



Exploring Consumer Preferences for Cannabis Vaping Products to Support Public Health Policy: A Discrete Choice Experiment

Jennifer R. Donnan¹ · Karissa Johnston¹ · Michael Coombs¹ · Maisam Najafizada² · Lisa D. Bishop¹

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Abstract

Background Phase two of cannabis legalisation in Canada brought cannabis vaping products to the market. This decision was controversial due to an outbreak of vaping cannabis use-associated lung injury. This resulted in three provinces banning the sale of cannabis vaping products causing inequitable access. This study sought to explore consumer preferences for cannabis vaping products to inform cannabis policy.

Methods We used a discrete choice experiment to explore consumer preferences for attributes of cannabis vaping products. Attributes included type of device, price, tetrahydrocannabinol (THC) potency, vape liquid content, product recommendations and Health Canada regulation. Participants lived in Canada, were aged ≥ 19 years, and had purchased a cannabis vape in the last 12 months. A multinomial logit (MNL) model was used for the base model, and latent class analysis to assess preference sub-groups.

Results In total, 384 participants completed the survey; the MNL model showed that price and potency were the most important attributes. A three-group latent class model showed that $\sim 40\%$ of the sample was driven primarily by Health Canada Regulation and were willing to pay \$56 more for a product that was regulated compared to one that was not. About 33% of the sample was driven by price, and 26% was driven by type of device.

Conclusion While regulated status by Health Canada was most important to some consumers ($\sim 40\%$), nearly 60% of the sample were willing to make trade-offs in regulated status for products with a lower price. Therefore, policymakers need to consider the broader public health implications of banning cannabis vapes in some regions.

Key Points for Decision Makers

While about 40% of consumers are willing to pay more for vaping products knowing they come from a regulated source, the remaining 60% (who are also the more frequent consumers), will trade-off the regulated status for products at a lower price, and/or those with a higher THC content.

To encourage more consumers to purchase cannabis vapes from regulated sources and reduce overall public health risks, policymakers need to consider the regulations that may be preventing this transition. In particular regulations that (1) restrict access and (2) limit package THC content.

✉ Jennifer R. Donnan
Jennifer.donnan@mun.ca

Karissa Johnston
kjohnston@broadstreetheor.com

Michael Coombs
mdcoombs@mun.ca

Maisam Najafizada
maisam.najafizada@mun.med.ca

Lisa D. Bishop
ldbishop@mun.ca

¹ School of Pharmacy, Memorial University of Newfoundland, NL, St. John's, Canada

² Faculty of Medicine, Memorial University of Newfoundland, St. John's, NL, Canada

1 Introduction

Phase two of cannabis legalisation in Canada, in October 2019, brought cannabis vaping and other alternative cannabis products like edibles and topicals to the market [1]. Smoking dried flower remains the most common method of consumption in Canada; however, the use of edibles and topicals is expanding. National survey data demonstrated that individuals vaporising with vape pen or e-cigarette jumped from 24% in 2020 to 28% in 2021 [2].

While the variety and availability of dried flower available on the licensed market closely mirrors that of the unlicensed market, the same cannot be said for vape pens and cartridges. Health Canada approved cannabis vaping products for sale; however, some provinces, including Quebec (QC), Prince Edward Island (PE) and, until recently, Newfoundland and Labrador (NL), do not allow the sale of vaping products in provincially licensed stores. Vaping products are only available to residents of these provinces through licensed medical producers using medical authorisation, which creates inequitable access across the country. These decisions were due to the emergence of a condition known as E-cigarette or vaping-associated lung injury (EVALI) that was identified in the summer of 2019 [3]. It is an acute respiratory illness that can lead to hospitalisation or death. In the months leading up to the legalisation of vaping products in Canada, it was still unknown what was causing this condition.

