

# Cannabis Vaping – What Teens, Their Parents and Their Naturopathic Doctors Need to Know



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**Abstract:** Cannabis is the most commonly used illicit drug globally, and Canada has among the highest use rates.<sup>1</sup> In 2014, 10% to 15% of general-population adults and 25% to 30% of adolescents or young adults report current (i.e., past-year) cannabis use.<sup>2</sup> Arguably, the legalization of cannabis in Canada can be regarded as one of the most significant public health policy changes in the last 50 years. The stated aim of legalization of cannabis was to protect youth and eliminate the criminal element from the cannabis industry, and it has been challenging, as the government attempts to navigate the creation a new industry that can compete with the well-established illicit market.

**M**edicinal use of cannabis was legalized in Canada, on July 30, 2001 under the *Maribuana for Medical Purpose Regulations* (MMPR). There have been subsequent regulations over the years with the federal *Cannabis Act* coming into effect on 17 October 2018 and made Canada the second country in the world, after Uruguay, to formally legalize the cultivation, possession, acquisition and consumption of cannabis and its by-products. At this time, recreational use of cannabis no longer violated criminal law. The process removed cannabis possession for personal consumption from the *Controlled Drugs and Substances Act*, and created regulations similar to that of alcohol in Canada, limiting home production, distribution, consumption areas and sale time as well as implementing taxation and strengthening punishment of those convicted of either supplying cannabis to minors, or of impairment while driving a motor vehicle. The implementation of the cannabis laws has not been without its problems. There have been missteps, delays and frustration which was not unexpected given that this is an industry that just launched and is becoming more adept at navigating the need to balance consumer education consumer experience while operating in a tightly regulated market.

The illicit cannabis market is used to operating below the radar and adapted quickly to the new laws. With lower costs of production and a wider variety of products these producers have managed to capture substantial market share by not being encumbered by the regulations. Consequently, it can be very difficult for consumers to distinguish legal from illegal products; while the higher concentration products appear to still be available through illicit channels, they are not appearing in the legalized recreational market. Additionally, longer term market forces in the illicit market have resulted in an abundance of products that emphasize higher THC content, which has more hallucinogenic effects. This has diverged from the regulated medical cannabis market, which uses cannabis strains with higher CBD, CBG and other therapeutic constituents.

Canada's legal recreational cannabis industry is still in its very early stages. Cannabis 1.0 regulation legalized combustible cannabis, cannabis oils, and cannabis plants and seeds and everyone is still navigating this new landscape. Cannabis 2.0 regulation, which includes edibles and extracted products, such as vape cartridges, has just begun.

With the rollout of the Cannabis 2.0 legalization in December 2019, Canadian cannabis consumers are currently diverging into two broad segments. The first segment include novice or 'cannabis-curious' consumers, which tend to be older and more conservative in their use, preferring lower dose edible or tea formats and occasional use (1x/month or less). The second segment includes younger, more consistent users, who gravitate to the inhaled flower products, higher THC dosages, and seek to consume cannabis several times a week.<sup>3</sup>

Market research by the CAND has indicated that Naturopathic doctors occupy a unique niche in the minds of many patients, and the health care system as a whole. This may help the profession play an effective role in patient education regarding cannabis. The public health burden of cannabis use has been smaller than for alcohol, tobacco, and other illicit drugs,<sup>4,5</sup> however, the strongest evidence exists for the following associations: acute cognitive and psychomotor impairments, motor-vehicle accidents (MVAs), brain development and chronic functioning, dependence and psychosis, pulmonary or bronchial system problems, and poorer pregnancy outcomes.<sup>6,7,8,9,10</sup>

It is in the younger, higher volume segment that cannabis use-associated harms are most likely to manifest. The literature suggests that a substantial proportion of these problems occurs in users who initiated use in adolescence or continued to use it frequently into adulthood.<sup>11,12,13,14,15</sup> The harms themselves - or at least their severity - are influenced by modifiable behavioral factors or user choices and it is important to educate patients on these topics.

This article will discuss the vapourization of cannabis, (vaping) in youth, potential hazards regarding product manufacturing, specifically e-cigarette vaping associated lung injury (EVALI), in the context of legal vs illegal products and present low risk guidelines that can be discussed with patients.

