PUBLIC HEALTH COMMUNICATION CENTRE AOTEAROA

Youth vaping addiction: How it happens and why it matters

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BRIEFING to the Incoming Government

Summary

Daily nicotine vaping prevalence among youth in Aotearoa New Zealand is higher than in comparable countries—15% of 15-17 year olds vape every day. Nicotine causes minimal physical harm, but use may quickly lead to addiction. Physiological changes result in strong cravings and withdrawal symptoms that make it hard to quit nicotine, especially if smoking or vaping is embedded in social life and daily rituals. Policy responses need to reflect the highly addictive nature of vaping, particularly in young people, and mitigate risks of vapers turning to smoking. The definition of vaping harm needs to include psychological, financial and social impacts, as well as physical harm. The Government should assist schools to take a health approach to youth vaping, and fund youth-specific services to help children and adolescents cut down or quit vaping.

When vaping products were first introduced, many young people tried them, but few became daily users (see Appendix). However, over time, vaping technology has evolved to deliver high doses of nicotine very rapidly, comparable to the 'hit' from cigarette smoking.[1 2] Now an increasing proportion of young people who experiment with vaping are becoming daily users – by 2022, the conversion rate from experimental to daily vaping was one in four (see Appendix). In 2022/23, 15% of 15-17 year olds in Aotearoa vaped every day, up from 2% in 2019/20 - much higher than in comparable countries (see Appendix). Based on overseas evidence, it is likely that most of these teens are (or will soon be) experiencing nicotine addiction.[3]

How does nicotine addiction happen?

Each hit of nicotine, whether smoked or vaped, acts directly on the nicotinic receptors on dopamine neurons, which in turn fire up the nucleus accumbens, the pleasure centre in the brain.[4] Repeated firing strengthens these pathways and plays a key part in the development of addiction.[4] The process often begins with the first cigarette or vape, and drives increasing frequency of use.[5] Cravings can become difficult to resist within a few weeks, although there is marked variation between individuals.[6 7]

Nicotine is particularly addictive because it briefly desensitises (inactivates) brain receptors each time it is used. As receptors resensitise, and come back 'online', cravings start.[4] The body responds to receptor inactivation by making more, and these additional receptors lead to more craving.[4]

Evidence suggests that developing adolescent brains may be more susceptible to addiction than adult brains, and exposure to addictive substances in this key developmental period is therefore riskier (see Appendix).[8 9]

Why is it so hard to quit nicotine, and stay quit?

Addiction affects the primitive part of the brain that operates underneath consciousness so is difficult to counter with 'will power'.[4] A key sign of addiction is the appearance of withdrawal symptoms, such as anger, irritability, anxiety, concentration difficulties, restlessness, depressed mood and insomnia when nicotine use stops.[4] Strong cravings and withdrawal symptoms make it hard to quit nicotine, especially if smoking or vaping is

embedded in social life and daily rituals.[10]

Re-setting the reward pathway to a more normal state after stopping nicotine often takes a year or more; during that time cravings continue and there is a high risk of relapse.[7] Once addicted, the primitive part of the brain may never forget nicotine use and may stay primed to lapse into addiction, even with just one slip.[4] Remaining smokefree or vapefree after addiction may thus require a lifetime of vigilance.

What are the effects of nicotine addiction on young people?

The adverse effects of addiction for young people are significant and include: negative financial impacts; disruption to learning caused by withdrawal symptoms (e.g. difficulty concentrating) and/or having to leave class to vape; loss of physical fitness and decreasing participation in sports; risk of getting caught and associated consequences e.g., school suspension; impact on relationships e.g., with parents; sleep disruption; impact on self-esteem due to perceptions of "weakness" associated with addiction; and increased anxiety and mood disorders.[11-15]

Furthermore, nicotine may have negative long-term effects on adolescents' cognition, attention and memory, which may affect academic achievement.[15-17] These far-reaching impacts of nicotine addiction can have cascading effects on adolescents' life trajectories and should be included in the definition of vaping harm.

What are the implications for policy and practice?

The highly addictive nature of nicotine vaping has implications for how policy makers respond to this product.

Broaden the definition of 'harm'. To date, debate has generally focused on potential physical health benefits and risks of vaping. But nicotine addiction has psychological, financial and social impacts, which policymakers should also consider when evaluating risks and benefits of policy options.

