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Review Article

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Review Article

Cannabis vaping: Understanding the health risks of a rapidly emerging trend

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Abstract

The rapid emergence of youth vaping has completely changed the landscape of adolescent substance use in Canada and has become a pressing public health issue of our time. While nicotine remains the most common substance encountered in vaping devices, cannabis vaping is now reported by one-third of youth who vape. Though cannabis vaping is thought to generate fewer toxic emissions than cannabis smoking, it has been associated with several cases of acute lung injury and often involves high-potency forms of cannabis, exposing youth to several acute and long-term health risks. The low perceived riskiness of cannabis as a substance and of vaping as a mode of consumption may bring a false sense of security and be particularly appealing for youth who may be looking for a 'healthier way' to use substances. While research is still lacking on how best to support youth who may have already initiated cannabis vaping, concerted efforts among paediatric providers, public health experts, schools, communities, and families are urgently needed to limit the spread of cannabis vaping among Canadian youth.

Keywords: *Adolescent; Cannabis; Health risk behavior; Injury; Substance related disorder; Vaping*

The risks of vaping for children and youth were forecasted in a 2015 statement from the Canadian Paediatric Society but the rapidity of uptake of this method of consumption was clearly underestimated (1). While rates of tobacco use in North America have been decreasing steadily and rates of cannabis use among youth under age 18 have trended downwards since the turn of the century, nicotine and cannabis vaping have seen unprecedented increases in popularity among youth in the span of less than a decade (2–4). Nicotine vaping remains more common than cannabis vaping; yet, the overlap between those two substances is significant. In Canada, one-third of adolescents who report e-cigarette use also report using their vaping device to consume cannabis (5).

Youth-friendly designs, aggressive marketing by e-cigarette and cannabis companies, increased access due to legalization, and low perceived riskiness are only some of the factors that may have led to such a rapid increase in popularity of cannabis vaping among youth. Of concern, youth who vape cannabis are at risk of developing e-cigarette or vaping-associated lung injuries (EVALI) (6) and often use very high-potency products, which may lead to more severe health consequences than the use of other forms of cannabis (7).

Cannabis vaping has become one of the most popular modes of cannabis consumption among youth. In this article, we describe cannabis vaping trends and products, discuss some of the specific health risks and youth perceptions of cannabis vaping, and present key clinical considerations for paediatric providers.

EPIDEMIOLOGY

Steady increases in cannabis vaping, which mirror rapid increases in rates of e-cigarette use among youth, have been noted across North America. Although combustible cannabis

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(i.e., smoked as a joint or using a pipe) remains the most common mode of cannabis consumption among teens (6), cannabis vaping is becoming more and more common among youth. In Canada, the use of vape pens increased from 20% to 26% among adolescents and young adults with cannabis use between 2017 and 2018 (8). Data from Ontario also shows an increase in the proportion of high-school students (grades 9 to 12) who reported cannabis vaping in the past 12 months from 5.1% in 2015 to 6.9% in 2017 (4). Similar trends have been reported in the USA, where lifetime cannabis vaping increased from 4.9% to 7.5% among grade 12 students, 4.3% to 7.0% among grade 10 students, and 1.6% to 2.6% among grade 8 students between 2017 and 2018 alone (9). A recent online survey also found that 44% of American adolescents who had tried cannabis had tried cannabis vaping (10).

According to a recent meta-analysis, use of nicotine containing e-cigarettes increases the odds of cannabis use 3.5-fold among adolescents and young adults, suggesting a strong association between the two substances (11). While nicotine vaping remains more common than cannabis vaping, the boundaries between the two substances appear to be thinning. Importantly, cannabis vaping has been associated with increased amounts of cannabis consumed when compared with other modes of consumption (12).

VAPING PRODUCTS

Cannabis vaping devices come in a wide range of shapes, sizes and designs. They can generally be divided into two categories: dab pens and vaporizers. Dab pens are typically the size of a highlighter and are used exclusively with cannabis concentrates (called dabs) created through butane extraction. This concentrate, referred to as butane hash oil, or butane honey oil (BHO), can take several forms, from a thick liquid to a firm, almost glassy solid. Dabs are referred to by several colloquial terms such as 'budder', 'earwax', 'honeycomb' or 'shatter' among others (13). Vaporizers, on the other hand, vary more in terms of size (ranging from small flash-drive-like devices to larger tank-like devices) and can be used with either cannabis concentrates or dried or liquid forms of cannabis (14). Mechanisms for both types of devices usually include a small battery, a heating element, a vaporization chamber, a cartridge or reservoir and a mouthpiece. The vaporization process involves heating the desired substance, producing an aerosol, which is then inhaled and absorbed systemically through the respiratory system (14).