Between June 2019 and February 2020, there were more than 2800 hospitalisations and 68 fatalities from EVALI in the USA; however, cases of EVALI appeared to drop off after this time period [4]. Cases were seen in other countries [5–7], and as of 2020, 20 cases were identified in Canada including 16 hospitalisations [8]. Mounting evidence has shown a strong linkage between vitamin E acetate and EVALI, which is commonly found in illegal and unregulated tetrahydrocannabinol (THC)-containing vaping products [8]. As a result, vitamin E additives have been banned from cannabis vape cartridges and pens in Canada [1] and many US states as recommended by the US Centre for Disease Control [9]. However, only vaping products that are sold through licensed markets are regulated and tested to ensure they are meeting these standards. It is possible that vapes sold through unlicensed channels may still use Vitamin E as a thickening agent or to dilute THC content.

Despite the limited access in some areas of the country, there still is demand for vape pens and cartridges. Public health policy makers should consider the fact that even with restricted sales through licensed channels, consumers can still access these products. Understanding the purchase decision-making process can help refine policies that meet

both the preferences of consumers and protect public health. Choice modelling studies help to break down the factors that contribute to decision making. For example, discrete choice experiments (DCE) are used as a means to measure the strength of consumer preferences for the various attributes that contribute to decisions via a survey-based approach. This method is grounded in the multi-attribute utility theory [10]. Participants are asked to make a choice between two hypothetical alternatives, each described by a set of attributes. After repeated choice tasks where the attribute descriptions are altered, the relative importance of each attribute can be quantified.

Knowledge of the trade-offs that consumers make for cannabis products is key to creating and modifying policies that encourage the uptake of regulated products, especially in this new and evolving legalised market. The purpose of this study was to quantify consumer preferences for attributes of cannabis vaping products and measure the trade-offs consumers make between attributes.

2 Methods

2.1 Study Design

We used a survey that included four unique DCE questions to solicit preferences from cannabis consumers across Canada in October 2021. These include product profiles for dried flower cannabis, edible cannabis and cannabis vapes, and one question that profiles retailer characteristics. Details here pertain to the DCE question that focused on preferences for attributes of cannabis vaping products. A full detailed protocol can be found in a Supplementary Appendix 1. This study is part of a series of studies that explored consumer preferences for different types of cannabis products and cannabis retail stores. Earlier work by our team includes a systematic review to identify attributes of importance for cannabis consumers [11] and focus groups and interviews with cannabis consumers [12]. Results from the systematic review, focus groups and interviews were used to prioritise a list of attributes and levels relevant to consumers and policymakers. These included the type of device; price; amount of THC; flavour; product recommendations; and if the product was regulated by Health Canada. The type of device relates to the packaging, as vape liquids are available as disposable pens or cartridges that can be used with reusable pens or vaporisers. Levels for price and concentration of THC were selected based on available options on both the licensed and unlicensed market. Compared to those who purchase dried flower, vape consumers tend to focus more on the flavour profile as vape products come in a variety of options that either profile or mask the traditional cannabis smell. Participants

in our preliminary qualitative work indicated that they rely on recommendations from a variety of sources, including retailer, family/friend, and online reviews. A complete list of attributes and levels used can be found in Table 1.

Each participant was randomised to one of 300 versions of the survey. The DCE question was prefaced by a description of a scenario to help frame the choice which the consumer was asked to make. The scenario read “You are purchasing a 0.5 g cannabis vape product with THC of your preferred variety (sativa, indica, hybrid). Which of the following products would you choose? While some options may not seem possible, assume both options are available as presented”

The DCE choice task included two unlabelled alternatives, where alternative were presented as “Option A” and “Option B”, and not with a description that held meaning (e.g., legal, illegal, etc.) [13]. A sample choice task is presented in the Supplemental Appendix. A fractional factorial design was used and a total of eight choice tasks were presented to each participant, which allowed for a standard error below the threshold of 0.05 of the main effect in the design test. Additional questions including sociodemographic (e.g., age, province, sex, gender), cannabis consumption and purchasing history were also collected.