## The Endocannabinoid System

To set the stage for this discussion, a brief overview of the endocannabinoid system (ECS) is warranted. The ECS is an ancient, evolutionarily conserved, and ubiquitous lipid signaling system found in all vertebrates, and which appears to have important regulatory functions throughout the human body. Health Canada's *Information for Health Care Professionals: Cannabis (marihuana, marijuana) and the cannabinoids* statement collates and documents the evidence that dysregulation of the ECS contributes to many human diseases including pain, inflammation, psychiatric disorders and neurodegenerative diseases.<sup>1</sup> Dysregulation of the ECS has also been observed to impact a wide range of physiological and pathophysiological processes including nervous system development, immune function, inflammation, appetite, metabolism and energy, homeostasis, cardiovascular function, digestion, bone development and bone density, synaptic plasticity and learning, pain, reproduction, psychiatric disease, psychomotor behavior, memory, wake/sleep cycles, and the regulation of stress and emotional state/mood.<sup>16</sup>

The ECS acts through several non-cannabinoid receptors. Besides the well-known CB1 and CB2 receptors, a number of different cannabinoids are believed to bind to a number of other molecular targets which include the third putative cannabinoid receptor GPR55 (G protein-coupled receptor 55), the transient receptor potential (TRP) cation channel family, and a class of nuclear receptors/transcription factors known as the PPARs, as well as 5-HT1A receptors, the  $\alpha$ 2 adrenoceptors, adenosine and glycine receptors.<sup>17</sup>

McPartland et al. have noted that many randomized controlled trials identified in this systematic review have been conducted on lifestyle modifications (e.g., exercise, maintenance of ideal body weight) and CAM interventions (e.g., dietary supplements, stress modification, acupuncture, massage, and manipulation). In our opinion these are sensible methods of enhancing the ECS.<sup>18</sup>

Russo has published extensively on non-cannabis modifiers of the ECS, noting that it has been conventional wisdom until recently that only cannabis contained active agents affecting the endocannabinoid system. "In recent decades, a widened search has identified numerous

additional plants whose components stimulate, antagonize, or modulate different aspects of this system. These include common foodstuffs, herbs, spices, and more exotic ingredients: kava, chocolate, black pepper, and many others".<sup>19</sup> Many core naturopathic botanical and dietary therapies act through the ECS; adding an ironic twist to the current exclusion of naturopathic doctors from the list of Health Canada authorized prescribers.

## What is Vaping?

Vaping refers to the act of inhaling an aerosol (e.g., nicotine, marijuana, tetrahydrocannabinol, tetrahydrocannabinol concentrates, cannabinoids, synthetic cannabinoids, flavorings, or other substances) produced by a vaping product (e.g., electronic nicotine delivery system (ENDS), electronic cigarette (e-cigarette), vaporizer, vape(s), vape pen, dab pen, or other device). 'Dabbing' refers to inhaling very hot vapours from heating cannabis oils, concentrates, or extracts.

It's important to note that vaping can refer to either dried cannabis flower or prefilled oil cartridges, commonly referred to as 'carts'. Vaping can also refer to the use of non-cannabis, electronic cigarettes (also known as 'e-cigarettes' or EC), which advocates claim is a harm reduction approach to curb consumption of conventional cigarettes given the fact that most of the carcinogens in cigarettes are formed as a result of combustion.

Similarly, vaping cannabis is promoted as having health benefits by reducing harm from ingesting toxic smoke.<sup>20</sup> Vaping is perceived and being sold as a safer way to use cannabis, despite the lack of data on the health effects of chronic vaping. Other perceived benefits include better taste, more efficient and intense effects, and greater discretion which allows for use in more places.

A typical EC is powered by a rechargeable battery connected to a reservoir containing an 'e-liquid' that the user periodically refills. The user activates the heating coils by holding down a push button during inhalation. The e-liquid is rapidly vaporized by being wicked through one or two coils and aerosolized as the user inhales the vapor and dilution air through a mouthpiece. There are thousands of e-liquids on the market, most of which contain nicotine in varying concentrations (typically up to 30 mg/ml) in addition to flavorings and other additives dissolved in propylene glycol (PG), vegetable glycerin (VG), or a various mixture.<sup>21</sup>

Many Public Health experts have increasingly raised concerns about potential harms of ECs. There is concern, for instance, that ECs may serve as a gateway to tobacco addiction for a new generation of users and contribute to the relegitimization and glamorization of tobacco-containing products.<sup>22</sup> The promoted benefits of ECs and vaging in general could also result in an increasing likelihood of experimenting with cannabis at a younger age, and facilitate more frequent use, increasing the probability of problematic use.

