seizures. [61] There is a rare risk of burns and injuries from explosions, but none have been reported from disposables, the most popular type of device used by young people.

Dependence on nicotine

Vaping likely causes nicotine dependence in some young never-smokers. The evidence suggests, however, that this affects a small minority of vapers and it is not creating a “new generation addicted to nicotine”. [62]

An analysis of the 2018 US National Youth Tobacco Survey found that <4% of never-smokers who had vaped in the past 30 days had signs of nicotine dependence. [30] This low incidence is consistent with the dominant pattern of occasional and short-term use.

Vaping is associated with lower nicotine dependence than smoking in youth and adults.[63, 64] Nicotine dependence is concentrated in young people who are current or previous smokers. [28, 65, 66]

In the US, there was a 50% decline in youth vaping from 2019-2021, suggesting that significant nicotine dependence was unlikely to be an issue for many vapers. [67] This decline also raises the possibility that vaping may have been a passing adolescent fad.

Nicotine dependence in US youth population has not increased overall from 2012-19 despite the rise in youth vaping. [62] This may be partly attributable to a shift away from cigarettes (on which users are most dependent) to vaping products (on which users are less dependent).

Not all young people who vape use nicotine. Thirty to fifty percent report not using nicotine, or not knowing if they had used it or not. [15, 68, 69]

What about young smokers who take up vaping?

The vast majority of young people who experiment with both vaping and smoking were smokers before they tried vaping. [30, 70-72] Many teen smokers vape to quit smoking or as a safer alternative. In Australia in 2019, 44% of 14-17-year-old smokers reported using vapes to quit smoking, 32% to cut down, 23% to avoid relapse to smoking and 27% to reduce harm. [73] As vaping is substantially less harmful than smoking, smokers who switch to vaping are likely to see health benefits. [32]

3. Approaches in schools and other settings relevant to children and young people to discourage uptake and use of e-cigarettes

Most of the information on youth vaping in the media is alarmist and misleading, and often plain wrong, including campaigns by Queensland Health [74], NSW Health [75] and the Alcohol and Drug Foundation. [76] The campaign planned for South Australia appears to be based on fear, misinformation and exaggeration. [77]

Young people should be told that vaping is an adult quitting aid and is not for young people. Vaping is not risk-free, but it is much less harmful than smoking. While there is a risk of nicotine dependence in young non-smokers, there is so far very little evidence of harm, especially from short-term use.

Telling teens not to vape will only lead to more vaping, especially if the information provided is exaggerated and patently untrue.

False and alarmist misinformation will undermine trust in health authorities. It will also mislead adult smokers and discourage them from switching to the safer alternative.

Appropriate messaging to youth should be honest and proportionate. There is no place for exaggeration or fear mongering. Youth will see through this.

One risk of exaggerating the harms from nicotine is that it may discourage smoking youth from switching from deadly cigarettes to vaping or NRT. [78]

4. Awareness of the harmful effects of e-cigarette use

Studies in Australia, the UK, US Canada, New Zealand and Poland have found that most adolescents **correctly** believe that vaping is **far less harmful** than smoking, [79-81] including a systematic review of 27 studies. [82] However, **less than half report that they were harmful to health.** [83]

Most youth understand that nicotine is the main chemical causing addiction. [83] A majority incorrectly perceive e-cigarettes to be **more addictive** than smoking. [84] However some studies have reported that more than half perceived e-cigarettes to be “not at all addictive. [83, 85] Like adults, youth remain misinformed about nicotine with many incorrectly believing it causes cancer. [80]

Graphic photos do not appear to reduce use as youth do not see that they are relevant for them. [79]

Appropriate risk messages for youth

- Vaping is an adult quitting aid
- Young people should not smoke or vape
- Vaping can have harmful health effects especially with long-term use but vaping is far less harmful than smoking
- Vaping nicotine can cause dependence but it is less habit-forming than smoking
- If you are already a smoker, vaping can help you quit

5. Programs to prevent uptake and continuing use of e-cigarettes

There have been very few evaluated youth education programs on vaping. One study of school-based substance use prevention programs in the US found that overall “There were no statistically significant associations observed for any method of public health engagement and e-cigarette and cigarette use.” [86]

Few Australian schools have e-cigarette policies. [87] However, the evidence concerning the effectiveness of a school policy alone in preventing youth tobacco use is weak and inconclusive. [88] Policies are most effective when they feature prevention education and are not punitive. [87]

Sensible, accurate risk-proportionate advice at schools for young people is available from the following organisations and will require staff education:

***[Dovetail. Queensland-based youth AOD training organisation](#)

Dovetail is a Queensland-based training organisation which provides training across Queensland including in rural and remote locations. Dovetail has a specific focus on young people who use alcohol and other drugs.

Their advice is

- Vaping is not for young people who are non-smokers
- Evidence-informed prevention work is important
- Poorly designed responses can increase harm
- The best thing for health is to be smoke and vape free
- Vaping is not harmless but current evidence suggests it is likely less harmful than smoking
- Evidence suggests vaping can help some people quit smoking

[Sheffield City Council](#)

- Two posters for display in school toilets, classrooms, and noticeboards
- [A short, animated film](#)
- Classroom presentation for use by teachers alongside the animated film
- Teachers Toolkit to back up the classroom presentation
- Vaping: The Facts. Leaflet for parents and carers

[Talk to Frank](#)

[Action on Smoking and Health, UK](#)

ASH brief for local authorities on youth vaping

6. Waste management and environmental impact

- Cigarettes have a substantial environmental impact including litter from discarded butts, tobacco packaging waste, deforestation, damage to marine environments, greenhouse gas emissions and public cleaning costs
- The environmental impact of vaping products is far lower than from cigarettes, however vapes are a cause of litter and fire risk and can cause soil and water pollution from leaking chemicals
- Over 90% of vape litter is from disposable products sold on the black-market over which there is currently almost no control
- A national manufacturer-retailer run recycling program for vaping products is needed to coordinate the recycling of vaping products
- **A recycling program is only workable when nicotine vaping products are made legal, adult consumer products sold from licensed retail outlets**
- Funding would be provided by product manufacturers, with possibly a contribution from retailers
- Currently lithium from lithium-ion batteries and metals can be recycled from vapes
- Future technological and design changes will improve the recycling process
- Education of the harmful effects from discarded vapes could increase recycling and reduce the environmental impact of vapes.

We recently prepared guidelines for a national program to reduce environmental waste by recycling vaping products. The report was prepared by academics and vape manufacturers with input from recycling experts. **A copy is available on request.**

7. Jurisdictional analysis

An outline of regulations for vaping in New Zealand, the United Kingdom and the United States can be found in the Appendix. The preferred model is the one successfully working in New Zealand and the United Kingdom.

Regulations for vaping and tobacco smoking should focus on reducing the net public health harm. Policymakers need to find a balance between allowing easier access to vapes for adult smokers while restricting access to youth. Harsh restrictions and bans are ineffective and often counterproductive.

The preferred regulatory approach is a pragmatic, age-restricted, regulated tightly consumer model that is proportionate to risk. An overly restrictive approach to protect young people which reduces the access, effectiveness and appeal of vaping by adult smokers is likely to perpetuate smoking and illegal vaping product sales and have an overall negative effect on population health.

Recommendations for regulation in Australia

Our peer-reviewed paper titled *How should nicotine vaping be regulated in Australia?* published in *Drug and Alcohol Review* in April 2023 is included in the Appendix.

