



## INVITED COMMENTARY

# Vaping and Mental Health

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### Abstract

“Vaping” refers to the inhalation of aerosols produced in devices that heat liquid solutions. The aerosols may contain various additives, flavours, nicotine and other drugs such as cannabis. Nicotine is the most common psychoactive substance in vaping devices (or e-cigarettes) in Canada. While vaping has been viewed primarily as a cessation method or harm reduction strategy for smokers of combustible tobacco cigarettes, a new pattern is becoming evident in adolescents and youth (age 15-24) in Canada. In this age group, vaping is reported in increasing frequencies among those who have never smoked. This suggests the possible emergence of a de novo pattern of substance use and suggests the emergence of an unmet treatment need, vaping cessation. The mental health implications of vaping are largely unknown but available data suggest that vaping is associated with mental health changes similar to those seen with combustible tobacco cigarettes. Understanding the mental health impact of “vaping” will be challenging and research is needed. An important message from the smoking literature is that data from randomized cessation trials may be especially valuable because of complex issues of temporality and confounding connected to observational data.

**Key Words:** *e-cigarettes, vaping, nicotine, smoking, mental health*

### Résumé

Le « vapotage » désigne l'inhalation d'aérosols produits dans des appareils qui réchauffent des solutions liquides. Les aérosols peuvent contenir divers additifs, saveurs, nicotine et d'autres drogues, le cannabis. La nicotine est la substance psychoactive la plus commune dans les appareils de vapotage (ou cigarettes électroniques) au Canada. Bien que le vapotage ait été vu principalement comme une méthode de cessation ou une stratégie de réduction des méfaits pour les fumeurs de cigarettes de tabac combustible, un nouveau modèle devient évident chez les adolescents et les jeunes (15-24 ans) au Canada. Dans ce groupe d'âge, le vapotage est déclaré en fréquence petite mais croissante chez ceux qui n'ont jamais fumé. Cela suggère une possible émergence d'un nouveau modèle d'utilisation de substance et suggère en outre l'émergence d'un nouveau besoin de traitement inédit, la cessation du vapotage. Les implications du vapotage pour la santé mentale sont largement inconnues mais les données disponibles suggèrent que le vapotage est associé aux changements de santé mentale semblables à ceux observés avec les cigarettes de tabac combustible. Comprendre l'effet du vapotage sur la santé mentale sera difficile et il faut de la recherche. La littérature sur le tabagisme nous livre l'important message que les données des essais randomisés sur la cessation peuvent être spécialement valables en raison des questions complexes de temporalité et de confusion liées aux données observationnelles.

**Mots clés:** *cigarettes électroniques, vapotage, nicotine, tabagisme, santé mentale*

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Submitted: August 31, 2020; Accepted: October 24, 2020

“Vaping” refers to the inhalation of aerosols produced by devices that heat liquid solutions. The aerosols may contain various additives, flavours, nicotine and other drugs such as cannabis. Nicotine is the psychoactive substance contained in almost all fluids vaped in Canada (Statistics Canada, 2020a) and is the focus of this commentary. Vaping devices are sometimes called “e-cigarettes” since early devices resembled cigarettes. Modern devices are manufactured in a variety of shapes and forms.

The most detailed data about vaping in community populations in Canada derives from the Canadian Tobacco and Nicotine Survey (CTNS), conducted in 2019 (Statistics Canada, 2020a). According to this survey, in the 15-24 year age range the frequency of past month e-cigarette use was 15%, compared to 3% in those over 25 (Statistics Canada, 2020a). This is a cohort effect: only 12% of the 25+ age group reported that they had ever tried vaping. Increasing e-cigarette use has been characterized by some authors as an “explosion” and an “outbreak” (Cao et al., 2020) and is linked to e-cigarette and vaping associated lung injury (known as EVALI), as well as additional health concerns. In Canada, the addition of nicotine to vaping solutions received regulatory approval for adults quite recently, in 2018, although a majority of vaping solutions available prior to this date contained nicotine (Statistics Canada, 2019).

Mental health concerns related to vaping (other than addiction) have been generally neglected. This is perhaps not surprising when one considers that strong evidence of adverse mental health effects of combustible tobacco smoking have also been neglected (Williams & Ziedonis, 2004). Smoking is one of the risk factors most consistently associated with poor mental health, e.g. (Colman et al., 2011; Goodman & Capitman, 2000; Jorm et al., 1999). Reasons for this tendency to underemphasize smoking as a potential determinant of mental health are unknown. Perhaps the mental health effects have been overshadowed by concerns about its physical effects. There may also be a tendency to view smoking as a self-medication strategy, a perspective that situates the behaviour as an epiphenomenon rather than as a core contributor to diminished mental health. These perceptions may be augmented by perceptions held by smokers themselves. Smokers tend to view smoking as way of improving dysphoric symptoms, without recognizing that this improvement may actually be due to treatment of nicotine withdrawal (Williams & Ziedonis, 2004). There is now compelling evidence, summarized in a systematic review by Taylor et al. that smoking cessation leads to better, not worse, mental health (Taylor et al., 2014). Consistent with this, evidence of improvement is also seen after smoking cessation in observational data collected from population representative samples (Patten et al., 2017). Notably, the

effect sizes identified for smoking cessation in the systematic review by Taylor et al. resembled those typically seen for psychiatric treatments (Taylor et al., 2014).