Participants were eligible to complete the survey if they lived in Canada, were aged ≥ 19 years and reported having purchased cannabis within the last 12 months. Among those eligible for the survey, participants were asked to complete the cannabis vape DCE if they had purchased a vape product in the last 12 months. An online research company (Angus Reid) used email solicitation to recruit a sample from their proprietary panel. The sample of cannabis consumers was

chosen over a representative sample of the general public, since approximately 75% of the Canadian population does not consume cannabis, and inclusion of non-consumers would reduce the ability to understand choice patterns of the current market. Given their lack of experience, it is also likely that the general population would not fully understand the attributes described, and we suspect that if the general population did display preferences, they would be more likely to prefer regulated products. Data from respondents who were eligible for the vape product DCE and had completed the full survey were included in the analysis.

2.2 Analysis

Sawtooth Software (Lighthouse Studio) was used for the analysis of DCE data. Counts analysis was used to explore attribute dominance, significance of the impact on choice, and to explore two-way attribute interactions for all attribute combinations. Two regression models, including a multinomial logit (MNL) model and a latent class model were used to quantify preference weights.

The MNL model was used for the base analysis. This model calculated average preferences across the full sample. Effects coding was used for each attribute except for price where continuous coding was used to allow for interpretable willingness to pay (WTP) values. Using the least desirable level from each attribute as a reference, odds ratios (ORs) were calculated. Willingness to pay was calculated by estimating the marginal rate of substitution (MRS) by taking the ratio of two coefficients, with the linear cost estimate used for the comparison attribute.

Table 1 Attributes and levels cannabis vaping products

| Attribute | Levels |
|----------------------------|--|
| Type of device | Pre-filled cartridge Disposable pen |
| Price (CAD) | \$30, \$40, \$50, \$60 |
| Amount of THC | 70% 80% 90% |
| Contents | Full spectrum with cannabis taste and terpenes Distillate with no cannabis taste or terpenes Distillate with non-cannabis flavours (e.g., fruit) |
| Product recommendation | Recommended by person selling Recommended by family or friend Recommended in online reviews Self-selected without input from others |
| Regulated by Health Canada | Yes No Unknown |

CAD Canadian dollar, THC tetrahydrocannabinol

The latent class model was used to explore preference patterns within sub-groups of the sample. The number of segments with the best fit was determined by selecting the solution with the lowest CAIC (Consistent Akaike Information Criterion) and BIC (Bayesian Information Criterion) values [14, 15]. Segment membership probabilities estimated by Sawtooth Software were used to explore differences in participant characteristics between the groups. Specifically, we were interested to see if key demographic characteristics (i.e., age, sex, income, or province [due to different provincial regulations]) as well as cannabis use behaviours (i.e. purchase frequency, consumption amount and frequency, reason for use, length of use) influenced preference patterns. Chi-squared tests were used to assess significant differences.

2.3 Ethical Considerations

This study was carried out in accordance with the Tri-Council Policy Statement and approval by the Memorial University Interdisciplinary Committee on Ethics in Human Research (File #20210143).

3 Results

A total of 1626 individuals were eligible to participate. The survey consisted of demographic, cannabis use questions and four unique DCE questions. Not all participants were eligible for each question. The findings here represent the sample of 385 participants who completed the DCE focused on cannabis vape product purchase decisions. Approximately half of the sample identified as men, and about one-third were aged between 30 and 39 years. The vast majority (87.2%) had at least some post-secondary education (Tables 2, 3).

The counts analysis demonstrated that no attribute level dominated choices, with level selection ranging from 37.0 to 64.7%. No significant between-attribute interactions were found. The MNL model showed that all attributes significantly influenced choice, with the exception of product recommendations ($p < 0.05$ for within attribute chi-squared test). The MNL model showed that price was the most important consideration in purchase decisions, followed by THC potency and Health Canada regulation. Product recommendations was the least relevant attribute (Table 4). The odds of selecting a profile that consisted of pre-filled cartridge with 90% THC, and full spectrum cannabis flavour that was from a regulated source were 2.39 times greater compared to the same product from an unlicensed source (Supplementary Appendix).