Multiple studies indicate that reductions in perceived risk of harm may lead to earlier initiation of use of many types of substances

including cannabis, increased frequency or quantity of use, and decreased motivation to quit or reduce use.<sup>23,24</sup> All these issues are being played out in the EC literature, which is indicating that EC manufacturers are recruiting adolescents with lower-risk profiles than tobacco smokers.<sup>25</sup> Several studies suggest that ECs may be failing to deliver on initial hopes that these products would greatly reduce or eliminate the use of combusted products among habitual smokers.<sup>26,27</sup>

Data from Public Health England's *Evidence review of e-cigarettes and heated tobacco products 2018* report suggested that the rates of EC use varies with previous smoking experience. For 11-16 y.o. EC use is concentrated in young people who had already smoked while remaining very low (0.1% to 0.5%) in those who have never smoked. Data for 17-18 y.o. are consistent with the data for 11 to 16 y.o. with never-smokers' weekly EC use being negligible and never smokers' EC experimentation being around 9% since 2016.<sup>28</sup>

### Key findings from the PHE

- ECs cannot be legally sold to young people under the age of 18 in most parts of the UK except for Northern Ireland. Purchasing does occur including from sources rarely used for tobacco such as online suppliers.
- Despite some experimentation with these devices among never smokers, ECs are attracting very few young people who have never smoked into regular use.
- ECs do not appear to be undermining the long-term decline in cigarette smoking in the UK among young people.
- Never smokers in the UK who try ECs are more likely to have tried smoking subsequently than those who have not tried ECs.
- A causal link has not been established and neither has progression to regular smoking. The 'common liability' hypothesis seems a plausible explanation for the relationship between ECs and smoking experimentation.

Given these findings, it would not be an unreasonable conclusion that youth with a history of smoking cannabis would be more likely to try vaping cannabis while those that have never smoked cannabis are less likely to vape. Cassidy et al. concluded that individuals with the greatest risk of initiation of vaping cannabis during the first year of college are those with a prior history of other cannabis use and other electronic nicotine delivery system (ENDS) use and who have peers in their network who initiate cannabis vaping.<sup>29</sup>

Several recent studies have measured harmful pollutants in vapor generated by ECs, including fine and ultrafine particles,<sup>30,31,32</sup> reactive oxygen species (ROS),<sup>33</sup> and toxic compounds associated with flavorants.<sup>34</sup> Increased attention is being paid to the presence of aldehydes associated with irritation of the respiratory tract and/or carcinogenicity, such as formaldehyde, acetaldehyde, and acrolein.<sup>35,36</sup>

There is evidence that vaping may achieve higher blood levels for THC. Spindle, et al. reported a comparison of acute effects of smoked

vs vaporized cannabis at two different doses. Subjective drug effects, cardiovascular effects, and impaired cognitive and psychomotor function were observed, with greater effects and higher blood cannabinoid concentrations achieved from vaporization. Vaporized low-dose cannabis produced a greater number of measurable impairments than smoked high-dose cannabis in a sample of infrequent users. These findings have implications for novice users, trying for the first time the multitude of products available legally, and believing vaporization to be a safer route of administration.<sup>37</sup>

### Additives

Consumers have used disposable vaporizer cartridges with standard additives—propylene glycol, vegetable glycerin, or medium-chain triglyceride (MCT) oil—for many years. However, officials at the US Food and Drug Administration proposed adding propylene glycol as a respiratory toxicant to its list of "*Harmful and Potentially Harmful Constituents in Tobacco Products.*" FDA officials have also proposed regulating all EC ingredients by 2022.<sup>38</sup>

Cannabis is a complex plant that produces a vast array of medicinal and bioactive compounds, over 1000 at last count. These include highly lipophilic compounds, volatile terpene compounds and numerous flavonoids. As a result, the cannabis extraction process and vape cartridge production is quite complicated. The resulting concentrate from cannabis extraction is a thick tar like substance that does not flow easily and requires either further processing or admixtures to decrease viscosity so that the material can be loaded into cartridges. Cutting agents refer to chemicals added to vape cartridges that dilute the cannabis oil inside. The primary reason cutting agents are used is to increase the final volume available for sale by the producer of the vape cartridge. Cutting agents don't materially change the appearance, flavour or effect of the product when added and are often present without the consumer's knowledge or understanding.