References

1. Delnevo CD. e-Cigarette and Cigarette Use Among Youth: Gateway or Common Liability? *JAMA Netw Open*. 2023;6(3):e234890.
2. Chan GCK, Stjepanovic D, Lim C, Sun T, Shanmuga Anandan A, Connor JP, et al. Gateway or common liability? A systematic review and meta-analysis of studies of adolescent e-cigarette use and future smoking initiation. *Addiction*. 2021;116(4):743-56.
3. Sokol NA, Feldman JM. High School Seniors Who Used E-Cigarettes May Have Otherwise Been Cigarette Smokers: Evidence From Monitoring the Future (United States, 2009-2018). *Nicotine Tob Res*. 2021;23(11):1958-61.
4. Walker N, Parag V, Wong SF, Youdan B, Broughton B, Bullen C, et al. Use of e-cigarettes and smoked tobacco in youth aged 14-15 years in New Zealand: findings from repeated cross-sectional studies (2014-19). *Lancet Public Health*. 2020;5(4):e204-e12.
5. Foxon F, Selya AS. Electronic cigarettes, nicotine use trends and use initiation ages among US adolescents from 1999 to 2018. *Addiction*. 2020;115(12):2369-78.
6. Selya AS, Foxon F. Trends in electronic cigarette use and conventional smoking: quantifying a possible 'diversion' effect among US adolescents. *Addiction*. 2021;116(7):1848-58.
7. Pesko MF, Warman C. Re-exploring the early relationship between teenage cigarette and e-cigarette use using price and tax changes. *Health Econ*. 2022;31(1):137-53.
8. Cantrell J, Huang J, Greenberg MS, Xiao H, Hair EC, Vallone D. Impact of e-cigarette and cigarette prices on youth and young adult e-cigarette and cigarette behaviour: evidence from a national longitudinal cohort. *Tob Control*. 2020;29(4):374-80.
9. Abouk R, Courtemanche C, Dave D, Feng B, Friedman AS, Maclean JC, et al. Intended and unintended effects of e-cigarette taxes on youth tobacco use. *J Health Econ*. 2023;87:102720.
10. Chan GCK, Gartner C, Lim C, Sun T, Hall W, Connor J, et al. Association between the implementation of tobacco control policies and adolescent vaping in 44 lower-middle, upper-middle, and high-income countries. *Addiction*. 2022;117(8):2296-305.
11. Friedman AS. How does electronic cigarette access affect adolescent smoking? *J Health Econ*. 2015;44:300-8.
12. Pesko MF, Hughes JM, Faisal FS. The influence of electronic cigarette age purchasing restrictions on adolescent tobacco and marijuana use. *Prev Med*. 2016;87:207-12.
13. Dave D, Feng B, Pesko MF. The effects of e-cigarette minimum legal sale age laws on youth substance use. *Health Econ*. 2019;28(3):419-36.
14. Pesko MF. Effects of e-cigarette minimum legal sales ages on youth tobacco use in the United States. *Journal of Risk and Uncertainty*. 2023; Online first, <https://doi.org/10.1007/s11166-022-09402-y>.
15. Watts C, Egger S, Dessaix A, Brooks A, Jenkinson E, Grogan P, et al. Vaping product access and use among 14-17-year-olds in New South Wales: a cross-sectional study. *Aust N Z J Public Health*. 2022;46(6):814-20.
16. Mus S, Monzon J, Islam F, Thrasher JF, Barnoya J. First tobacco product tried and current use of cigarettes and electronic cigarettes among adolescents from Guatemala City. *Salud Publica Mex*. 2023;65(1, ene-feb):46-53.
17. Shahab L, Beard E, Brown J. Association of initial e-cigarette and other tobacco product use with subsequent cigarette smoking in adolescents: a cross-sectional, matched control study. *Tob Control*. 2021;30(2):212-20.
18. Legleye S, Aubin HJ, Falissard B, Beck F, Spilka S. Experimenting first with e-cigarettes versus first with cigarettes and transition to daily cigarette use among adolescents: the crucial effect of age at first experiment. *Addiction*. 2021;116(6):1521-31.

19. Chyderiotis S, Benmarhnia T, Beck F, Spilka S, Legleye S. Does e-cigarette experimentation increase the transition to daily smoking among young ever-smokers in France? *Drug Alcohol Depend.* 2020;208:107853.
20. Xu S, Coffman DL, Liu B, Xu Y, He J, Niaura RS. Relationships Between E-cigarette Use and Subsequent Cigarette Initiation Among Adolescents in the PATH Study: an Entropy Balancing Propensity Score Analysis. *Prev Sci.* 2022;23(4):608-17.
21. Kim S, Selya AS. The Relationship Between Electronic Cigarette Use and Conventional Cigarette Smoking Is Largely Attributable to Shared Risk Factors. *Nicotine Tob Res.* 2019.
22. Levy DT, Warner KE, Cummings KM, Hammond D, Kuo C, Fong GT, et al. Examining the relationship of vaping to smoking initiation among US youth and young adults: a reality check. *Tob Control.* 2019;28(6):629-35.
23. Sun T, Lim CCW, Stjepanović D, Leung J, Connor JP, Gartner C, et al. Has increased youth e-cigarette use in the USA, between 2014 and 2020, changed conventional smoking behaviors, future intentions to smoke and perceived smoking harms? *Addict Behav.* 2021;123:107073.
24. Economics I. Tobacco and vaping products in Australia: An updated economic assessment 2023.
25. Pettigrew S, Miller M, Alvin Santos J, Raj TS, Brown K, Jones A. E-cigarette attitudes and use in a sample of Australians aged 15-30 years. *Aust N Z J Public Health.* 2023:100035.
26. NHS Digital. Smoking, Drinking and Drug Use among Young People in England, 2021. 2022. [cited 2023 April 6]. Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england/2021>
27. Action on Smoking and Health UK. Use of e-cigarettes (vapes) among young people in Great Britain, 2021. 2022. [cited 2023 January 11]. Available from: <https://ash.org.uk/wp-content/uploads/2022/07/Use-of-e-cigarettes-among-young-people-in-Great-Britain-2022.pdf>
28. Hammond D, Reid JL, Rynard VL, Fong GT, Cummings KM, McNeill A, et al. Prevalence of vaping and smoking among adolescents in Canada, England, and the United States: repeat national cross sectional surveys. *BMJ.* 2019;365:l2219.
29. Glasser AM, Johnson AL, Niaura RS, Abrams DB, Pearson JL. Youth Vaping and Tobacco Use in Context in the United States: Results From the 2018 National Youth Tobacco Survey. *Nicotine Tob Res.* 2021;23(3):447-53.
30. Jarvis M, Jackson S, West R, Brown J. Epidemic of youth nicotine addiction? What does the National Youth Tobacco Survey 2017-2019 reveal about high school e-cigarette use in the USA? *Qeios.* 2020. [cited 2023 April 6]. Available from: <https://www.qeios.com/read/745076.5/pdf>
31. ASH New Zealand. ASH Year 10 Snapshot Survey 2022. 2022. [cited 2023 January 7]. Available from: https://assets.nationbuilder.com/ashnz/pages/357/attachments/original/1670892009/2022_ASH_Y10_Snapshot_Topline_smoking_and_vaping_FINAL.pdf?1670892009
32. McNeill A, Simonavicius E, Brose LS, Taylor E, East K, Kuilova E, et al. Nicotine vaping in England: an evidence update including health risks and perceptions, September 2022. A report commissioned by the Office for Health Improvement and Disparities. London: Office for Health Improvement and Disparities. 2022. [cited 2022 Nov 7]. Available from: <https://www.gov.uk/government/publications/nicotine-vaping-in-england-2022-evidence-update>
33. McNeill A, Brose LS, Calder R, Bauld L, Robson D. Evidence review of e-cigarettes and heated tobacco products 2018. A report commissioned by Public Health England. London: Public Health England. 2018. [cited 2022 Nov 7]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684963/Evidence_review_of_e-cigarettes_and_heated_tobacco_products_2018.pdf

34. Royal College of Physicians. Nicotine without smoke: Tobacco harm reduction. London: RCP. 2016 [cited 2022 Nov 7]. Available from: <https://www.rcplondon.ac.uk/projects/outputs/nicotine-without-smoke-tobacco-harm-reduction-0>
35. National Academies of Sciences Engineering and Medicine. Public health consequences of e-cigarettes. Washington, DC: The National Academies Press. 2018. [cited 2022 Nov 7]. Available from: <http://nap.edu/24952>
36. Committee on Toxicity of Chemicals in Food Consumer products and the Environment (COT). Statement on the potential toxicological risks from electronic nicotine (and non-nicotine) delivery systems (E(N)NDS – e-cigarettes). 2020. [cited 2022 Nov 7]. Available from: <https://cot.food.gov.uk/sites/default/files/2020-09/COT%20E%28N%29NDS%20statement%202020-04.pdf>
37. US Department of Health and Human Services. The health consequences of smoking - 50 years of progress. A report of the Surgeon General.; 2014. [cited 2022 Nov 7]. Available from: <https://www.surgeongeneral.gov/library/reports/50-years-of-progress/full-report.pdf>
38. Nyakutsikwa B, Britton J, Bogdanovica I, Boobis A, Langley T. Characterising vaping products in the United Kingdom: an analysis of Tobacco Products Directive notification data. *Addiction*. 2021;116(9):2521-8.
39. Goniewicz ML, Knysak J, Gawron M, Kosmider L, Sobczak A, Kurek J, et al. Levels of selected carcinogens and toxicants in vapour from electronic cigarettes. *Tob Control*. 2014;23(2):133-9.
40. Goniewicz ML, Smith DM, Edwards KC, Blount BC, Caldwell KL, Feng J, et al. Comparison of Nicotine and Toxicant Exposure in Users of Electronic Cigarettes and Combustible Cigarettes. *JAMA Netw Open*. 2018;1(8):e185937.
41. Hartmann-Boyce J, Lindson N, McRobbie H, Butler AR, Bullen C, Begh R, et al. Electronic cigarettes for smoking cessation. Cochrane Database of Systematic Reviews. 2022. [cited 2023 April 6]. Available from: <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD010216.pub7/full>
42. Schweitzer KS, Chen SX, Law S, Van Demark M, Poirier C, Justice MJ, et al. Endothelial disruptive proinflammatory effects of nicotine and e-cigarette vapor exposures. *Am J Physiol Lung Cell Mol Physiol*. 2015;309(2):L175-87.
43. Wang MP, Ho SY, Leung LT, Lam TH. Electronic Cigarette Use and Respiratory Symptoms in Chinese Adolescents in Hong Kong. *JAMA Pediatr*. 2016;170(1):89-91.
44. McConnell R, Barrington-Trimis JL, Wang K, Urman R, Hong H, Unger J, et al. Electronic Cigarette Use and Respiratory Symptoms in Adolescents. *Am J Respir Crit Care Med*. 2017;195(8):1043-9.
45. Tanski S, Halenar MJ, Edwards KC, Emond J, Woloshin S, Brunette M, et al. Tobacco Product Use and Functionally Important Respiratory Symptoms Among US Adolescents/Young Adults. *Acad Pediatr*. 2022;22(6):1006-16.
46. Stevens ER, Xu S, Niaura R, Cleland CM, Sherman SE, Mai A, et al. Youth E-Cigarette Use and Functionally Important Respiratory Symptoms: The Population Assessment of Tobacco and Health (PATH) Study Waves 3 and 4. *Int J Environ Res Public Health*. 2022;19(22).
47. Li X, Zhang Y, Zhang R, Chen F, Shao L, Zhang L. Association Between E-Cigarettes and Asthma in Adolescents: A Systematic Review and Meta-Analysis. *Am J Prev Med*. 2022;62(6):953-60.
48. Mattingly DT, Cook S, Hirschtick JL, Patel A, Arenberg DA, Barnes GD, et al. Longitudinal associations between exclusive, dual, and polytobacco use and asthma among US youth. *Prev Med*. 2023:107512.
49. Balfour DJK, Benowitz NL, Colby SM, Hatsukami DK, Lando HA, Leischow SJ, et al. Balancing Consideration of the Risks and Benefits of E-Cigarettes. *Am J Public Health*. 2021;111(9):1661-72.