The three-group latent class model demonstrated the best fit (Table 5). Group 1, representing 40% of the sample, was

Table 2 Sample characteristics

| Characteristic | Number (%) <i>N</i> = 385 |
|---|------------------------------|
| Sex | |
| Female | 167 (43.4) |
| Male | 217 (56.4) |
| Prefer not to say | 1 (0.3) |
| Gender | |
| Woman | 165 (42.9) |
| Man | 211 (54.8) |
| Other | 8 (2.0) |
| Prefer not to say | 1 (0.3) |
| Age | |
| 19–29 | 97 (25.2) |
| 30–39 | 139 (36.1) |
| 40–49 | 65 (16.9) |
| 50–59 | 44 (11.4) |
| ≥ 60 | 40 (10.4) |
| Race | |
| Black | 6 (1.6) |
| East/Southeast Asian | 13 (3.4) |
| Latino | 4 (1.0) |
| Middle | 3 (0.8) |
| South Asian | 11 (2.9) |
| White | 344 (89.4) |
| Other (please specify) | 26 (6.8) |
| Province | |
| British Columbia | 56 (14.5) |
| Alberta | 68 (17.7) |
| Saskatchewan | 51 (13.2) |
| Manitoba | 39 (10.1) |
| Ontario | 57 (14.8) |
| Quebec | 21 (5.5) |
| New Brunswick | 25 (6.5) |
| Nova Scotia | 39 (10.1) |
| Prince Edward Island | 3 (0.8) |
| Newfoundland and Labrador | 23 (6.0) |
| Territories | 3 (0.8) |
| Education | |
| Did not complete high school | 9 (2.3) |
| High school diploma | 40 (10.4) |
| Some post-secondary school | 59 (15.3) |
| College/trade/technical/vocational training completed | 134 (34.8) |
| Undergraduate degree | 104 (27.0) |
| Graduate degree | 39 (10.1) |
| Employment | |
| Full-time student | 37 (9.6) |
| Part-time student | 7 (1.8) |
| Unemployed, but seeking employment | 13 (3.4) |
| Unemployed by choice | 7 (1.8) |
| Unemployed due to disability | 13 (3.4) |
| Employed part-time | 28 (7.3) |

Table 2 (continued)

| Characteristic | Number (%) N = 385 |
|------------------------|-----------------------|
| Employed full-time | 228 (59.2) |
| Self employed | 28 (7.3) |
| Retired | 35 (9.1) |
| Other (please specify) | 16 (4.2) |
| Income (CAD) | |
| < \$25,000 | 28 (7.3) |
| \$25,000–\$49,999 | 61 (15.8) |
| \$50,000–\$74,000 | 66 (17.1) |
| \$75,000–\$99,999 | 68 (17.7) |
| \$100,000 or more | 137 (35.6) |
| Prefer not to say | 25 (6.5) |

CAD Canadian dollar

Table 3 Sample cannabis use characteristics

| Characteristic | Number (%) N = 385 |
|--|-----------------------|
| Frequency of cannabis purchase in last 12 months | |
| < 1 per month | 106 (27.5) |
| 1–2 times per month | 164 (46.2) |
| 3 or more times per month | 115 (29.9) |
| Cannabis consumption frequency | |
| Less than once per month | 32 (8.3) |
| At least once per month, less than once per week | 38 (9.9) |
| At least once per week | 85 (22.1) |
| Once per day | 86 (22.3) |
| Multiple times per day | 140 (36.4) |
| Prefer not to answer | 4 (1.0) |
| Reason for cannabis use | |
| Medical (self-prescribed) | 26 (6.8) |
| Medical (authorised) | 21 (5.5) |
| Non-medical | 122 (31.7) |
| Both medical and non-medical | 210 (54.5) |
| Other | 6 (1.6) |
| Initiation of cannabis use | |
| Since legalisation | 47 (12.2) |
| Used in the past then started again since legalisation | 95 (24.7) |
| Regular user prior to legalisation | 243 (63.1) |
| Cannabis purchase location | |
| Licensed in-person store | 327 (84.9) |
| Licensed online store | 174 (45.2) |
| Licensed medical dispensary | 54 (14.0) |
| Unlicensed in-person store | 66 (17.1) |
| Unlicensed online stores | 113 (29.4) |
| Unlicensed connection in the community | 106 (27.5) |
| Other | 12 (3.1) |

