Choice and variety-seeking of e-liquids and flavour categories by New Zealand smokers using an electronic cigarette: a longitudinal study

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ABSTRACT

Background: Little is currently known about how e-liquid flavour use evolves among electronic cigarette users. We describe patterns of e-liquid and flavour category use, and variety-seeking, among New Zealand adult smokers attempting to transition from smoking to e-cigarettes.

Methods: Data were collected in 2018–19, using a longitudinal design comprising up to five in-depth interviews over a 12–20 week period. Participants (n=32) were current smokers aged ≥ 18 years, who were not currently using an e-cigarette once a week or more often, and were willing to use an e-cigarette in an attempt to stop smoking. We purchased participants a starter e-cigarette of their choice; they supplied their own e-liquids throughout the study. We extracted e-liquid use data from the verbatim interview transcripts, categorised these into flavour categories, and then explored these data for the whole sample, and by flavour category purchased at intake.

Results: Most participants (n=12) selected a tobacco-flavoured e-liquid at intake; fruit (n=7), mint/menthol (n=6), and dessert/sweets and non-alcoholic beverage (both n=5) were also popular. Most participants were still using their initially chosen flavour category at study exit, however many described variety-seeking behaviours, which typically occurred during the first 12 weeks of enrolment.

Conclusion: Most participants did not follow a straightforward e-liquid or flavour category pathway. Evidence of a variety-seeking continuum, typically occurring within the first 12 weeks, suggests possible opportunities at specialist e-cigarette stores to couple e-liquid purchasing occasions with cessation advice.
Implications

Variety-seeking behaviour was common and typically reported within the first 12 weeks of participants’ e-cigarette-assisted attempt to transition away from smoking. Policies allowing diverse e-liquid flavours at specialist stores only could support users’ variety-seeking and potentially create opportunities to couple e-liquid purchasing occasions with cessation advice during the first months of a transition attempt.
INTRODUCTION

In many countries, e-liquids for electronic cigarettes are available in a bewildering array of flavours,\(^1\) despite restrictions on “characterising flavours” in combusted tobacco products.\(^2\)\(^-\)\(^4\) While uncertainties remain about whether flavours assist smokers to transition from smoking to e-cigarettes,\(^5\)\(^-\)\(^10\) several studies report e-cigarette users’ preferences for non-tobacco flavours such as fruit, candy and dessert,\(^8\)\(^,\)\(^11\)\(^-\)\(^16\) though a substantial minority, particularly smokers, prefer tobacco-flavoured liquids.\(^6\)\(^,\)\(^8\)\(^,\)\(^11\)\(^-\)\(^16\) Studies have also documented e-cigarettes’ appeal to young people,\(^8\)\(^,\)\(^13\) with evidence that adolescents, young people and non-smokers prefer non-tobacco flavours such as fruit, mint and candy.\(^12\)\(^,\)\(^16\)\(^-\)\(^20\) These findings have led to calls for restrictions on diverse, non-tobacco flavours,\(^21\) and several countries are developing policies to address these concerns.

Legislation enacted in 2020 by the New Zealand (NZ) Parliament will restrict e-liquid flavours sold by “generic” (e.g., convenience stores and service stations) and online-only e-cigarette retailers to tobacco, menthol and mint.\(^22\) Specialist retailers (at least 70% of a specialist store’s total sales to come from the sale of e-cigarette products; in special cases this threshold will be 60% of total sales) would be allowed to continue selling an unlimited number of flavours (excluding e-liquids deemed to contain “harmful constituents”).\(^22\)

Restricting e-liquid flavours is unpopular with e-cigarette advocates, who argue that flavour variety is essential for transition from smoking.\(^23\)\(^,\)\(^24\) They suggest flavour use evolves as smokers wish to distance themselves from the physical experience of smoking and that flavour choices offer an additional reward that differentiates e-cigarette use from smoking.\(^25\)\(^-\)\(^28\) These assertions draw on consumer behaviour theory that presents variety-seeking as a tendency “to seek diversity in…choices of services or goods” (p.139).\(^29\) Kahn suggests variety-seeking arises from three motivations: an intrinsic desire for variety; a response to
external constraints (such as product discontinuations); or a desire to develop choice repertoires that ensure a preferred option remains available, should marketplace offerings change. Of these motivations, advocates’ arguments align most closely with the first, which suggests flavour satiation occurs rapidly and drives demand for different flavours. However, there has been little discussion or debate about how to define or measure variety-seeking among e-cigarette users, despite the apparent usefulness of this construct in understanding users’ flavour choices.

