Sex, Gender & Vaping

In the context of ongoing investigations and debates regarding the benefits and harms of vaping, researchers at the Centre of Excellence for Women's Health have examined the existing sex and gender related factors affecting patterns of use, exposure and health effects of cannabis vaping and electronic nicotine delivery systems (ENDS).

However, long term effects of vaping and ENDS are still unknown, and much more research on sex, gender and nicotine and cannabis vaping is necessary to understand and mitigate specific risks for men, women, boys, girls and gender diverse individuals.

Cannabis vaping and harm reduction

Vaping cannabis has been promoted as a safer alternative to smoking cannabis.

- The Lower Risk Cannabis Use Guidelines for Canada and Lower Risk Cannabis Use for Youth Guidelines suggest *avoiding combustible cannabis*. Instead, they recommend choosing vaping and edibles, based on a 2017 review that identified harmful byproducts in smoked cannabis and adverse respiratory health outcomes associated with smoking [1].
- However, the form of cannabis used, as well as the route of administration (ROA) matters. Vapourizing cannabis flower (dried herb) is recommended, but vapourizing cannabis concentrates and dabbing have greater harms, including enhanced impairment and potential for injuries [1].

More recently, evidence has emerged of harms associated with vaping cannabis, particularly for youth, such as:

- Reports of e-cigarette or vaping associated lung injury (EVALI). EVALI has primarily affected young males (66%) in the USA [4].
- Case reports described patients presenting with lipoid pneumonia, acute respiratory distress syndrome and pulmonary hemorrhage [5].

The type of vaping device matters

Cannabis vaping devices, their byproducts and health effects may vary depending on the carrier compounds, flavourings, product materials and heating capacity [2, 3].

- Some devices use cartridges that contain cannabinoid extracts combined with propylene glycol, vegetable glycerin and flavours [6].
- There are portable, disposable vape pens as well as rechargeable devices that use dried flower or THC or CBD extracts [6]. Some devices use conduction heat, and others convection heat.
- Stationary vapourizers have tubing or bags/ balloons attached to deliver the vapour.
- Dabbing is a method of aerosolizing cannabis concentrates by placing them on a hot surface.

The long term health effects of cannabis vaping on human health are unknown [1].

What are electronic nicotine delivery systems (ENDS)?

- ENDS contain nicotine dissolved in a liquid solution, often including vegetable glycerin, propylene glycol and flavourings, that is heated to create an aerosol (vapour) that the user inhales.
- There are disposable and rechargeable devices, some that resemble cigarettes or pens, and larger tank systems or MODS (Mechanical Modified Nicotine Delivery Systems) [6, 7].
- The latest device is the pod mod, such as Juul, that contains nicotine salt e-liquid in disposable pods.
- Other non-combusted tobacco products are available, including heat-not burn products that heat dried tobacco to create an aerosol that is inhaled.

What is the harm reduction potential of ENDS?

ENDS are being investigated for their harm reduction potential or as tools in tobacco smoking cessation as they produce fewer toxicants and known carcinogens compared to cigarettes [8-10]. But, there is increasing evidence of harms for youth including:

- Frequency and misuse among youth [2, 9]; and dual use of ENDS and cigarette smoking [11-13] leading to a greater risk of misuse and addiction [2].
- Among youth and young adults, the risk of addiction associated with ENDS use is a key public health issue [14]. Among ENDS users, young adults who only use ENDS reported the lowest intention to quit using nicotine products [15].
- The byproducts and health effects of ENDS may vary depending on the carrier compounds, flavourings, product materials and heating capacity [2].
- There is no long term research on nicotine vaping [16], but emerging evidence suggests vaping related pulmonary illness [14] and adverse effects of ENDS on lung cellular function, organ physiology, cardiovascular and respiratory health and immune function [16-18].

What do we know about sex, gender and cannabis vaping?

Sex related effects of cannabis vaping:

- There is a lack of evidence from human studies on the sex related effects of cannabis vaping.
- Female rats are more sensitive to the hypothermic effects (reduced body temperature) of vaporized THC at lower doses [19] compared to male rats.
- Rats of both sexes become tolerant to the hypothermic and antinociceptive (reduced reaction to potentially painful stimuli) effects after repeated daily THC vapor inhalation [20].
- Plasma THC levels reached after a 30 minute session of vapour inhalation session did not differ between male and female rats [20].

Gender, equity and prevalence and patterns of cannabis vaping:

- More boys and young men report vaping cannabis [12, 21] and using cannabis concentrates [22, 23] compared to girls and young women.
- Based on a large US national sample, cannabis vapers were more likely to be young, male, White and to have initiated cannabis use at an earlier age [12].
- Studies of high school students in the US report greater use of e-cigarette devices to vaporize cannabis among boys [24], or no difference between girls and boys [25].
- In a sample of college students, men and individuals from higher socioeconomic status (SES) families were more likely to report vaping cannabis, while women and individuals from low SES families reported lower rates of vaping [26].
- Vaping devices are designed to target specific user groups, including girls and young women; marketing rebrands cannabis users as “stylish and fashionable” [27].

What do we know about sex, gender and electronic nicotine delivery systems (ENDS)?

Sex related effects of ENDS:

- In mice, e-cigarettes promoted mitochondrial depolarization in primary brain vascular endothelial cells (which may affect cerebrovascular tone) but no sex differences were observed [28].
- Following aerosol nicotine exposure there were no sex differences in brain nicotine concentrations in mice [29].
- In a human study, females who were taking oral contraceptives demonstrated more negative changes in vitamin E levels and flow-mediated dilation (widening of artery with increased blood flow in the artery) compared to males after e-cigarette use [30].

Gender, equity and prevalence and patterns of ENDS:

- Across multiple studies, boys have reported greater prevalence of use of ENDS and poly-tobacco product use [31-43].
- In a Canadian study, past 30 day use of e-cigarettes was associated with initiation of smoking a whole tobacco cigarette, with slightly higher rates in males (9.5%) than females (7.4%) at follow up [44].
- In a sample of US youth who had tried e-cigarettes, males were more likely to report liking the flavours and taste and perceiving them as less harmful for self and others compared to cigarettes, and liking the ability to use in locations where smoking is prohibited [45].
- Girls who reported cannabis use [3] and perceived stress [46] were more likely to report e-cigarette use.
- A study on the ENDS devices used by high school youth found that those who used vape or hookah pens and multiple devices were more likely to be female [47].
- Among a sample of young adults ages 18–34, females preferred non tobacco and non-menthol flavours of e-cigarettes [48].
- Prevalence of ENDS use is higher for sexual minorities [49-51] and gender minorities [52, 53].

What next?

More research is urgently needed on the sex-specific health effects of both cannabis and nicotine vaping. Policy and public health approaches to cannabis vaping and ENDS use need to consider how sex-based factors affect health and how decisions, regulations and messaging impact different gender groups.

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