driven primarily by Health Canada Regulation, followed by price and type of device (preference for disposable pens). This group were willing to pay \$56 more, with an odds ratio (OR) of 2.59, for a regulated product compared to a non-regulated one. Group 2, representing 33% of the sample, was driven by price, followed by potency and contents (preferred a full spectrum cannabis flavour). They were willing to pay \$20 more, with an OR of 9.49, for a product with 90% THC compared to 70% THC. Finally, Group 3, representing 26% of the sample, was driven by type of device (prefer pre-filled cartridges), followed by potency and price. They had an OR of 8.25 for selecting a pre-filled cartridge over a disposable pen, and an OR of 2.97 for selecting a product with 90% THC over 70% THC (Table 6). Probability for membership in each of the three groups is mapped in a Ternary plot (Fig. 1).

The distribution of group membership demonstrated that individuals who purchased and consumed cannabis vapes more frequently (p values 0.005 and < 0.001, respectively), and who consumed greater quantities (p value 0.003) were significantly more likely to be in Group 2, followed by Group 3. Age, sex, province or income were not significant predictors of group membership (Table 7). Bar plots of group membership analysis included in the Supplementary Appendix 2.

4 Discussion

This study demonstrated that price and THC potency were the most important considerations for cannabis vape consumers. However, some Canadians placed a high level of importance on purchasing cannabis vaping liquids from regulated sources. This study was the first DCE to explore consumer preferences for cannabis vape liquids, and the first study to explore purchasing behaviours of cannabis vaping products specifically.

Unsurprisingly, for about 40% of our sample, decisions were driven primarily by regulated status. In light of the outbreak of ELAVI in late 2019 in the USA, consideration for product safety was at the forefront for many consumers. With the vast majority of cases resulting from use of unregulated products, choosing regulated products is an obvious safer choice. The same cannot be said for other cannabis product types like flower and edibles, where safety concerns from unregulated sources have not been as widely publicised in the media. While it would appear that the regulated market is meeting the preferences of this consumer segment, access is still banned in two Canadian provinces (QC, PE). Consumers living in these regions would need medical authorisation to obtain a regulated vape product. Despite this difference in access across the country, province of residence for the

Table 4 Multinomial logit model for cannabis vaping products

| | Level | Part-worth utility (95% CI) | OR (95% CI) | WTP (CAD, 95% CI) |
|----------------------------|----------------------|-----------------------------|-------------------|----------------------------|
| Price | Price | - 0.34 (- 0.39, - 0.30) | N/A | N/A |
| Type of device | Pre-filled cartridge | 0.16 (0.12, 0.20) | 1.38 (1.34, 1.42) | - 9.41 (- 9.45, - 9.37) |
| | Disposable pen | - 0.16 (- 0.20, - 0.12) | Ref | Ref |
| Amount of THC | 70% | - 0.31 (- 0.38, - 0.24) | Ref | Ref |
| | 80% | 0.02 (- 0.05, 0.09) | 1.39 (1.32, 1.46) | - 9.71 (- 9.77, - 9.64) |
| | 90% | 0.29 (0.22, 0.36) | 1.82 (1.75, 1.89) | - 17.65 (- 17.71, - 17.58) |
| Contents | Full spectrum | 0.12 (0.05, 0.19) | 1.23 (1.17, 1.30) | - 6.18 (- 6.24, - 6.11) |
| | No cannabis taste | - 0.04 (- 0.11, 0.03) | 1.05 (0.98, 1.12) | - 1.47 (- 1.54, - 1.40) |
| | Non-cannabis flavour | - 0.09 (- 0.16, - 0.02) | Ref | Ref |
| Product recommendations | Seller | - 0.07 (- 0.16, 0.02) | 1.00 (0.91, 1.09) | 0.00 (- 0.09, 0.09) |
| | Family/friend | 0.08 (- 0.01, 0.17) | 1.16 (1.08, 1.25) | - 4.41 (- 4.50, - 4.33) |
| | Online | 0.06 (- 0.03, 0.15) | 1.14 (1.05, 1.22) | - 3.82 (- 3.91, - 3.74) |
| | None | - 0.07 (- 0.16, 0.02) | Ref | Ref |
| Regulated by Health Canada | Yes | 0.25 (0.18, 0.32) | 1.57 (1.50, 1.63) | - 13.24 (- 13.30, - 13.17) |
| | No | - 0.20 (- 0.27, - 0.13) | Ref | Ref |
| | Unknown | - 0.05 (- 0.12, 0.02) | 1.16 (1.10, 1.23) | - 4.41 (- 4.48, - 4.35) |