50. Wennerstad KM, Silventoinen K, Tynelius P, Bergman L, Kaprio J, Rasmussen F. Associations between IQ and cigarette smoking among Swedish male twins. *Soc Sci Med*. 2010;70(4):575-81.
51. Treur JL, Willemsen G, Bartels M, Geels LM, van Beek JH, Huppertz C, et al. Smoking During Adolescence as a Risk Factor for Attention Problems. *Biol Psychiatry*. 2015;78(9):656-63.
52. Corley J, Gow AJ, Starr JM, Deary IJ. Smoking, childhood IQ, and cognitive function in old age. *J Psychosom Res*. 2012;73(2):132-8.
53. Heishman SJ, Kleykamp BA, Singleton EG. Meta-analysis of the acute effects of nicotine and smoking on human performance. *Psychopharmacology (Berl)*. 2010;210(4):453-69.
54. Gil SM, Metherate R. Enhanced Sensory-Cognitive Processing by Activation of Nicotinic Acetylcholine Receptors. *Nicotine Tob Res*. 2019;21(3):377-82.
55. Morissette SB, Tull MT, Gulliver SB, Kamholz BW, Zimering RT. Anxiety, anxiety disorders, tobacco use, and nicotine: a critical review of interrelationships. *Psychol Bull*. 2007;133(2):245-72.
56. Picciotto MR, Brunzell DH, Caldarone BJ. Effect of nicotine and nicotinic receptors on anxiety and depression. *Neuroreport*. 2002;13(9):1097-106.
57. International Agency for Research on Cancer. Tobacco smoking and carcinogenic risk to humans. IARC Monograph 100E 2012. Available at: <http://monographs.iarc.fr/ENG/Monographs/vol100E/mono100E-6.pdf>
58. Benowitz NL, Burbank AD. Cardiovascular toxicity of nicotine: Implications for electronic cigarette use. *Trends Cardiovasc Med*. 2016;26(6):515-23.
59. Kim MM, Steffensen I, Miguel RTD, Babic T, Johnson AD, Carlone J, et al. Study title: A systematic review of RCTs to examine the risk of adverse cardiovascular events with nicotine use. *Front Cardiovasc Med*. 2023;10:1111673.
60. Mendelsohn CP, Wodak A, Hall W. Nicotine vaping was not the cause of e-cigarette, or vaping, product use-associated lung injury in the United States. *Drug Alcohol Rev*. 2023;42(2):258-61.
61. Benowitz NL. Seizures After Vaping Nicotine in Youth: A Canary or a Red Herring? *J Adolesc Health*. 2020;66(1):1-2.
62. Jackson SE, Brown J, Jarvis MJ. Dependence on nicotine in US high school students in the context of changing patterns of tobacco product use. *Addiction*. 2021;116(7):1859-70.
63. Hammond D, Reid JL, Rynard VL, O'Connor RJ, Goniewicz ML, Piper ME, et al. Indicators of dependence and efforts to quit vaping and smoking among youth in Canada, England and the USA. *Tob Control*. 2021.
64. Shiffman S, Sembower MA. Dependence on e-cigarettes and cigarettes in a cross-sectional study of US adults. *Addiction*. 2020;115(10):1924-31.
65. Liu G, Wasserman E, Kong L, Foulds J. A comparison of nicotine dependence among exclusive E-cigarette and cigarette users in the PATH study. *Prev Med*. 2017;104:86-91.
66. Jackson SE, Kotz D, West R, Brown J. Moderators of real-world effectiveness of smoking cessation aids: a population study. *Addiction*. 2019;114(9):1627-38.
67. US Centers for Disease Control and Prevention. National Youth Tobacco Survey. 2021. [cited 2023 January 7]. Available from: https://www.cdc.gov/tobacco/data_statistics/surveys/nyts/data/index.html
68. Gorini G, Gallus S, Carreras G, De Mei B, Masocco M, Faggiano F, et al. Prevalence of tobacco smoking and electronic cigarette use among adolescents in Italy: Global Youth Tobacco Surveys (GYTS), 2010, 2014, 2018. *Prev Med*. 2020;131:105903.
69. Miech R, Johnston LD, O'Malley PM, Bachman JG, Patrick ME. The national prevalence of adolescent nicotine use in 2017: Estimates taking into account student reports of substances vaped. Supplementary Appendix: trends in adolescent vaping 2017-2019 2019. Available at: https://www.nejm.org/doi/suppl/10.1056/NEJMc1910739/suppl_file/nejmc1910739_appen_dix.pdf

70. de Lacy E, Fletcher A, Hewitt G, Murphy S, Moore G. Cross-sectional study examining the prevalence, correlates and sequencing of electronic cigarette and tobacco use among 11-16-year olds in schools in Wales. *BMJ Open*. 2017;7(2):e012784.
71. Chyderiotis S, Spilka S, Beck F. [Use of electronic cigarette in France among adolescents aged 17: Results from the ESCAPAD 2017 survey]. *Bull Cancer*. 2019;106(12):1132-43.
72. Berry KM, Fetterman JL, Benjamin EJ, Bhatnagar A, Barrington-Trimis JL, Leventhal AM, et al. Association of Electronic Cigarette Use With Subsequent Initiation of Tobacco Cigarettes in US Youths. *JAMA Netw Open*. 2019;2(2):e187794.
73. Australian Institute of Health and Welfare. National Drug Strategy Household Survey 2019. Drug Statistics series no. 32. PHE 270. Canberra AIHW. 2020. [cited 2022 Nov 7]. Available from: <https://www.aihw.gov.au/reports/illicit-use-of-drugs/national-drug-strategy-household-survey-2019/contents/summary>
74. Mendelsohn C. New campaign outlines the REAL truth about vaping 2022. Available at: <https://colinmendelsohn.com.au/campaign-blog/>
75. NSW Health. The facts about vaping. Do you know what you're vaping? 2022. Available at: <https://www.health.nsw.gov.au/vaping>
76. Mendelsohn C. Alcohol and Drug Foundation misleads on youth vaping 2022. Available at: <https://colinmendelsohn.com.au/adf/>
77. Mendelsohn C. Fear, misinformation, and exaggeration: behind the SA-led national approach to youth vaping 2022. Available at: <https://colinmendelsohn.com.au/boyer/>
78. O'Brien EK, Roditis M, Persoskie A, Margolis KA. Youths' Perceptions of Nicotine Harm and Associations With Product Use. *Nicotine Tob Res*. 2023.
79. Wojtecka A, Kalinowska-Beszczynska O, Tyrańska-Fobke A, Kaleta D, Wojnarowska M, Robakowska M, et al. Adolescents' Perceptions and Attitudes towards Traditional and Electronic Cigarettes-Results of Focus Group Interviews. *Int J Environ Res Public Health*. 2023;20(2).
80. East K, Brose LS, McNeill A, Cheeseman H, Arnott D, Hitchman SC. Harm perceptions of electronic cigarettes and nicotine: A nationally representative cross-sectional survey of young people in Great Britain. *Drug Alcohol Depend*. 2018;192:257-63.
81. Smith MJ, MacKintosh AM, Ford A, Hilton S. Youth's engagement and perceptions of disposable e-cigarettes: a UK focus group study. *BMJ Open*. 2023;13(3):e068466.
82. Sharma A, McCausland K, Jancey J. Adolescent's Health Perceptions of E-Cigarettes: A Systematic Review. *Am J Prev Med*. 2021;60(5):716-25.
83. Bernat D, Gasquet N, Wilson KO, Porter L, Choi K. Electronic Cigarette Harm and Benefit Perceptions and Use Among Youth. *Am J Prev Med*. 2018;55(3):361-7.
84. Rapp JL, Alpert N, Wilson KM, Flores RM, Taioli E. Changes in E-Cigarette Perceptions Over Time: A National Youth Tobacco Survey Analysis. *Am J Prev Med*. 2021;61(2):174-81.
85. Cooper M, Harrell MB, Pérez A, Delk J, Perry CL. Flavorings and Perceived Harm and Addictiveness of E-cigarettes among Youth. *Tob Regul Sci*. 2016;2(3):278-89.
86. Burnett T, Battista K, Butt M, Sherifali D, Leatherdale ST, Dobbins M. The association between public health engagement in school-based substance use prevention programs and student alcohol, cannabis, e-cigarette and cigarette use. *Can J Public Health*. 2023;114(1):94-103.
87. Jongenelis MI, Robinson A. Educators' perceptions of e-cigarettes in Australian secondary schools. *Tob Induc Dis*. 2023;21:41.
88. Galanti MR, Coppo A, Jonsson E, Bremberg S, Faggiano F. Anti-tobacco policy in schools: upcoming preventive strategy or prevention myth? A review of 31 studies. *Tob Control*. 2014;23(4):295-301.