Treat addiction in children and adolescents as a health issue, rather than 'bad behaviour'. Once addiction is established, users cannot easily change their behaviour. Therefore, responding with punishment (such as suspending children from school) is inappropriate as it is unjust and stand-downs are harmful and generally ineffective. Schools must be supported to provide a health-based approach to youth vaping, and use restorative practices if rules are broken.

Enforce the current laws and introduce stronger protections for young people. Previous briefings have noted that current policy settings are inadequate and poorly enforced, and recommended additional measures to make vaping products less available and appealing to young people e.g., disallowing disposable vapes, disallowing price promotions (e.g. 2-for-1 deals), removing vapes from general retailers (e.g., dairies), and introducing plain packaging.

Mitigate risks of addicted vapers turning to smoking. Very stringent or poorly designed vaping regulation risks pushing heavily addicted young people toward cigarettes, particularly if they have easy access to tobacco (e.g., via family members who smoke). To reduce this risk, complementary policies are needed to greatly reduce the availability, appeal and addictiveness of tobacco products. If not repealed by the coalition government,

the current Smokefree laws will achieve that end and ensure the more harmful product (tobacco) remains harder to access and less attractive than the less harmful product (e-cigarettes). Furthermore, the rationale for changing vaping regulations should be clearly communicated to vapers, including young people who vape.

Introduce quit vaping services. Support services are urgently needed to help children and adolescents cut down or quit vaping. These must be tailored to relevant age-groups (including primary-school aged children) and to the cultural needs and preferences of young people who vape.

What's new in this briefing

- Youth vaping prevalence is high in New Zealand compared to similar countries, and an increasing proportion of young people who experiment with vaping are becoming addicted.
- The process of addiction involves development of neurochemical 'reward' pathways in the primitive part of the brain that are difficult to counter with conscious self-control.
- Because their brains are still developing, adolescents are more vulnerable to addiction than adults.

Implications for public health policy and practice

- Harm from vaping and smoking includes psychological, financial and social harms associated with nicotine addiction. When developing regulatory responses to youth vaping, policy makers should take into account these harms and the difficulty of changing behaviour, once addiction is established.
- Schools must be supported to take a health approach to youth vaping, rather than suspending students caught vaping (many of whom are addicted).
- Support services are urgently needed to help children and adolescents cut down or quit vaping.

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Appendix

Conversion rate from experimental to daily vaping

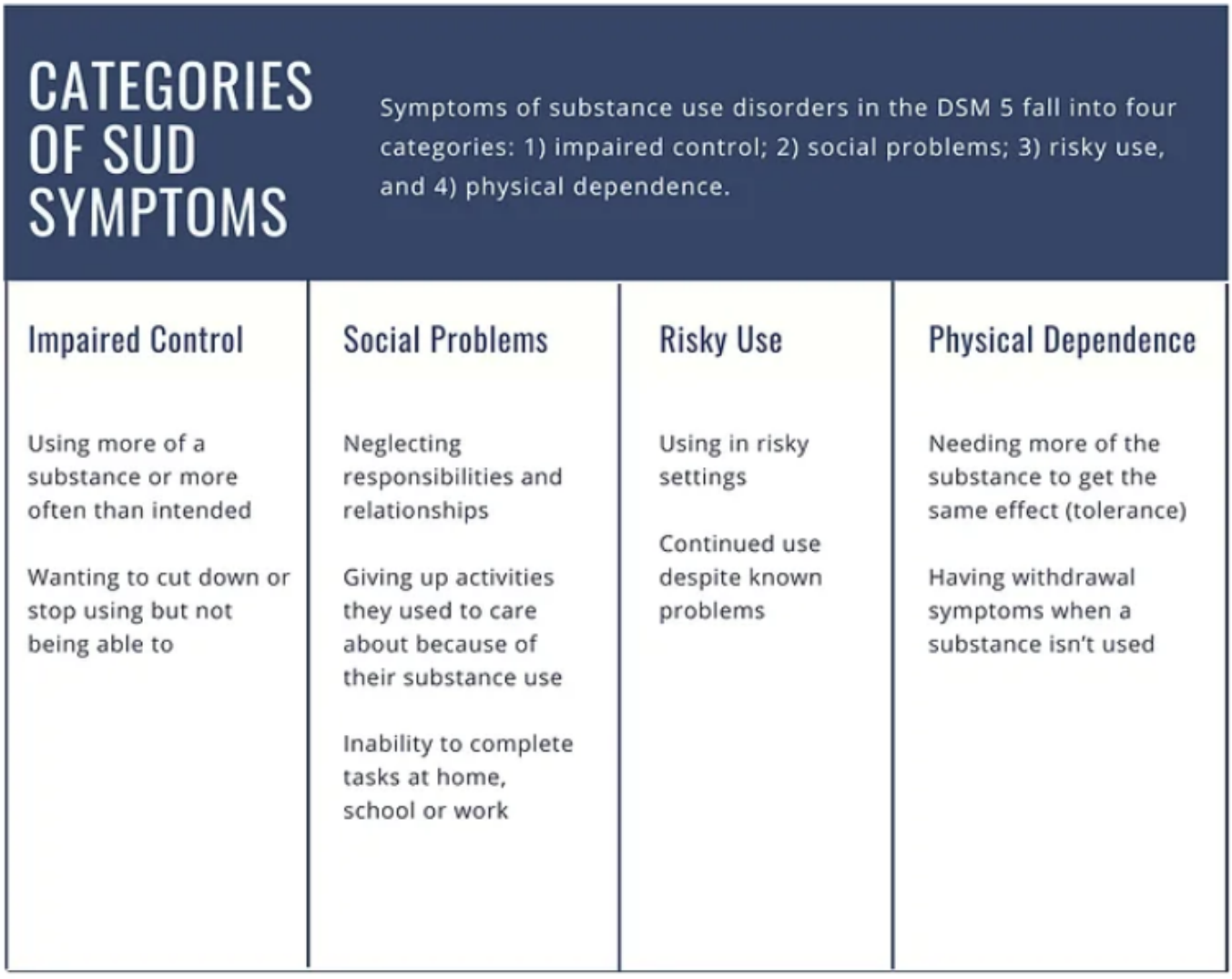
- In 2015, less than 1 in 20 Year 10 students who had ever vaped were daily vapers. That is, 23% had tried vaping and 1.1% vaped daily (39% and 2% respectively for Māori).
- In 2022, the ratio was 1 in 4. That is, 40% had tried vaping, and 10% vaped daily (59%