CAD Canadian dollar, CI confidence interval, OR odds ratio, THC tetrahydrocannabinol, WTP willingness to pay

Table 5 Latent class model fit statistics

| Groups | CAIC | BIC |
|--------|---------|---------|
| 2 | 3975.24 | 3952.24 |
| 3 | 3966.98 | 3931.98 |
| 4 | 3990.85 | 3943.85 |
| 5 | 4038.73 | 3979.73 |

BIC Bayesian Information Criterion, *CAIC* Consistent Akaike Information Criterion

participant was not a significant predictor of group membership in the latent class model for this current study.

The 40% of participants whose decisions were driven primarily by regulated market status represent a smaller proportion of purchases. Group membership revealed that this group makes purchases less frequently and consumes less frequently in smaller quantities. This same group also had a higher preference towards disposable vape pens over cartridges, and market data have shown that in Canada

Table 6 Latent class model for cannabis vaping products

| | Segment Sizes | Part-Worth Utility | OR | WTP (CAD) | Part-Worth Utility | OR | WTP (CAD) | Part-Worth Utility | OR | WTP (CAD) |
|----------------------------|----------------------|--------------------|------|-----------|--------------------|------|-----------|--------------------|------|-----------|
| | | Group 1 - 40.3% | | | Group 2 - 33.2% | | | Group 3 - 26.4% | | |
| Price | Price | -0.17 | N/A | N/A | -1.13 | N/A | N/A | -0.18 | N/A | N/A |
| Type of Device | Pre-filled cartridge | -0.16 | 0.73 | 18.70 | 0.04 | 1.08 | -0.68 | 1.06 | 8.25 | -114.68 |
| | Disposable pen | 0.16 | Ref | Ref | -0.04 | Ref | Ref | -1.06 | Ref | Ref |
| Amount of THC | 70% | -0.03 | Ref | Ref | -1.15 | Ref | Ref | -0.46 | Ref | Ref |
| | 80% | 0.08 | 1.12 | -6.49 | 0.05 | 3.33 | -10.60 | -0.18 | 1.32 | -15.29 |
| | 90% | -0.05 | 0.99 | 0.79 | 1.10 | 9.49 | -19.85 | 0.63 | 2.97 | -59.21 |
| Contents | Full Spectrum | 0.17 | 1.31 | -16.03 | 0.49 | 2.12 | -6.62 | -0.34 | 0.60 | 27.51 |
| | No Cannabis Taste | -0.07 | 1.03 | -1.91 | -0.23 | 1.03 | -0.25 | 0.17 | 1.00 | 0.08 |
| | Non-Cannabis Flavor | -0.10 | Ref | Ref | -0.26 | Ref | Ref | 0.17 | Ref | Ref |
| Product Recommendations | Seller | -0.15 | 0.97 | 1.83 | -0.03 | 0.98 | 0.16 | 0.07 | 1.49 | -21.61 |
| | Family/Friend | 0.15 | 1.31 | -15.98 | 0.13 | 1.15 | -1.26 | 0.17 | 1.65 | -27.23 |
| | Online | 0.13 | 1.29 | -15.08 | -0.10 | 0.91 | 4.91 | 0.10 | 1.54 | -23.45 |
| | None | -0.12 | Ref | Ref | -0.01 | Ref | Ref | -0.33 | Ref | Ref |
| Regulated by Health Canada | Yes | 0.55 | 2.59 | -56.44 | 0.12 | 1.38 | -2.84 | 0.01 | 1.18 | -8.82 |
| | No | -0.40 | Ref | Ref | -0.20 | Ref | Ref | -0.16 | Ref | Ref |
| | Unknown | -0.15 | 1.29 | -15.07 | 0.08 | 1.32 | -2.44 | 0.15 | 1.36 | -16.78 |