In the Canadian regulatory environment, it is essentially impossible for the average consumer to tell whether the oil in their cartridge has been "cut" with off-label chemicals. It will be important to monitor the situation as legal, regulated vaping products enter the market. The concern being that the unregulated illicit market will then attempt to introduce unregulated vapes into the market.

### Vaping-induced Acute Lung Injury (EVALI)

Triantafyllou, et al<sup>39</sup> describe the features of six cases seen this past summer at the University of Pittsburgh Medical Center. These cases were young men who presented with respiratory and gastrointestinal complaints who reported regular use of vaporized cannabis and nicotine products. The patients showed evidence of a systemic inflammatory response with leukocytosis, and chest imaging showed bilateral, multifocal ground-glass opacifications. The patients were treated with IV antibiotics and corticosteroids. Two patients required mechanical ventilation, but they, like the others, subsequently recovered and were discharged. The case descriptions from the University of Pittsburgh team are similar to those of a larger case series published earlier this year from Illinois and Wisconsin.<sup>40</sup>



One common finding in the two published case series is the prevalence of use of a cannabis product known as 'Dank Vape'. According to the CDC, Dank Vapes are the most prominent in a class of largely counterfeit brands, with common packaging that is easily available online and used by distributors to market THC-containing cartridges.<sup>41</sup>

Triantafyllou, et al. describe several possible mechanisms by which vaping can lead to acute lung injury.<sup>11</sup> The common vehicles of the nicotine-containing extracts are propylene glycol and glycerin, which have been shown to induce airway remodeling.<sup>42</sup> Nicotine vapor itself has been shown to induce macrophage activation,<sup>43</sup> and flavoring additives, including the known respiratory toxin diacetyl, lead to the generation of by products that directly injure the airway epithelium.<sup>44</sup> It should be no surprise then that chemically complex extracts heated to the point of vaporization will generate toxic agents.<sup>45</sup> A recent paper from the Mayo Clinic that described the pathological examination of lung biopsies from 17 patients with vaping associated lung injury reported findings more consistent with airway-centered chemical pneumonitis from one or more inhaled toxic substances, rather than lipoid pneumonia.<sup>46</sup>

There are multiple known contaminants in illicit vape cartridges, that could cause lung injury. But on Nov. 8, 2019, the CDC announced a “very strong culprit of concern” — vitamin E oil, (tocopheryl-acetate). Lung fluid analyses of 29 victims from 10 states tested positive for the substance. “The samples,” said CDC Dr. Anne Schucat, “provided evidence of vitamin E acetate at the primary site of injury in the lungs. No other potential toxins were detected”.<sup>47</sup> According to the CDC, laboratory data show that vitamin E acetate, an additive in some THC-containing ECs or vaping products, is strongly linked to the EVALI outbreak.<sup>48</sup>

A recent study analyzed samples from 51 EVALI cases from 16 states and a comparison group of samples from 99 comparison individuals without EVALI for vitamin E acetate, plant oils, medium chain triglyceride (MCT) oil, coconut oil, petroleum distillates, and diluent terpenes. Vitamin E acetate was identified in bronchoalveolar lavage (BAL) fluid samples from 48 of the 51 EVALI patients, but not in the BAL fluid from the healthy comparison group. No other toxicants were found in BAL fluid from either group, except for coconut oil and limonene (1 EVALI patient each).<sup>49</sup>

New York health authorities have confirmed that synthetic vitamin E (tocopheryl-acetate) is tainting most seized vape carts in that state.<sup>50</sup> Pen makers report using it because it's a cheap thickener.<sup>51</sup>

Wu and O'Shea<sup>52</sup> demonstrated that the vaping of vitamin E acetate has the potential to produce exceptionally toxic ketene gas, which may be a contributing factor to the upsurge in pulmonary injuries associated with using EC/vaping products. Additionally, the pyrolysis of vitamin E acetate also produces carcinogen alkenes and benzene for which the negative long-term medical effects are well recognized.