Appendix. International Regulations and recommendations for Australia

International regulations

Policies marked **yellow** are preferred options

	New Zealand	United Kingdom	USA	Australia
Classification	Dual pathway <ul style="list-style-type: none"> Consumer product, or Medical product if making claims about safety or efficacy (currently none) 	Dual pathway <ul style="list-style-type: none"> Consumer product, or Medical (therapeutic) product if <ol style="list-style-type: none"> higher nicotine concentration, or making claims of safety or efficacy. Submitted to MHRA for approval (currently none) 	Dual pathway <ul style="list-style-type: none"> Tobacco product Medicine. Submit to Centre for Drug Evaluation and Research (currently none) 	Prescription medicine <ul style="list-style-type: none"> Unapproved therapeutic products. Available to adult smokers with a prescription from a medical practitioner to purchase from a pharmacy or import from overseas Approved therapeutic products (by the TGA) if making claims about safety or efficacy. Registered on the Australian Register of Therapeutic Goods (currently none)
Nicotine concentration	<ul style="list-style-type: none"> Freebase nicotine max 20mg/mL Nicotine salt max 50mg/mL Maximum 1,800mg nicotine per container 	<ul style="list-style-type: none"> Max 20mg/mL for consumer products >20mg/mL for therapeutic products 	<ul style="list-style-type: none"> Uncapped 	<ul style="list-style-type: none"> 100 mg/mL
Minimum age	<ul style="list-style-type: none"> 18 years (smoking 18) [link] 	<ul style="list-style-type: none"> 18 years (smoking 18) 	<ul style="list-style-type: none"> 21 years (smoking 21) 	<ul style="list-style-type: none"> 18 years (smoking 18)

	New Zealand	United Kingdom	USA	Australia
	<ul style="list-style-type: none"> Individuals under 18 years not permitted entry to specialist vape shops 			<ul style="list-style-type: none"> Individuals under 18 years not permitted entry to specialist vape shops
Advertising	<ul style="list-style-type: none"> It is prohibited to encourage the use, promote the sale, or notify the availability of vaping products [link] Sponsorship of activities, events etc is prohibited [link] However a specialist vape retailer may: <ul style="list-style-type: none"> Display it's trade name outside it's premises even if it is derived from 'vape' Talk to customers about using vape products Distribute vaping products for free or reduced charge from their premises May communicate health information or warnings 	<ul style="list-style-type: none"> Prohibited except for outdoor, posters, cinema, side of bus, leaflets, direct hard copy mail, in trade press, blogs, tweets independently compiled [ASA] [TPD] 	<ul style="list-style-type: none"> Unregulated, except must include a warning that nicotine is addictive Advertising on internet, print media, TV, retail stores, social media etc FDA has the authority to restrict some marketing, but this is rarely used 	<ul style="list-style-type: none"> Prohibited Limited advertising by pharmacies re availability of vaping products, type of product, nicotine concentrations, no brands
Point of sale display	<ul style="list-style-type: none"> Allowed 	<ul style="list-style-type: none"> Allowed 	<ul style="list-style-type: none"> Permitted 	<ul style="list-style-type: none"> Pharmacies only. In-store advice that products are available
Retail and online sale	<ul style="list-style-type: none"> A two tier retail system. Specialist vape shops and general retailers Specialist vape retailers 	<ul style="list-style-type: none"> Retail stores including specialist vape shops and 'general retail' Online sales permitted 	<ul style="list-style-type: none"> Retail stores 28 states currently require a retail licence to sell nicotine [link] 	<ul style="list-style-type: none"> Only pharmacies can sell nicotine products

	New Zealand	United Kingdom	USA	Australia
	<ul style="list-style-type: none"> - are licensed, pay an annual fee [link] and are listed online. [link] - may sell all legal vape products, including tank systems and liquid refills in a variety of flavours - online sales permitted <ul style="list-style-type: none"> ▪ General retailers <ul style="list-style-type: none"> - can only sell vaping products in tobacco, mint of menthol flavours. - Are prohibited from discussions with customers that encourage, promote or notify the availability of vaping products. - No online sales ▪ No vending machines in public areas [link] 		<ul style="list-style-type: none"> ▪ Mandatory age verification ▪ No sale from vending machines ▪ Online sales permitted 	<ul style="list-style-type: none"> ▪ Non-nicotine e-liquids, devices and accessories available from any retail store ▪ Online sales from Australian websites banned ▪ Importation from international websites allowed with a doctor's prescription under the TGA Personal Importation Scheme [link]
Bans	<ul style="list-style-type: none"> ▪ n/a ▪ Disposables available 	<ul style="list-style-type: none"> ▪ n/a ▪ Disposables available 	<ul style="list-style-type: none"> ▪ Some states and cities have introduced bans on flavours, online sales and even vaping products [link] ▪ Disposables available 	<ul style="list-style-type: none"> ▪ n/a ▪ Prescription disposables available
Public vaping	<ul style="list-style-type: none"> ▪ Prohibited in smoke-free areas 	<ul style="list-style-type: none"> ▪ Vaping permitted outdoors including smoke-free areas 	<ul style="list-style-type: none"> ▪ Varies by state from unrestricted to bans in smoke-free areas 	<ul style="list-style-type: none"> ▪ Prohibited in smoke-free areas

	New Zealand	United Kingdom	USA	Australia
	<ul style="list-style-type: none"> ▪ Prohibited in workplaces, aircraft, public transport, restaurants, schools etc [link] ▪ Local authorities can make decisions on vaping in outdoor smoke-free areas ▪ Specialist vape retailers are exempt from the indoor workplace vaping ban 	<ul style="list-style-type: none"> ▪ Local proprietors or organisations can decide policy on use in their premises ▪ [PHE] [ASH] 		<ul style="list-style-type: none"> ▪ Specialist vape retailers have exemptions for vaping indoors in some jurisdictions
Labelling	<ul style="list-style-type: none"> ▪ Names and quantities of ingredients, including nicotine concentration in mg/mL ▪ Safety of use instructions ▪ Volume or weight of substances ▪ Expiry date ▪ Batch number ▪ Manufacturer name and contact details ▪ PG:VG ratio [link] ▪ Safety warnings on package: "This product contains nicotine, which is a highly addictive substance" 	<ul style="list-style-type: none"> ▪ Bottle or leaflet to display <ul style="list-style-type: none"> - List of ingredients, including nicotine content - use and storage - contraindications - possible adverse effects - addictiveness and toxicity - advice to keep out of reach of children - warnings for at-risk groups - batch number - contact details of manufacturer - no health claims ▪ Health warnings must cover 30% of label's surface area and must be placed on front and back Health warning: "This product contains 	<ul style="list-style-type: none"> ▪ Label must say it contain nicotine ▪ Ingredient list mandatory ▪ Health warning: "WARNING: This product contains nicotine. Nicotine is an addictive chemical." 	<ul style="list-style-type: none"> ▪ TGO 110 standards <ul style="list-style-type: none"> - Ingredient list - Nicotine concentration ▪ Safety Warnings <ul style="list-style-type: none"> - 'KEEP OUT OF REACH OF CHILDREN' - 'Avoid contact with eyes' and - 'Avoid contact with skin'.