CAD Canadian dollar, THC tetrahydrocannabinol, WTP willingness to pay

Fig. 1 Ternary plot. This ternary plot depicts individual survey participants on a three-dimensional plane, represented in a triangle on a scale of 0–100%. The colour of the point represents the groups in which the participant is mostly likely to belong, with participants at points further from the vertex demonstrating a combination of behaviours of each of the groups

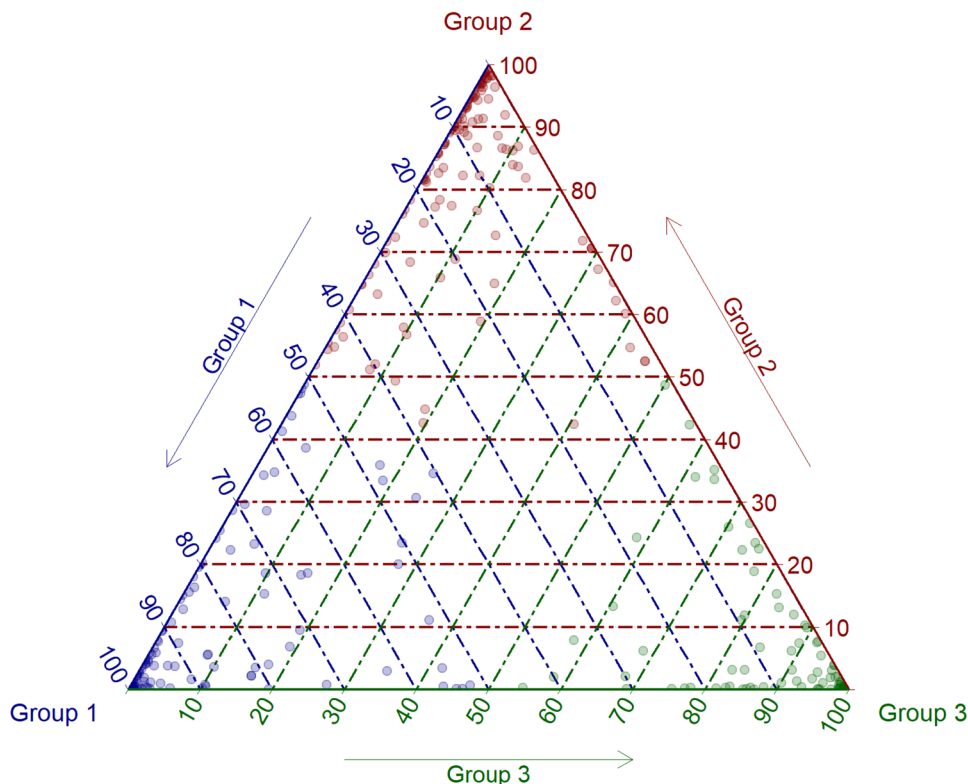


Table 7 Latent class significance of group membership by participant characteristic

| Factor | Chi-squared | p value |
|------------------------------------|-------------|---------|
| Age | 5.87 | 0.662 |
| Sex | 3.06 | 0.549 |
| Province | 26.70 | 0.223 |
| Income | 11.39 | 0.328 |
| Cannabis use in the past 12 months | 14.81 | 0.005 |
| Frequency of cannabis use | 32.30 | 0.000 |
| Amount of cannabis use | 19.48 | 0.003 |
| Purpose of cannabis use | 8.96 | 0.345 |
| Use of cannabis pre-legalisation | 9.26 | 0.055 |

disposable pens make up only 5% of the vape product market [16]. This means that the remaining 60% of our sample represent preferences for a population that make up a much greater proportion of vape purchases. This 60% placed a much lower level of importance on regulated status and expressed willing to make trade-offs to get their products for a lower price and/or higher THC content.

Policy makers need to consider the potential effects of banning access to vape products. According to a Headset report, vape products have the third largest market share in Canada at 17.4%, behind dried flower and pre-rolls [16]. With most of the market not generally concerned with regulated status, restricting sales does little to limit exposure

to cannabis vapes and the potential risks they possess. Rather, it is forcing consumers to purchase potentially unsafe products from unregulated sources.