As of February 4th, 2020, 2,758 confirmed and probably cases of severe acute respiratory distress syndrome (ARDS) were reported to the US CDC.

'In Canada, as of February 11th, 2020, 17 cases of vaping-associated lung illness have been reported to the Public Health Agency of Canada.<sup>53</sup> Four patients presented with respiratory symptoms only (shortness of breath, cough), while thirteen presented with a combination of respiratory, gastrointestinal, and/or constitutional symptoms, such as fever or weight loss.

In many cases, symptoms and treatment mirror a condition called lipoid pneumonia,<sup>54</sup> previously found in patients who inhaled mineral oil. Subsequent biopsies of 17 victims indicated “airway-centered chemical pneumonitis<sup>55</sup> from one or more inhaled toxic substances rather than exogenous lipoid pneumonia as such, but the agents responsible remain unknown.” A third biopsy series looked similar to the first two, adding organizing pneumonia<sup>56</sup> to the diagnosis cluster.

## Effects on Youth

These incidences of lung injury due to vaping in young, apparently healthy patients should be a cautionary tale to clinicians and the general public about the safety of these products and their use. With the increased visibility of legalized cannabis for use in vaping systems has raised concerns regarding EC use by youth were being expressed before cannabis legalization.

In 2016, the Office of the Surgeon General issued a report warning youth against e-cigarettes. Vaping “has the potential to create a whole new generation of kids who are addicted to nicotine,” said Vivek Murthy, M.D., then the U.S. surgeon general, in issuing the report in December 2016.

Key findings included:

- In 2014, current (past-month) use of ECs by young adults 18–24 years of age surpassed that of adults 25 years of age and older.
- ECs are now the most commonly used tobacco product among youth.
- Vaping is also strongly associated with the use of other tobacco products among youth and young adults, including combustible tobacco products.
- The use of products containing nicotine poses dangers to youth, pregnant women, and fetuses. The use of products containing nicotine in any form among youth, including in ECs, is unsafe.
- The aerosol from ECs is not harmless. It can contain harmful and potentially harmful constituents, including nicotine.
- Nicotine exposure during adolescence can cause addiction and can harm the developing adolescent brain.
- ECs are marketed by promoting flavors and using a wide variety of media channels and approaches that have been used in the past for marketing conventional tobacco products to youth and young adults.

Permitting tobacco company–funded companies to market flavored EC pods has led to the nicotine addiction of thousands of children. Data from the 2019 Monitoring the Future Survey conducted annually by the National Institute on Drug Abuse showed a doubling of the percentage of teens who reported vaping, with 25% of high school seniors reporting use in the last month.<sup>57</sup>

With regards to cannabis, in addition to the issues relating to lung injury, the greater efficiency of delivery afforded by vaporization may result in stronger effects with collateral impairment. Increased availability of cannabis of higher potency combined with increasing use raises public safety concerns around impairment and acute intoxication. The greater cognitive and psychomotor effects of vaporized cannabis relative to smoked cannabis reported by Spindle et al<sup>16</sup> at a dose substantially lower than that of products available in cannabis dispensaries, further amplify these concerns around impairment. In a placebo-controlled crossover trial conducted in healthy adults who infrequently use cannabis, Spindle and colleagues report a comparison of acute effects of smoked versus vaporized cannabis at 2 different doses. Dose-orderly subjective drug effects, cardiovascular effects, and impaired cognitive and psychomotor function were observed, with greater effects and higher blood cannabinoid concentrations achieved from vaporization. The authors warn that even relatively low-potency cannabis can adversely affect inexperienced users.<sup>58</sup>

### Lower-Risk Cannabis Use Guidelines (LRCUG)<sup>59</sup>

Extensive data suggest that many cannabis use–associated harms—or at least their severity—are influenced by modifiable behavioral factors or user choices and these present opportunities for interventions to modify cannabis users' behavior toward improved public health outcomes. Health Canada's *Lower Risk Cannabis Use Guidelines* (LRCUG) may be a worthwhile public health intervention for cannabis, particularly following legalization of use. LRCUG are primarily aimed at individuals, initially in the context of Canada, who have made the choice to use cannabis, as a knowledge-based tool to lower their risk of harms.<sup>60</sup>