	New Zealand	United Kingdom	USA	Australia
	<ul style="list-style-type: none"> ▪ Safety warnings on containers - “CAUTION: Keep this substance out of reach of children or pets.”: - “Do not swallow this substance. If this substance is taken into the mouth, rinse mouth thoroughly.”: - “Contact 0800 POISON (0800 764 766) for advice if this substance is swallowed.”: <p>“Seek medical advice if you feel unwell after contact with this substance or use of this product.” [link]</p>	<p>nicotine which is a highly addictive substance”</p>		
Containers	<ul style="list-style-type: none"> ▪ Child-resistant closures and tamper-evident measures ▪ Breakage, leakage and anti-spill protection ▪ Maximum bottle size 120mL unless containing zero nicotine 	<ul style="list-style-type: none"> ▪ Nicotine-containing products or their packaging to be child-resistant, tamper evident, breakage and leak proof ▪ Refillable without leakage ▪ Limit of 2ml for tanks or pods ▪ Limit of 10ml for nicotine e-liquids 	<ul style="list-style-type: none"> ▪ Mandatory child-resistant closures 	<ul style="list-style-type: none"> ▪ Child resistant container
Product safety	<ul style="list-style-type: none"> ▪ Must not contain restricted substances [link] 	<ul style="list-style-type: none"> ▪ <u>Emissions testing</u> ▪ No vitamins, colourings or prohibited additives (including caffeine and taurine) 	<ul style="list-style-type: none"> ▪ For existing products, safety is assessed as part of the PMTA process to determine whether the product can continue to be marketed 	<ul style="list-style-type: none"> ▪ Must not contain other 'active' ingredients other than nicotine eg caffeine, THC, stimulants or vitamins

	New Zealand	United Kingdom	USA	Australia
	<ul style="list-style-type: none"> ▪ Testing of liquid by an accredited laboratory (no mandatory emission testing) ▪ USP quality for nicotine, PG, VG, alcohol, water ▪ Flavours must be water-soluble. Flavours other than tobacco extracts to meet food standards ▪ Electrical safety compliance for devices ▪ Consistent nicotine delivery ▪ No food colourings allowed 	<ul style="list-style-type: none"> ▪ Using only ingredients of high purity ▪ Must not include ingredients (except for nicotine) which pose a risk to human health ▪ Deliver a dose of nicotine at consistent levels ▪ Mechanism for ensuring re-filling without leakage 	<ul style="list-style-type: none"> ▪ Future products assessed by FDA prior to marketing 	<ul style="list-style-type: none"> ▪ Must not contain acetoin, benzaldehyde, cinnamaldehyde, diacetyl, diethylene glycol, ethylene glycol, pentane-2,3-dione, vitamin E acetate ▪ Maximum concentration of 100mg/mL ▪ Nicotine to be within 10% of concentration stated on label [TGO 110 standards]
Reporting	<ul style="list-style-type: none"> ▪ Manufacturers and importers must advise the Vaping Regulatory Authority of any adverse reaction [link] 	<ul style="list-style-type: none"> ▪ Side effects and safety concerns can be reported to MHRA through the Yellow Card reporting system 	<ul style="list-style-type: none"> ▪ Reporting of safety issues, faulty products, side effects to FDA Safety Reporting Portal [link] 	<ul style="list-style-type: none"> ▪ Importers, exporters or manufacturers to maintain records demonstrating compliance ▪ Reporting of adverse effects or faulty products to TGA
Pre-market Notification or Authorisation	<ul style="list-style-type: none"> ▪ Manufacturers and importers must notify products through the Ministry of Health's Vaping Regulatory Authority's Health Advisory and Regulatory Platform (HARP) 	<ul style="list-style-type: none"> ▪ 6 months prior to marketing, producers must supply: <ul style="list-style-type: none"> - A list of all ingredients in the product (liquid) - Emissions from the product - Toxicological data, including health and addictive effects 	<ul style="list-style-type: none"> ▪ Manufacturers apply to FDA for pre-market authorisation, PMTA (Pre-market Tobacco Product Application) [link] ▪ Only 3 manufacturers have authorised products so far (as of September 2022) [link] <ul style="list-style-type: none"> - Vuse - Logic 	<ul style="list-style-type: none"> ▪ Not applicable

	New Zealand	United Kingdom	USA	Australia
	<ul style="list-style-type: none"> All notified products are available on the HARP searchable database [link] 	<ul style="list-style-type: none"> Nicotine dose and uptake when consumed Components of the product Production process details [TPD] 	<ul style="list-style-type: none"> NJoy Only tobacco flavoured products have been approved so far 	
Flavours	<ul style="list-style-type: none"> Specialist vape shops: No flavours prohibited General retailers: Tobacco, mint and menthol only 	<ul style="list-style-type: none"> No flavours prohibited 	<ul style="list-style-type: none"> Restricted in some cities and states 	<ul style="list-style-type: none"> No flavours prohibited Certain flavouring chemicals banned for health reasons: benzaldehyde, cinnamaldehyde, diacetyl
Vaping in retail stores	<ul style="list-style-type: none"> Specialist vape shops: permitted General retailers: Prohibited 	<ul style="list-style-type: none"> Not restricted 	<ul style="list-style-type: none"> Not restricted 	<ul style="list-style-type: none"> Permitted in vape shops in most states
Taxation	<ul style="list-style-type: none"> 15% GST. No excise tax 	<ul style="list-style-type: none"> 20% VAT, no excise tax [link] Current proposal to reduce this to 5% [link] 	<ul style="list-style-type: none"> Varies by state [link] 	<ul style="list-style-type: none"> Nicotine e-liquids not taxed
Federal regulator	<ul style="list-style-type: none"> Ministry of Health's Vaping Regulatory Authority [link] 	<ul style="list-style-type: none"> Medicines and Healthcare Products Regulatory Agency (MHRA) 	<ul style="list-style-type: none"> Food and Drug Administration (FDA) 	<ul style="list-style-type: none"> Therapeutic Goods Administration (TGA)
Legislation	<p><i>Smokefree Environments and Regulated Products Regulations Act 2021 [link]</i></p>	<p><i>The Tobacco and Related Products Regulations 2016 (Parts 6, 7 and 8) [link]</i></p>		<p><i>Therapeutic Goods Regulations 1990 [link]</i></p>

	New Zealand	United Kingdom	USA	Australia
		<p><i>E-cigarettes: regulations for consumer products 2019</i> [link]</p> <p><i>Advice for retailers (MHRA)</i> [link]</p> <p><i>E-cigarettes and vaping: policy, regulation and guidance 2020</i> [link]</p> <p><i>TPD restrictions on the advertising of e-cigarettes 2016</i> [link]</p> <p><i>Advertising Standards Authority. Guidance on electronic cigarette advertising prohibition 2017</i> [link]</p> <p><i>Licensing procedure for electronic cigarettes as medicines</i> [link]</p> <p><i>Tobacco Products and Nicotine Inhaling Products (Amendment) (EU Exit) Regulations 2020</i> [link]</p> <p><i>Use of e-cigarettes in public places and workplaces. Public Health England</i> [link]</p>		<p><i>Therapeutic Goods (Standard for Nicotine Vaping Products) (TGO 110) Order 2021</i> [link]</p> <p>Pharmacy advertising <i>Therapeutic Goods (Restricted and Prohibited Representations—Nicotine) Permission (No. 2) 2021</i></p> <p>Customs <i>Customs Tariff Act 1995</i> [link]</p>

How should nicotine vaping be regulated in Australia?

Colin Mendelsohn¹  | Alex Wodak² | Wayne Hall³

¹General Practice, Sydney, Australia

²Alcohol and Drug Service, St Vincents' Hospital, Sydney, Australia

³National Centre for Youth Substance Use Research, University of Queensland, Brisbane, Australia

Correspondence

Colin Mendelsohn, 11 Carlotta Rd, Double Bay, NSW 2028, Australia.
Email: mendel@bigpond.net.au

Abstract

In Australia, nicotine vaping products are regulated as prescription-only medicines which can only be sold from a pharmacy, with the aim of preventing youth access and allowing use by adult smokers with a doctor's support. The Therapeutic Goods Administration has acknowledged that this policy has not achieved its goals. Instead, a thriving black market has developed which sells unregulated vape products to children and adults. Very few adult vapers use the legal prescription pathway. Regulation should find the optimal balance between facilitating legal access for adult smokers while restricting access by youth. The preferred approach is a tightly regulated consumer model with nicotine vaping products sold by licenced retail outlets with strict age-of-sale verification. Regulations should be proportionate to risk and reflect the lower harms of vaping relative to smoking. A consumer model would bring Australia into line with other Western countries and improve population health.

KEYWORDS

electronic cigarettes, public policy, regulation, smoking, vaping

Tobacco control has traditionally focussed on achieving complete smoking abstinence [1] but some smokers are unable or unwilling to quit on their own or using conventional treatments [2,3]. An alternative to complete quitting is to switch to one of the tobacco harm reduction options such as nicotine vaping products (NVP). Vaping is the most popular aid for quitting and reducing smoking used by Australian smokers [4].

There is now scientific agreement that vaping is more effective than nicotine replacement therapy as a quitting aid [5]. Although neither vaping nor nicotine replacement therapy are risk-free, vaping is a substantially safer alternative for adult smokers [6–9]. Switching completely to NVPs dramatically reduces toxicant exposure and biomarkers of harm and improves symptoms and clinical outcomes. The precise long-term effects of vaping have not yet been established but are likely to be far less harmful than from smoking [7].