While the risk of EVALI prompted consumers and policy makers to think about vape safety, it is not the only potential health risk to be considered. Some flavouring agents used to mask the sometimes unwanted cannabis flavour have been shown to contain several harmful and carcinogenic aerosols [17, 18], and many ingredients have not been tested for long-term safety [19]. This is a particular concern for youth who are often attracted to the flavoured products [19]. In 2021, the Government of Canada proposed that flavouring agents be banned from vape products (not limited to cannabis-containing vapes), with the exception of tobacco, mint and menthol flavours [20]. This has yet to be implemented. However, Nova Scotia already moved in this direction in 2019 [21].

The weighing of risks versus benefits of vaping flavouring agents has been debated by some experts as vaping has been shown to contain fewer toxins and be less risky than regular smoking [22, 23]. Vaporising has even been highlighted in Canada’s “Lower Risk Cannabis Use Guidelines” as a safer, though not risk-free, alternative to smoking combusted cannabis [24]. For some, it could be considered a harm reduction strategy for moving consumers away from traditional smoking alternatives [25, 26]. However, the role that flavours play within that harm reduction strategy remains unclear. About 26% of

the sample in our current study had a preference towards non-cannabis flavours; however, the relative importance of flavour ranked lower than device type, price and THC content.

4.1 Limitations

Inherent limitations known to be present in DCE studies include ordering effect, hypothetical bias and framing effect [27]. Methods used to mitigate these issues are described in the supplementary detailed methods. Our preliminary qualitative work found THC potency to be of importance to consumers, but issues around cartridge size (e.g., 0.5 g, 1 g, 2 g) were not discussed [12]. However, with larger cartridge sizes being available in the unregulated market (e.g., 4 g), that would have made an interesting attribute to explore as we know bulk purchasing options do play a role in decision making for other product types like dried flower and edibles [12]. We did not include an opt-out option within the choice tasks, as we felt the scenarios were realistic given the participants had purchased a cannabis vape product in the last 12 months. However, it is possible that some choice tasks presented two options of vapes that are not regulated by Health Canada. For someone opposed to purchasing anything not regulated, this could result in them being forced to select a product they would not purchase in reality. We anticipate the overall impact to be minimal given that respondents would still be making realistic trade-offs with the other attributes. Finally, we cannot be sure if our sample mirrors the general cannabis consuming population in Canada. We do know the sample has a greater proportion of higher income earners and higher levels of education than the general Canadian population. Additionally, our sample was predominantly Caucasian. Therefore, the data may not reflect the preferences of minority races, or those belonging to a lower socioeconomic status.

5 Conclusion

The use of cannabis vaping products, including pens and cartridges, is not without potential risks. However, they can be a safer alternative to smoking combustible cannabis, which remains the most common form of cannabis consumption. This is especially true for regulated vaping products that do not contain vitamin E acetate, which has been highly suspected as the cause of EVALI. Our study demonstrated that 60% of cannabis vape consumers in our sample, representing an even greater proportion of the vape market, place a low priority on their purchases being Health Canada-regulated products. With inequitable access

to vaping products across Canada, it is now time for policy makers to consider the broader public health impact of banning cannabis vaping pens and cartridges. For regions where regulated cannabis vapes are accessible, changes to other policies may be needed to encourage more purchases from licensed stores.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s40258-023-00804-w>.

Declarations

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Consent to participate All participants consented to participate in the study.

Consent for publication All participants consented to have their data included in publications.

Availability of data and material Data can be made available upon request, and with the approval of the Interdisciplinary Committee on Ethics in Human Research.

Code availability Not applicable.

Author contributions JD developed the research protocol, designed the survey, did the preliminary analysis of the data, and drafted the manuscript. KJ provided input in the discrete choice experimental design and conducted some of the analyses, and provided feedback on the manuscript. MC supported the literature search and drafted sections of the manuscript. MN supported the development of the protocol, supported data interpretation and reviewed the manuscript. LB supported the development of the protocol, survey design, data interpretations and manuscript review.

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