The epidemiology of vaping differs by age. Vaping is most common among young people, by a large margin, as noted above. The frequency is highest in the 15 to 24 age range, with no difference within this group between those aged 15-19 and those aged 20-24 (Statistics Canada, 2020b). Of those aged 15-24 who report vaping, 58.4% are male (95% CI 52.7 – 64.0). Only 19.0% (95% CI: 12.4-25.6) of 15-24 year olds who vape identify themselves as members of a visible minority group (compared to 34.3% of those who do not) and only 11.8% (95% CI: 6.3-17.3) report that they are immigrants (compared to about 20% in the Canadian population). A similar pattern is seen for 15 to 24 year old smokers of combustible tobacco cigarettes. According to the CTNS survey, 9.2% (95% CI: 8.3-10.1) of Canadians aged 15 to 24 live in economically deprived households with a total income of less than \$20,000. Among those who vape, the proportion is nearly identical, whereas combustible tobacco smokers are more likely to report being in this low income stratum (13.5%, 95% CI: 11.0-16.03) (Statistics Canada, 2020b). While dual use is common, a sizable proportion of e-cigarette use now occurs among 15 – 24 year olds who have never smoked, an apparent *de novo* pattern of substance use. According to the CTNS (Statistics Canada, 2020a), 61.0% (95% CI: 55.4-66.7) of e-cigarette users in this age range reported that they had never smoked. In the 25+ age group, only 14.3% of e-cigarette users report this, the remainder being former or current smokers (Patten et al., 2020).

It is possible that much of the negative impact of combustible tobacco smoking on mental health may be due to the systemic inflammation associated with smoking, or due to associated cardiovascular or lung disease. If one assumes that vaping causes less inflammation, one may be willing to assume that the mental health difficulties associated with smoking will not occur with vaping. However, vaping does cause inflammatory changes (Lerner et al., 2015; Wu, Jiang, Minor, & Chu, 2014). Vaping also leads to exposure to nicotine and may amount to adoption of a passive and emotion-focused coping strategy, as does smoking. An important concern is that some vaping devices may deliver higher concentrations of nicotine than do combustible tobacco cigarettes, with unknown effects on the developing brain. Accumulating evidence suggests similar associations of vaping and smoking with indicators of negative mental health. Mood and anxiety disorders, suicidal ideation, depressive symptoms and negatively perceived mental health are all associated with e-cigarette use (Pham et al., 2020). These associations are likely bidirectional, and e-cigarette

use in response to psychiatric symptoms may account for a component of the cross-sectional associations reported. Retrospective epidemiologic data, however, suggest that smoking cessation followed by continued vaping may not have the same mental health benefits as smoking cessation that is not followed by continued vaping (Dahal, Adhikari, & Patten, 2020).

Of course, drawing strong causal conclusions from an observational literature is problematic since the association of nicotine-containing products with poor mental health is likely to occur through a complex series of temporal patterns including bidirectional etiology, effects of poor mental health on initiation and persistence of nicotine use, and *vice versa*. Due to the complexity of underlying causal mechanisms, detailed longitudinal follow-up and advanced statistical methods such as structural equation modeling may prove useful, as they have in the smoking literature, e.g. (Pahl, Brook, Koppel, & Lee, 2011).

Future trials of e-cigarette cessation seem inevitable given the rapid emergence of vaping as a means of nicotine delivery, it will be critically important that these randomized trials monitor mental health post-cessation in order to clarify the effects of such interventions on psychiatric symptoms. A valid hypothesis is that cessation of vaping will lead to improved mental health.

It is essential that mental health clinicians and researchers not be “asleep at the wheel” as vaping increases in frequency. Nor should their concerns be limited to EVALI. While one may hope that vaping will not be as harmful to mental health as smoking, available data does not support this. Also, the potentially beneficial harm reduction properties of vaping for nicotine dependent smokers should not be forgotten. Historically, the slow emergence of awareness of smoking as a strong determinant of mental health should motivate additional caution and a greater research focus on the mental health effects of vaping, especially among adolescents and young adults.

## Acknowledgements

Dr. Patten is supported by the Cuthbertson & Fischer Chair in Pediatric Mental Health at the University of Calgary.

## Conflicts of Interest

Dr. Patten has no conflicts to declare.

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