Current Australian vaping policy is driven by alarmist and exaggerated media reports about youth vaping 'epidemics' [10]. However, most youth vaping is

experimental and transient and frequent vaping is most common among current or former smokers [11–13]. Regular vaping by never-smokers is rare. Rather than being a gateway to smoking [14], the evidence suggests that vaping diverts more young people away from smoking and is displacing smoking at the population level [15–17]. Very few young never-smokers who vape become dependent on nicotine [18, 19]. The evidence that nicotine harms the human adolescent brain is weak [20].

Four important principles should be considered in the regulation of NVPs. Firstly, the paramount objective must be reducing smoking-related death and disease.

Secondly, regulation of vaping should be proportionate to risk and reflect its lower harms compared to smoking [21]. As vaping is substantially less harmful than smoking, a lighter touch regulatory approach is required.

Thirdly, policymakers should also consider the harmful unintended consequences of regulation.

Fourthly, regulatory measures should be informed by evidence rather than by values, ideology, politics and opinion [22].

The challenge for policymakers is to find the optimal balance between facilitating access for adult smokers who are at substantial and more immediate risk from smoking, while restricting access to youth, for whom the risks of vaping are smaller and delayed [20]. Measures to protect non-smoking youth are essential, but excessive regulation which makes vaping less accessible, less appealing, more expensive, less consumer-friendly or less effective inadvertently perpetuates adult smoking and increases smoking-related death and illness [7].

1 | CURRENT AUSTRALIAN VAPING POLICY

Since 1 October 2021, nicotine liquid has been classified in Australia as an unapproved prescription-only medicine (Schedule 4) [23]. No NVPs are registered on the Australian Register of Therapeutic Goods [23].

Australians are permitted to import nicotine liquid for personal use or purchase it from an Australian pharmacy if they hold a valid doctor's prescription [24]. Possessing nicotine without a prescription is a criminal offence punishable by fines up to \$45,000 and/or 2 years jail [25].

These regulations were intended to achieve two goals: (i) firstly, to allow adult smokers access to regulated vaping products ideally through a pharmacy with a doctor's support; and (ii) to prevent youth vaping [23]. However, the Therapeutic Goods Administration has acknowledged that they have failed to achieve either objective [26].

Few doctors are prepared to prescribe unapproved nicotine products. Many are sceptical or uninformed about vaping and are discouraged from prescribing nicotine by health and medical authorities [27]. Fewer than 1% of doctors are publicly listed as nicotine prescribers [28] and over 90% of people who vape do not have a nicotine prescription [29].

Very few pharmacies stock nicotine liquids and the range of products is very limited. Only 2% of vapers are estimated to purchase nicotine from pharmacies with a prescription [29].

The de facto prohibition of NVPs has diverted users to a thriving illicit market [30]. Unregulated and incorrectly labelled products are freely sold to adults and young people and policing and enforcement are minimal. As a result, there has been a substantial increase in youth vaping, tax revenue has been lost and otherwise law-abiding citizens have been criminalised.

Proposals for more intensive enforcement of an approach already overwhelmingly rejected by consumers and health professionals will most likely boost black-market supply, intensify criminal activity and increase smoking (Data S1, Supporting information).

2 | HARMFUL UNINTENDED CONSEQUENCES

Well-intentioned flavour bans to reduce vaping by young people have often been counterproductive. For example, a ban on flavoured tobacco and vaping products in San Francisco in 2020 resulted in a more than doubling of smoking by high school students [31]. Among adults, vaping was reduced and smoking increased [32].

In the United States, flavours in pod-based products other than tobacco and menthol were banned nationally in 2019. One study reported that 14% of adult vapers returned to smoking [33]. The main impact on youth vapers was a shift to disposable products. Vaping and smoking behaviours remained unchanged [34, 35].

Increased taxation of NVPs has led to increased smoking by youth [36, 37], young adults [38] and adults [39]. This suggests that NVPs and cigarettes are economic substitutes.

Attempts to reduce youth vaping by restricting the age of legal sale have also perversely led to an increase in youth smoking [40–42].

Alarmist public health campaigns to deter youth from vaping can be harmful. In an experimental setting, a youth-targeted health warning was found to discourage adult smokers from using vaping to quit [43].

Proposals to reduce the nicotine content in NVPs risk detrimental effects. Higher concentrations of nicotine are needed for compact pod devices and disposables that are very popular transition devices for adult smokers. Higher nicotine levels are safer because they generate smaller aerosol volume and fewer toxicants [44–47]. Excessively low doses of nicotine may make NVPs less satisfying, especially for more dependent smokers, and lead to lower rates of switching [48]. Smokers often need higher doses of nicotine in the early stages of switching while learning to vape.

A blanket advertising ban on vaping inadvertently protects established cigarette brands. However, carefully targeted, responsible marketing to adult smokers can raise awareness of vaping, reduce the demand for traditional cigarettes, and increase switching to vaping as a lower-risk alternative [49, 50].

Exaggerated and misleading warning statements to discourage youth experimentation, even if technically correct, could deter adult smokers from switching to the safer product [51].

Prohibition and harsh regulation push drugs underground and often cause increased harm [52]. Prohibition of vaping in a variety of jurisdictions has led to continued use [53], increased cigarette sales [54] and a shift to illegal markets and more sales to youth [55].

TABLE 1 Elements of the consumer regulatory model [56–59].

Product standards	<ul style="list-style-type: none"> The current TGO 110 standards [59] are inadequate and need to be upgraded, for example, include all blacklisted ingredients on the TPD list [57]. Minimum standards for the manufacture and safety of vaping liquids and devices should include electrical, thermal, mechanical and chemical safety; standardised testing regimes; purity standards for ingredients; extended blacklist or dose limits on problematic ingredients; laboratory testing; and possibly emission testing. Limits to nicotine, for example, 20 mg/mL for freebase nicotine; 50 mg/mL for nicotine salt (as in New Zealand) [56].
Containers and labelling	<p>Mandatory standards for labelling: ingredient list; expiry date and batch number; PG:VG ratio; nicotine concentration; safety warning.</p> <p>Barcodes for tracing.</p> <p>Child-resistant refill containers which are leak proof, unbreakable (PET plastics) and have anti-spill protection.</p> <p>Removal of images that appeal to youth, for example, cartoons, appealing characters.</p> <p>Bottle size limits, for example, maximum 1800 mg nicotine per container (as in New Zealand) [56].</p>
Health warnings	<p>Health warnings comparing the risks to smoking, for example [58]:</p> <ul style="list-style-type: none"> 'This product may be addictive but is a far less harmful alternative for adult smokers'. 'If you are a smoker, switching completely to vaping is a much less harmful option'.
Notification system	Mandatory notification of compliance to standards prior to marketing
Flavours	<ul style="list-style-type: none"> Simple descriptions of flavour profiles. Prohibit descriptive flavour names and images that specifically appeal to youth and unsafe flavouring chemicals.
Public vaping	<ul style="list-style-type: none"> Some restrictions to apply, especially indoors.
Public messaging	<ul style="list-style-type: none"> Communicate the absolute and relative harms for vaping nicotine compared to smoking. Frame vaping as a less harmful alternative for adult smokers. Messaging to youth should emphasise that no nicotine-containing product is fully safe to use, all can be addictive, and youth should never start using any tobacco or nicotine product. All messaging should be accurate and avoid exaggeration of risks.
Advertising	<ul style="list-style-type: none"> Restricted advertising targeted at smokers who are unable or unwilling to quit with a 'switch' message. Banning all advertising that could appeal to young people, such as lifestyle ads associating vaping with positive imagery and adventure. Placement of advertising to minimise exposure to young people.
Monitoring	A system for reporting adverse effects and recall of unsafe products
Taxation	<ul style="list-style-type: none"> Proportionate to risk, similar to nicotine gum and patches. Maintain a significant differential between NVP and cigarette prices. High NVP prices lead to increased smoking as cigarettes and vaping products are economic substitutes.

Abbreviations: NVP, nicotine vaping product; PET, polyethylene terephthalate; PG, propylene glycol; TPD, tobacco products directive; VG, vegetable glycerine.

3 | PROPOSED REGULATORY FRAMEWORK

A carefully regulated consumer model would bring Australia into line with other western countries such as New Zealand [56] and the United Kingdom [57] (Table 1).

The United States approach has been less successful because of an overriding focus on protecting children rather than assisting adult smokers, restrictive pre-marketing approval requirements by the US Food and Drug Administration and unclear relative risk communication by governments in the face of widespread media advertising of vaping products [60].

The first step required is to exempt low concentrations of nicotine liquid up to 20 mg/mL freebase nicotine and nicotine salt 50 mg/mL from the Poisons Standard, as in New Zealand [56]. This enables them to be sold as

consumer products rather than medicines. This change could be made at the federal level or by State and Territory governments.