and 23% for Māori, that is, over than 1 in 3). *Source: ASH Year 10 Snapshot Survey*

Vaping in comparable countries

- Daily vaping in Australia was 2% among 12-15 year olds and 6% among 16-17 year olds in 2022/2023.[18]
- In the USA, prevalence of daily nicotine vaping was 3.5% among Grade 8, 10 and 12 students combined (13-18 years) in 2022.[19]
- In Great Britain, fewer than 4% of 11 to 17 year olds vaped more than once a week in 2023.[20]

Symptoms of addiction



Source: DSM-5 Criteria for Addiction Simplified.
https://www.addictionpolicy.org/post/dsm-5-facts-and-figures

Adolescent brain development and addiction risk

Adolescence is a critical period for brain development. Adolescents are more susceptible to addiction than adults because their neural pathways are more easily changed and strengthened during this period of rapid development.[9] Lower impulse control, due to incomplete development of the prefrontal cortex, may also contribute to addiction vulnerability in adolescents. Furthermore, studies suggest that the neurochemical 'reward'

for nicotine use may be greater for adolescents.[17] For these reasons, exposure to addictive substances before the brain has finished developing (around age 23 years) poses higher addiction risk.[8 9 17 21]

This article is part of the series Briefings to the Incoming Government, highlighting challenges and opportunities in the public health policy space.