The LRCUG are as follows:

**Recommendation 1:** The most effective way to avoid any risks of cannabis use is to abstain from use.

Those who decide to use need to recognize that they incur risks of a variety of—acute and long-term—adverse health and social outcomes. These risks will vary in their likelihood and severity with user characteristics, use patterns, and product qualities, and so may not be the same from user to user or use episode to another.

*[Evidence Grade: None required.]*

**Recommendation 2:** Early initiation of cannabis use (i.e., most clearly that which begins before age 16 years) is associated with multiple subsequent adverse health and social effects in young adult life.

These effects are particularly pronounced in early-onset users who also engage in intensive and frequent use. This may be in part because frequent cannabis use affects the developing brain. Prevention messages should emphasize that, the later cannabis use is initiated, the lower the risks will be for adverse effects on the user's general health and welfare throughout later life.

*[Evidence Grade: Substantial.]*

**Recommendation 3:** High THC-content products are generally associated with higher risks of various (acute and chronic) mental and behavioral problem outcomes.

Users should know the nature and composition of the cannabis products that they use, and ideally use cannabis products with low THC content. Given the evidence of CBD's attenuating effects on some THC-related outcomes, it is advisable to use cannabis containing high CBD:THC ratios.

*[Evidence Grade: Substantial.]*

**Recommendation 4:** Recent reviews on synthetic cannabinoids indicate markedly more acute and severe adverse health effects from the use of these products (including instances of death).

The use of these products should be avoided.

*[Evidence Grade: Limited.]*

**Recommendation 5:** Regular inhalation of combusted cannabis adversely affects respiratory health outcomes.

While alternative delivery methods come with their own risks, it is generally preferable to avoid routes of administration that involve smoking combusted cannabis material (e.g., by using vaporizers or edibles). Use of edibles eliminates respiratory risks, but the delayed onset of psychoactive effect may result in the use of larger than intended doses and subsequently increased (mainly acute, e.g., from impairment) adverse effects.

*[Evidence Grade: Substantial.]*

**Recommendation 6:** Users should avoid practices such as “deep inhalation,” breath-holding, or the Valsalva maneuver to increase psychoactive ingredient absorption when smoking cannabis, as these practices disproportionately increase the intake of toxic material into the pulmonary system.

*[Evidence Grade: Limited.]*

**Recommendation 7:** Frequent or intensive (e.g., daily or near-daily) cannabis use is strongly associated with higher risks of experiencing adverse health and social outcomes related to cannabis use.

Users should be aware and vigilant to keep their own cannabis use—and that of friends, peers, or fellow users—occasional (e.g., use only on 1 day/week, weekend use only, etc.) at most.

*[Evidence Grade: Substantial.]*

**Recommendation 8:** Driving while impaired from cannabis is associated with an increased risk of involvement in motor-vehicle accidents.

It is recommended that users categorically refrain from driving (or operating other machinery or mobility devices) for at least 6 hours after using cannabis. This wait time may need to be longer, depending on the user and the properties of the specific cannabis product used. Besides these behavioral recommendations, users are bound by locally applicable legal limits concerning cannabis impairment and driving. The use of both cannabis and alcohol results in multiply increased impairment and risks for driving, and categorically should be avoided.

*[Evidence Grade: Substantial.]*

**Recommendation 9:** There are some populations at probable higher risk for cannabis-related adverse effects who should refrain from using cannabis.

These include individuals with predisposition for, or a first-degree family history of, psychosis and substance use disorders, as well as pregnant women (primarily to avoid adverse effects on the fetus or newborn). These recommendations, in part, are based on precautionary principles.

*[Evidence Grade: Substantial.]*

**Recommendation 10:** While data are sparse, it is likely that the combination of some of the risk behaviors listed above will magnify the risk of adverse outcomes from cannabis use.

For example, early-onset use involving frequent use of high-potency cannabis is likely to disproportionately increase the risks of experiencing acute or chronic problems. Preventing these combined high-risk patterns of use should be avoided by the user and a policy focus.