Nicotine liquids should be available from licenced retail outlets, such as specialist vape shops, pharmacies and general retail outlets, as for cigarettes and alcohol. The sale of vaping products where tobacco is sold exposes adult smokers to the safer alternative when they purchase tobacco.

Strict age verification at the time of purchase is required with harsh penalties for breaches and potential loss of licence. Consideration could be given to mandatory CCTV recording of sales as a condition of a sales licence. Online sales could be permitted by pharmacies and specialist vape retailers, with third party age verification on purchase and delivery.

All retailers would require a licence to sell nicotine liquids from state or territory health departments.

TABLE 2 Regulation and monitoring authorities.

Australian Competition and Consumer Commission
<ul style="list-style-type: none"> Standards for e-liquids, containers, labelling and health warnings Pre-market notification of nicotine liquids All notified products are recorded in a publicly available searchable database Post-market surveillance and reporting
State and territory health departments
<ul style="list-style-type: none"> Annual tobacco licences for retailers Supervision and enforcement of retailer compliance Spot checks for underage sales Advertising restrictions Public vaping restrictions Policing illicit sales by the black-market Public education about vaping Vape shop staff training and certification similar to the Responsible Service of Alcohol requirements
The Commonwealth government
<ul style="list-style-type: none"> Legislative changes Taxation Border control to intercept illicit imports Public education about vaping

Retailers would pay an annual licence fee, make annual reports and be subject to compliance checks.

A dual pathway which allows manufacturers to apply to the Therapeutic Goods Administration for medicines classification could engage additional smokers and give doctors more confidence to prescribe NVPs.

Under this model, the black-market would become less profitable and illicit sales would diminish over time, being largely replaced by a legal, regulated market.

Further details are listed in Table 1.

4 | REGULATORY AUTHORITIES

NVPs are consumer products designed to replace deadly cigarettes [61]. They are most appropriately regulated by the Australian Competition and Consumer Commission (ACCC) under dedicated consumer legislation. The ACCC can provide consumer protection and ensure that products comply with the legal requirements of the *Competition and Consumer Act 2010*.

The ACCC would be responsible for establishing and enforcing comprehensive standards for e-liquids, containers, labelling and health warnings. It would establish a pre-market notification system for nicotine liquids and a post-market surveillance system for reporting adverse events and faulty products. State and territory governments and the Commonwealth would also have specific responsibilities (Table 2).

5 | CONCLUSION

Regulations for vaping and tobacco smoking should focus on reducing the net public health harm. Policymakers need to find a balance between allowing ready access to NVPs for adult smokers while restricting access to youth. Harsh restrictions and bans are ineffective and often counterproductive.

The preferred regulatory approach is a pragmatic consumer model, regulated tightly and proportionate to risk. An overly restrictive approach to protect young people which reduces the access, effectiveness and appeal of vaping by adult smokers is likely to perpetuate illegal vaping product sales and tobacco smoking and have an overall profoundly negative effect on population health.

ORCID

Colin Mendelsohn  <https://orcid.org/0000-0001-9367-8870>

REFERENCES

- Beaglehole R, Bates C, Youdan B, Bonita R. Nicotine without smoke: fighting the tobacco epidemic with harm reduction. *Lancet*. 2019;394:718–20.
- Hughes JR, Keely J, Naud S. Shape of the relapse curve and long-term abstinence among untreated smokers. *Addiction*. 2004;99:29–38.
- Rosen LJ, Galili T, Kott J, Rees V. Beyond “safe and effective”: the urgent need for high-impact smoking cessation medications. *Prev Med*. 2021;150:106567.
- Australian Institute of Health and Welfare. National Drug Strategy Household Survey 2019. Drug Statistics series no. 32. PHE 270. Canberra AIHW. 2020. Available from: <https://www.aihw.gov.au/reports/illicit-use-of-drugs/national-drug-strategy-household-survey-2019/contents/summary>. Accessed 7 November 2022.
- Hartmann-Boyce J, Lindson N, McRobbie H, Butler AR, Bullen C, Begh R, et al. Electronic cigarettes for smoking cessation. *Cochrane Database Syst Rev*. 2022;(11):CD010216. <https://pubmed.ncbi.nlm.nih.gov/36384212/>. Accessed 2 April 2023.
- National Academies of Sciences Engineering and Medicine. Public health consequences of e-cigarettes. Washington, DC: The National Academies Press; 2018. Available from: <http://nap.edu/24952>. Accessed 7 November 2022.
- Royal College of Physicians. Nicotine without smoke: tobacco harm reduction. London: RCP; 2016. Available from: <https://www.rcplondon.ac.uk/projects/outputs/nicotine-without-smoke-tobacco-harm-reduction-0>. Accessed 7 November 2022.
- McNeill A, Simonavicius E, Brose LS, Taylor E, East K, Kuilova E, et al. Nicotine vaping in England: an evidence update including health risks and perceptions. A report commissioned by the office for health improvement and disparities. London: Office for Health Improvement and Disparities; 2022. p. 2022. Available from: <https://www.gov.uk/government/publications/nicotine-vaping-in-england-2022-evidence-update>. Accessed 7 November 2022.

9. Hartmann-Boyce J, Butler AR, Theodoulou A, Onakpoya IJ, Hajek P, Bullen C, et al. Biomarkers of potential harm in people switching from smoking tobacco to exclusive e-cigarette use, dual use or abstinence: secondary analysis of Cochrane systematic review of trials of e-cigarettes for smoking cessation. *Addiction*. 2023;118:539–45.
10. Erku DA, Morphett K, Steadman KJ, Gartner CE. Policy debates regarding nicotine vaping products in Australia: a qualitative analysis of submissions to a government inquiry from health and medical organisations. *Int J Environ Res Public Health*. 2019;16:4555.
11. NHS Digital. Smoking, drinking and drug use among young people in England, 2021. 2022. Available from: <https://digital.nhs.uk/data-and-information/publications/statistical/smoking-drinking-and-drug-use-among-young-people-in-england/2021>. Accessed 7 November 2022.
12. Glasser AM, Johnson AL, Niaura RS, Abrams DB, Pearson JL. Youth vaping and tobacco use in context in the United States: results from the 2018 National Youth Tobacco Survey. *Nicotine Tob Res*. 2021;23(3):447–53.
13. ASH New Zealand. ASH year 10 snapshot survey 2022. 2022. Available from: https://assets.nationbuilder.com/ashnz/pages/357/attachments/original/1670892009/2022_ASH_Y10_Snapshot_Topline_smoking_and_vaping_FINAL.pdf?1670892009. Accessed 2 April 2023.
14. Chan GCK, Stjepanovic D, Lim C, Sun T, Shanmuga Anandan A, Connor JP, et al. Gateway or common liability? A systematic review and meta-analysis of studies of adolescent e-cigarette use and future smoking initiation. *Addiction*. 2021;116:743–56.
15. Sokol NA, Feldman JM. High school seniors who used e-cigarettes may have otherwise been cigarette smokers: evidence from monitoring the future (United States, 2009–2018). *Nicotine Tob Res*. 2021;23:1958–61.
16. Selya AS, Foxon F. Trends in electronic cigarette use and conventional smoking: quantifying a possible ‘diversion’ effect among US adolescents. *Addiction*. 2021;116:1848–58.
17. Walker N, Parag V, Wong SF, Youdan B, Broughton B, Bullen C, et al. Use of e-cigarettes and smoked tobacco in youth aged 14–15 years in New Zealand: findings from repeated cross-sectional studies (2014–19). *Lancet Public Health*. 2020;5:e204–e12.
18. Jarvis M, Jackson S, West R, Brown J. Epidemic of youth nicotine addiction? What does the National Youth Tobacco Survey 2017–2019 reveal about high school e-cigarette use in the USA? *Qeios*. 2020. Available from: <https://www.queios.com/read/745076.5/pdf>. Accessed 11 January 2023.
19. Jackson SE, Brown J, Jarvis MJ. Dependence on nicotine in US high school students in the context of changing patterns of tobacco product use. *Addiction*. 2021;116:1859–70.
20. Balfour DJK, Benowitz NL, Colby SM, Hatsukami DK, Lando HA, Leischow SJ, et al. Balancing consideration of the risks and benefits of E-cigarettes. *Am J Public Health*. 2021;111:1661–72.
21. Bates C. The principle of proportionality. *The tobacco Reporter*; 2019. Available from: <https://tobaccoreporter.com/2018/12/01/the-principle-of-proportionality/>. Accessed 11 January 2023.
22. Eisenkraft Klein D, Hawkins B, Schwartz R. Understanding experts’ conflicting perspectives on tobacco harm reduction and e-cigarettes: an interpretive policy analysis. *SSM Qual Res Health*. 2022;2:100197.
23. Therapeutic Goods Administration. Nicotine vaping product access. 2022. Available from: <https://www.tga.gov.au/products/medicines/prescription-medicines/nicotine-vaping-products-hub/nicotine-vaping-product-access>. Accessed 7 January 2023.
24. Therapeutic Goods Administration. Nicotine vaping products hub. 2021. Available from: <https://www.tga.gov.au/products/medicines/prescription-medicines/nicotine-vaping-products-hub#:~:text=Nicotine%20vaping%20products%20require%20a,nicotine%20pods%20and%20liquid%20nicotine>. Accessed 7 January 2023.
25. Morandin P. Is vaping illegal in Australia?; 2022. Available from: https://www.criminaldefencelawyers.com.au/blog/is-vaping-illegal-in-australia/?utm_source=Mondaq&utm_medium=syndication&utm_campaign=LinkedIn-integration. Accessed 7 January 2023.
26. Therapeutic Goods Administration. Potential reforms to the regulation of nicotine vaping products. Consultation Paper 2022. Available at: <https://consultations.tga.gov.au/medicines-regulation-division/proposed-reforms-to-the-regulation-of-nicotine-vap/>
27. Selamoglu M, Erbas B, Kasiviswanathan K, Barton C. General practitioners’ knowledge, attitudes, beliefs and practices surrounding the prescription of e-cigarettes for smoking cessation: a mixed-methods systematic review. *BMC Public Health*. 2022;22:2415.
28. Therapeutic Goods Administration. Authorised prescribers of unapproved nicotine vaping products. 2022. Available from: <https://www.tga.gov.au/resources/resource/guidance/authorised-prescribers-unapproved-nicotine-vaping-products>. Accessed 19 November 2022.
29. Australian Association of Convenience Stores. Nicotine vaping product usages and change. 2022. Available from: <https://colinmendelsohn.com.au/wp-content/uploads/2022/10/AACS-CMA-Research-Attachment.pdf>. Accessed 2 April 2023.
30. ABC News. Street sales, online dealers and convenience stores: inside the thriving black market for nicotine vapes. 2022. Available from: <https://www.abc.net.au/news/2022-06-27/inside-the-thriving-black-market-for-nicotine-vapes/101176544>. Accessed 7 January 2023.
31. Friedman AS. A difference-in-differences analysis of youth smoking and a ban on sales of flavored tobacco products in San Francisco, California. *JAMA Pediatr*. 2021;175:863–5.
32. Yang Y, Lindblom EN, Salloum RG, Ward KD. The impact of a comprehensive tobacco product flavor ban in San Francisco among young adults. *Addict Behav Rep*. 2020;11:100273.
33. Li D, Ossip DJ, Bansal-Travers M, Xie Z. Impact of the FDA flavour enforcement policy on flavoured electronic cigarette use behaviour changes. *Tob Control*. 2022;31(Suppl 3):s176–s83.
34. Gravely S, Smith DM, Liber AC, Cummings KM, East KA, Hammond D, et al. Responses to potential nicotine vaping product flavor restrictions among regular vapers using non-tobacco flavors: findings from the 2020 ITC smoking and vaping survey in Canada, England and the United States. *Addict Behav*. 2022;125:107152.
35. Hammond D, Reid JL, Burkhalter R, Bansal Travers M, Gravely S, Hyland A, et al. E-cigarette flavors, devices, and