Cannabis vaping devices share many similarities with e-cigarettes and other nicotine vaping devices. Specifically, e-cigarettes that come with prefilled liquid cartridges (referred to as 'pod-mods', which can contain nicotine and/or cannabis), make it very simple for adolescents to try vaping one substance or the other (15). Vaporizers and e-cigarettes can also be used to consume other psychoactive substances such as synthetic cannabis (i.e., K2/'spice'), LSD, and bath salts (16). Examples of cannabis vaping devices and their different parts are shown in Figure 1.

HEALTH EFFECTS OF CANNABIS VAPING

Studies suggest that vaporized cannabis may generate fewer chemicals than smoked cannabis and could thus represent a less harmful, or 'healthier' mode of consumption (17). However, the use of high-potency concentrates, like those found in vape pens also correlates with a higher incidence of mental and physical health problems and may lead to a higher risk of developing acute adverse effects, such as paranoia, psychosis, and cannabis hyperemesis syndrome (18). In addition, there is a lack of evidence comparing long-term effects on lung health of smoked versus vaporized cannabis. In fact, while some vaporizers and vape pens can be used with relatively unprocessed cannabis leaves, buds, or flower, many vaping devices use highly processed products whose safety and chemical profile are much closer to that of e-liquids used in e-cigarettes. This is especially true of flavoured cannabis vaping products which may contain several harmful and carcinogenic aerosols (19). While there is still much to be discovered about the short- and long-term effects of these aerosols on the developing adolescent's lungs, the significant presence of carbonyls, volatile organics, nitrosamines, and heavy metals, all considered toxic and carcinogenic, found in several vaping products, is a reason for concern (20,21).

In recent months, several hundreds of cases of EVALI have been reported in Canada and the USA (6). Most patients diagnosed with EVALI present with severe respiratory symptoms (cough, chest pain, shortness of breath), gastro-intestinal symptoms (abdominal pain, nausea, vomiting, diarrhea) and constitutional symptoms such as fever, chills, and weight loss. EVALI often affects adolescents and young adults with approximately 15% of cases diagnosed in youths under the age of 18 and 20% in youths ages 18 to 20 years (6). While a specific causal agent has not yet been identified, more than three-quarters of individuals diagnosed with EVALI reported vaping THC products, many of which were purchased from the black market (22).

Finally, vape pens and vaporizers present risks related to the device itself. Indeed, reports of injuries tied to the malfunction or explosion of vaping devices have been increasing (23,24). The risk of accidental poisoning in young children who may mistake cannabis vaping products for candies or toys is another important concern, knowing that several of these products come in colourful packages and youth-friendly flavours.

PERCEIVED RISK

The increase in popularity of cannabis vaping among youth likely stems from several factors. Low perceived risk is an

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Figure 1. Examples of cannabis vaping devices and their different parts. Some models of vaping devices for use with (a) ground marijuana head tops; (b) cannabis wax (butane honey oil [BHO] concentrate), or (c) cannabis e-liquid. The letters a, b, or c after the numbers indicate the parts of the vaping devices used for herb, BHO, or e-liquid vaping, respectively. 1. Mega electronic cigarette (e-cig) with dual-coil clearomizer, adjustable airflow control ring, changeable resistance coils and high capacity, variable voltage battery. 2–7. Dry herb and wax vaporizer: 2. Spring-loaded mouthpiece; 3. Vaporizer chamber; 4. Dry herb coil head; 5. Wax coil head; 6. Detachable base with air holes; 7. Medium capacity battery. 8–10. See-through clearomizer for e-liquids: 8. Clearomizer tip; 9. Clearomizer tube; 10. Clearomizer coil and four-wick head with base assembly. 11–14. Glass-globe atomizer wax tank: 11. Drip tip; 12. Glass globe; 13. Ceramic heating chamber and coil; 14. Metal core. 15–19. Dry herb atomizer: 15. Soft drip tip (mouthpiece); 16. Ceramic screen; 17. Metal screen and spring; 18. Screens connector; 19. Ceramic chamber and battery connector. 20. Medium size battery. 21–22. Wax coil head atomizer: 21. Metal mouthpiece and wax coil chamber connector; 22. Wax coil ceramic chamber and battery connector. 23–25. Clearomizer for e-liquids: 23. Shell (mouthpiece attached to metal tank with viewing window); 24. Bottom head changeable coil assembly; 25. Battery base connector. a. Marijuana head tops, b. Cannabis BHO concentrate, c. Cannabis e-liquid (mixture of cannabinoid concentrates (cannabis wax), propylene glycol and glycerol). Source: see ref. (40).

important predictor of adolescent substance use and is perhaps one of the most important contributors (25). Vaping devices also tend to be considered more convenient and discreet in public and to have better taste, flavours, and smell than smoked cannabis (16).