*[Evidence Grade: Limited.]*

*Note.* A detailed rationale for each evidence grade is provided as a supplement to the online version of this article at <http://www.ajph.org>.

## Summary

The legalization of cannabis in Canada will no doubt be regarded as one of the most significant public health policy changes in the last 50 years. The decades of illicit cannabis consumption certainly provide us with epidemiological data that is hard to quantify due to its illegal status, however the impact of large-scale commercialization and the subsequent innovation in all aspects, from cultivation to processing and delivery methods, will have numerous unexpected consequences.

While the stated aim of recreational legalization was to protect youth from criminally cultivated product, the change in market demand generally towards products with higher THC content, and the increasing social prevalence of adolescent vaping, could very likely have unintended consequences to the short and long term health of youth who access cannabis illicitly. Pre-legalization epidemiological data is of little use in this regard, due to the difficulty of studying

illegal recreational use on a population basis, and the recent advent of widespread adoption of vaping over combustion use of cannabis.

Many cannabis use-associated harms—or at least their severity—are influenced by modifiable behavioral factors or user choices and it is important to educate adolescent patients on these topics. Given that a substantial proportion of both acute and chronic problems are appearing in younger users with high frequency vaping of higher THC products, this is critical, even if adolescent patients are reluctant to discuss illicit underage use. *Lower-Risk Cannabis Use Guidelines*, as discussed, are a worthwhile Public Health intervention strategy for cannabis use in this population in a naturopathic clinical setting

Additionally, there are vaping-related factors that also need to be discussed with adolescent patients who are using this delivery method. In particular, there is increasing evidence of acute and long-term lung injury related to the effects of cannabis additives that the patient may not even be aware of.

Vaping is one of the modes of consuming cannabis that can cross over between medical and recreational markets. Vaping can use dried flower or extracted oil products in cartridges (carts). Vaping has the advantage of rapid onset and shorter duration of effect than oral forms so it is considered in more acute situations such as pain, spasticity, nausea, anxiety and insomnia. In addition, vaping dried flower has several advantages as the plant material is not burned so many of the negative aspects of combustion are not a factor. It is important to differentiate vaping dried flower vs carts.

One of the major concerns with vaping has been the use of ingredients that may not be appropriate for their intended use. With dried flower there is concern over the use of pesticides in the illegal market that will be inhaled. In legal product, there is concern about mold. Vape cartridges have these issues as well as the use of emulsification agents that are not meant for use in inhaled products. Cannabinoids are highly lipophilic, and extraction and suspension can be complicated and can involve numerous solvents and additives. Vape cartridges are an example. The use of emulsification agents such as mineral oil and vitamin E acetate are examples of ‘work arounds’ where an ingredient is inappropriately used. In this case, delicate lung tissue is exposed to highly inflammatory substances, leading to a public health crisis.

Other issues beyond the LRCUG that NDs may wish to inquire about and discuss with patients include:

1. A discussion around the differences between legal and illegal products and how to distinguish between the two.
2. The type of product - Are they vaping dried flower or an extracted oil in a cartridge?
3. If not purchased from a licensed producer, where was it obtained, and how well do they know their supplier?
4. What was the variety or strain?
5. How was it manufactured and are there any additives?



It has been my experience that patients feel much more comfortable discussing cannabis with their naturopathic doctor than with their MD. Given that under 18 youth are still prohibited from using recreational cannabis in Canada, this is even more likely to be the case. This means that the profession can have an important role in Public Health and education around cannabis. It is important for NDs to apply their knowledge of general phytotherapy to educate and inform patients. Our profession understands phytotherapeutics and works daily with complex herbal formulations. NDs also understand the value of standardized herbal formulations and how to apply them holistically. In fact, many of the widely used herbal medicines appear to act through the endocannabinoid system. All these facts make us uniquely qualified to speak to the therapeutics that act via the endogenous endocannabinoid system and this includes recreational phytocannabinoids in vaping systems. 🍃

## About the Author

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**Disclosure of Potential Conflicts of Interest: Dr. Spooner reports personal fees from Heritage Cannabis Holdings, for his contracted work as Chief Scientific Officer.**

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