References

1. Diaz MC, Silver NA, Bertrand A, Schillo BA. Bigger, stronger and cheaper: growth in e-cigarette market driven by disposable devices with more e-liquid, higher nicotine concentration and declining prices. *Tob Control* 2023 doi: 10.1136/tc-2023-058033 [published Online First: 20230803]
2. Gholap VV, Kosmider L, Golshahi L, Halquist MS. Nicotine forms: why and how do they matter in nicotine delivery from electronic cigarettes? *Expert Opinion on Drug Delivery* 2020;17(12):1727-36. doi: 10.1080/17425247.2020.1814736
3. Lin C, Gaiha SM, Halpern-Felsher B. Nicotine Dependence from Different E-Cigarette Devices and Combustible Cigarettes among US Adolescent and Young Adult Users. *Int J Environ Res Public Health* 2022;19(10) doi: 10.3390/ijerph19105846 [published Online First: 20220511]
4. Stahl SM. Stahl's essential psychopharmacology: neuroscientific basis and practical applications. Cambridge, UK: Cambridge University Press 2021.
5. DiFranza JR, Ursprung WWS, Contreras GA. Assessment of Tobacco Addiction in Adolescents. *Int J Ment Health* 2014;40(1):65-84. doi: 10.2753/imh0020-7411400104
6. DiFranza JR, Savageau JA, Rigotti NA, et al. Development of symptoms of tobacco dependence in youths: 30 month follow up data from the DANDY study. *Tob Control* 2002;11:228-35.
7. Ray LA, Roche DJO. Neurobiology of Craving: Current Findings and New Directions. *Current Addiction Reports* 2018;5(2):102-09. doi: 10.1007/s40429-018-0202-2
8. Colyer-Patel K, Kuhns L, Weidema A, et al. Age-dependent effects of tobacco smoke and nicotine on cognition and the brain: A systematic review of the human and animal literature comparing adolescents and adults. *Neurosci Biobehav Rev* 2023;146:105038. doi: 10.1016/j.neubiorev.2023.105038 [published Online First: 20230107]
9. Schramm-Sapyta NL, Walker QD, Caster JM, et al. Are adolescents more vulnerable to drug addiction than adults? Evidence from animal models. *Psychopharmacology (Berl)* 2009;206(1):1-21. doi: 10.1007/s00213-009-1585-5 [published Online First: 20090623]
10. Blank ML, Hoek J. Smoking, vaping and drinking: A qualitative analysis of Aotearoa New Zealand young adults who tried e-cigarettes to stop smoking tobacco. *Addiction* 2023 doi: 10.1111/add.16413 [published Online First: 20231219]
11. Amato MS, Bottcher MM, Cha S, et al. "It's really addictive and I'm trapped:" A qualitative analysis of the reasons for quitting vaping among treatment-seeking young people. *Addict Behav* 2021;112:106599. doi: 10.1016/j.addbeh.2020.106599

[published Online First: 20200803]
12. Dube CE, Pbert L, Nagawa CS, et al. Adolescents Who Vape Nicotine and Their Experiences Vaping: A Qualitative Study. *Subst Abuse* 2023;17:11782218231183934. doi: 10.1177/11782218231183934 [published Online First: 20230628]
13. Chaiton M, Fan J, Bondy SJ, et al. E-Cigarette Dependence and Depressive Symptoms Among Youth. *Am J Prev Med* 2024;66(1):104-11. doi: 10.1016/j.amepre.2023.09.020 [published Online First: 20230927]
14. Laviolette SR. Molecular and neuronal mechanisms underlying the effects of adolescent nicotine exposure on anxiety and mood disorders. *Neuropharmacology* 2021;184:108411. doi: 10.1016/j.neuropharm.2020.108411 [published Online First: 2020/11/28]
15. Dearfield CT, Chen-Sankey JC, McNeel TS, et al. E-cigarette initiation predicts subsequent academic performance among youth: Results from the PATH Study. *Prev Med* 2021;153:106781. doi: 10.1016/j.ypmed.2021.106781 [published Online First: 20210903]
16. Smith RF, McDonald CG, Bergstrom HC, et al. Adolescent nicotine induces persisting changes in development of neural connectivity. *Neurosci Biobehav Rev* 2015;55:432-43. doi: 10.1016/j.neubiorev.2015.05.019 [published Online First: 20150603]
17. Leslie FM. Unique, long-term effects of nicotine on adolescent brain. *Pharmacol Biochem Behav* 2020;197:173010. doi: 10.1016/j.pbb.2020.173010 [published Online First: 2020/08/02]
18. Scully M, Bain E, Koh I, et al. ASSAD 2022/2023: Australian secondary school students' use of tobacco and e-cigarettes. Victoria, Australia: Cancer Council Victoria 2023.
19. Miech RA, Johnston LD, Patrick ME, et al. Monitoring the Future national survey results on drug use, 1975 - 2022: Secondary school students. . Monitoring the Future Monograph Series. Ann Arbour, Michigan: The University of Michigan Institute for Social Research 2023.
20. ASH (UK). Use of e-cigarettes (vapes) among young people in Great Britain. London: Action on Smoking and Health (ASH), UK, 2023.
21. Squeglia LM, Gray KM. Alcohol and drug use and the developing brain. *Current Psychiatry Reports* 2016;18(5):46. doi: 10.1007/s11920-016-0689-y [published Online First: 2016/03/18]

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