Cannabis is considered by youth to be one of the least harmful psychoactive substances, in part because it is often perceived as more 'natural' than other substances (26). Young people also report higher levels of concentration, higher sense of clarity, and better communication skills when using cannabis, though when tested objectively, the opposite is most often found (27). The parallel emergence of legal 'medical' and 'recreational' cannabis markets raises new challenges in understanding adolescent perceptions of cannabis risks and potential benefits. Indeed, many youths interpret the long list of potential indications suggested by medical dispensaries and cannabis companies as a proof of safety and benefit, though evidence is lacking for most of these indications, even in adults (26). As such, the low perceived risk of vaping as a mode of consumption combined with a favourably perceived risk/benefit profile of cannabis as a substance present an appealing combination for youth who may be looking for a 'healthier' way to use substances.

Studies show a high correlation between vaping product advertising and uptake of youth vaping and cannabis use (28,29). Indeed, while youth-targeted advertising for cannabis products is prohibited in North America, adolescents are frequently exposed to cannabis vaping content from unverified sources online and through social media (30). It is well known that teens exposed to multiple forms of advertising are more likely to try vaping than those who aren't (31). Given the high overlap between e-cigarettes and cannabis vaping devices, the aggressive and often uncontrolled marketing strategies from vaping companies and uptake by high visibility public figures has been contributing to increases in both nicotine and cannabis vaping (12).

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CLINICAL CONSIDERATIONS

Nicotine and cannabis co-use has been studied long before the recent increase in popularity of e-cigarettes and vaping devices but has now become a more pressing concern among teens given the frequent co-use of those two substances through vaping devices (32). It is well known that nicotine and cannabis addiction share common genetic risk factors, and that the concomitant or sequential use of these two substances can increase severity of withdrawal symptoms and hinder cessation efforts (33). In addition, nicotine consumed through e-cigarettes can enhance the addictive properties of cannabis and other substances, due to its rapid absorption and intense stimulation of the reward centre of the brain. This creates a 'perfect storm' for increased substance use behaviours among youth (11,34).

In order to address what has effectively become an epidemic among youth, health providers will need to seek proper education about nicotine and cannabis vaping products (35). An important first step is to use evidence-based tools to effectively screen for vaping among youth. Since many youth use vaping devices to consume both nicotine and cannabis, the use of a short evidence-based screening tool (36,37) with the inclusion of common vaping terms such as e-cigarettes, vapes, dabs, dab pens, vaporizers, and some of the most common commercial vaping brands will help increase screening effectiveness.

Though more research is needed in this area, therapeutic approaches that apply to smoked cannabis use such as motivational interviewing and individual counseling can be applied to cannabis vaping (38). One important consideration is that given the high potency of cannabis concentrates used in dab pens and vaporizers, youth should be informed about the higher risks of cannabis withdrawal when interrupting use (39).

CONCLUSION

While the risks and health effects of cannabis use during adolescence are well established, low perceptions of harm, especially with vaping devices, often considered 'cleaner' or less harmful than other modes of consumption, represent an important challenge for substance use prevention and reduction efforts. Improved regulation and oversight of the cannabis industry is a promising avenue to limit increases in underage cannabis vaping, but it is only a start. There is an important need for concerted efforts among paediatric providers, public health experts, schools, communities, and families to limit the spread of this rapidly growing trend. One point that will merit attention in upcoming years is the impact of the legalization of extracts of cannabis for vaping in late 2019. The Public Health Agency of Canada currently mentions in its *Lower-Risk Cannabis Use Guidelines* that cannabis vaping could represent a safer mode of consumption than smoking, due to lower toxic emissions. Caution will be needed to prevent young people with a still developing brain from considering this public health messaging and change in policy as an incentive to consume high-potency cannabis products with all their associated health risks.

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