- brands used by youths before and after partial flavor restrictions in the United States: Canada, England, and the United States, 2017–2020. *Am J Public Health*. 2022;112:1014–24.
36. Pesko MF, Warman C. Re-exploring the early relationship between teenage cigarette and e-cigarette use using price and tax changes. *Health Econ*. 2022;31:137–53.
37. Abouk R, Courtemanche C, Dave D, Feng B, Friedman AS, Maclean JC, et al. Intended and unintended effects of e-cigarette taxes on youth tobacco use. *J Health Econ*. 2023;87:102720.
38. Friedman AS, Pesko MF. Young adult responses to taxes on cigarettes and electronic nicotine delivery systems. *Addiction*. 2022;117:3121–8.
39. Pesko MF, Courtemanche CJ, Catherine MJ. The effects of traditional cigarette and e-cigarette tax rates on adult tobacco product use. *J Risk Uncertain*. 2020;60:229–58.
40. Friedman AS. How does electronic cigarette access affect adolescent smoking? *J Health Econ*. 2015;44:300–8.
41. Dave D, Feng B, Pesko MF. The effects of e-cigarette minimum legal sale age laws on youth substance use. *Health Econ*. 2019;28:419–36.
42. Pesko MF, Hughes JM, Faisal FS. The influence of electronic cigarette age purchasing restrictions on adolescent tobacco and marijuana use. *Prev Med*. 2016;87:207–12.
43. Sawyer LE, Brandon TH. Unintended consequences: testing the effects of adolescent-targeted anti-vaping media upon adult smokers. *Nicotine Tob Res*. 2022; [Online ahead of print].
44. Kosmider L, Kimber CF, Kurek J, Corcoran O, Dawkins LE. Compensatory puffing with lower nicotine concentration e-liquids increases carbonyl exposure in e-cigarette aerosols. *Nicotine Tob Res*. 2018;20:998–1003.
45. Dawkins L, Cox S, Goniewicz M, McRobbie H, Kimber C, Doig M, et al. 'Real-world' compensatory behaviour with low nicotine concentration e-liquid: subjective effects and nicotine, acrolein and formaldehyde exposure. *Addiction*. 2018;113:1874–82.
46. Talih S, Salman R, El-Hage R, Karam E, Karaoghlanian N, El-Hellani A, et al. Might limiting liquid nicotine concentration result in more toxic electronic cigarette aerosols? *Tob Control*. 2021;30:348–50.
47. Kimber C, Zaidell L, Hunter S, Cox S, Notley C, Dawkins L. Comparing the effects of the EU- versus the US-JUUL pod in a sample of UK smokers: nicotine absorption, satisfaction and other nicotine-related subjective effects. *Nicotine Tob Res*. 2022; [Online ahead of print].
48. Goldenson NI, Ding Y, Prakash S, Hatcher C, Augustson EM, Shiffman S. Differences in switching away from smoking among adult smokers using JUUL products in regions with different maximum nicotine concentrations: North America and the United Kingdom. *Nicotine Tob Res*. 2021;23:1821–30.
49. Collins L, Glasser AM, Abudayyeh H, Pearson JL, Villanti AC. E-cigarette marketing and communication: how e-cigarette companies market e-cigarettes and the public engages with e-cigarette information. *Nicotine Tob Res*. 2019;21:14–24.
50. Tuchman AE. Advertising and demand for addictive goods: the effects of e-cigarette advertising. *Mark Sci*. 2019;38:994–1022.
51. Wackowski OA, Hammond D, O'Connor RJ, Strasser AA, Delnevo CD. Smokers' and e-cigarette users' perceptions about e-cigarette warning statements. *Int J Environ Res Public Health*. 2016;13:655.
52. Westermeyer J. The pro-heroin effects of anti-opium laws in Asia. *Arch Gen Psychiatry*. 1976;33:1135–9.
53. McCausland K, Maycock B, Leaver T, Wolf K, Freeman B, Jancey J. "Is it banned? Is it illegal?": navigating Western Australia's regulatory environment for e-cigarettes. *Int J Drug Policy*. 2021;94:103177.
54. Xu Y, Jiang L, Prakash S, Chen T. The impact of banning electronic nicotine delivery systems on combustible cigarette sales: evidence from US state-level policies. *Value Health*. 2022;25:1352–9.
55. Freitas-Lemos R, Stein JS, Tegge AN, Kaplan BA, Heckman BW, McNeill A, et al. Illegal experimental tobacco marketplace II: effects of vaping product bans—findings from the 2020 International Tobacco Control Project. *Tob Control*. 2022;31-(Suppl 3):s214–s22.
56. New Zealand Ministry of Health. Smokefree environments and regulated products act 1990—proposals for regulations. 2021. Available from: <https://consult.health.govt.nz/tobacco-control/vaping-regulations-consultation/>. Accessed 11 January 2023.
57. legislation.gov.uk. The tobacco and related products regulations 2016, No. 507. 2016. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/440989/SI_tobacco_products_acc.pdf. Accessed 2 April 2023.
58. Kimber C, Cox S, Frings D, Albery IP, Dawkins L. Development and testing of relative risk-based health messages for electronic cigarette products. *Harm Reduct J*. 2021;18:96.
59. Australian Government Department of Health. Therapeutic goods (standard for nicotine vaping products) (TGO110) Order 2021 (TGO110) 2021. Available from: https://www.tga.gov.au/sites/default/files/nicotine-vaping-products-and-vaping-devices_0.pdf. Accessed 2 April 2023.
60. Green SH, Bayer R, Fairchild AL. Evidence, policy, and E-cigarettes—will England reframe the debate? *N Engl J Med*. 2016;374:1301–3.
61. Hajek P, Foulds J, Le Houezec J, Sweanor D, Yach D. Should e-cigarettes be regulated as a medicinal device? *Lancet Respir Med*. 2013;1:429–31.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Mendelsohn C, Wodak A, Hall W. How should nicotine vaping be regulated in Australia? *Drug Alcohol Rev*. 2023. <https://doi.org/10.1111/dar.13663>