Currently, little is known about the evolution of e-liquid flavour choices among smokers using an e-cigarette to try and stop smoking. A multinational online survey among visitors to an e-cigarette advocacy website who had been using an e-cigarette on average for 12 months found participants commonly reported using tobacco-flavours at initiation, but had switched to other flavours at the time of the survey, with fruit flavours more popular. An industry-funded study, using a convenience sample of participants recruited from e-cigarette advocacy organisations in the US, found that adult users who self-reported transitioning from exclusive smoking to exclusive e-cigarette use were more likely to have used non-tobacco flavours at initiation, or to have transitioned from tobacco to non-tobacco flavours. A cross-sectional study using a convenience sample of predominantly long-term e-cigarette users (mean duration of use 3.9 years) also described a similar shift from tobacco to non-tobacco flavours. While tobacco was the most common flavour category at e-cigarette initiation, fruit, sweet and food flavours were most popular at the time of the survey.

Given these varying findings, limited knowledge of flavour choice patterns over time, and on-going debates in many countries about policies proposing flavour restrictions, we believe
it is timely to explore flavour choice and variety-seeking among e-cigarette users. We aimed to describe patterns of e-liquid and flavour category choice, and variety-seeking, among New Zealand adult smokers attempting to move from smoking to e-cigarettes, over 12–20 weeks.

METHODS

Overview of Smoking-to-Vaping study methods

Data were collected in Dunedin, New Zealand from May–December 2018 and March–September 2019 as part of the longitudinal mixed-methods Smoking-to-Vaping Study (S2V). Full details of the S2V study are described in the methods report. In brief, enrolled participants were at least 18 years old, smoked at least one cigarette per week, did not currently use an e-cigarette once a week or more often, were not currently trying to quit using any means (including nicotine replacement therapy and “cold turkey”), had never stopped smoking for 30 or more days with the aid of an e-cigarette, and were willing to embark on an e-cigarette-assisted attempt to stop smoking. Participants were purposively sampled to try and obtain a diverse sample in terms of age, gender, ethnicities, and cigarettes-per-day at baseline.

Participants attended up to five in-depth, in-person face-to-face interviews (intake, and approximately 2, 6, 12 and 18 weeks after intake) over approximately 18–20 weeks. During the intake session, participants selected an e-cigarette starter kit (up to NZ$80 value purchased with research funds and gifted to the participant) from a collaborating retailer. They could sample various non-nicotine e-liquids in-store (approximately 39 individual e-liquid flavours, depending on the specific tester e-cigarettes available (i.e., tester e-cigarettes were sufficiently charged) and e-liquid introductions and deletions over the
study period) before purchasing the flavour(s) and nicotine concentration(s) of their choice. Shop staff often discussed flavour preferences with participants and suggested specific flavours to sample. Researchers recorded e-liquid names sampled and purchased by participants during this visit. During each follow-up interview, researchers asked open-ended questions about the e-liquid participants had used since their last visit (specific e-liquid names, or flavour descriptions when participants could not recall specific names).

Throughout the study, participants supplied their own e-liquid in the flavours and nicotine concentrations of their choice. Participants were free to purchase e-liquid from any physical or online retailer. Freebase nicotine e-liquids were available throughout the study period, while nicotine salt e-liquids were available from e-cigarette retailers from approximately August 2018. Participants were not specifically offered cessation support by the researchers, but were free to seek additional assistance if desired; they were reimbursed a maximum of NZ$290 (in 2019; NZ$260 in 2018) to recognise their participation in the study. Participants were considered lost to follow-up if they did not respond to at least two researcher-initiated contacts to reschedule missed interviews. Only participants who attended at least four interviews (over approximately 12 weeks) are included in this analysis (n=32).

Classification of e-liquids into flavour categories

We extracted proprietary e-liquid names (e.g., “Caffïend”, “Sherbinator”) and verbatim flavour descriptions (e.g., “melon”, “chocolate milkshake”) from each participant’s transcripts. We compiled a list of all e-liquid names and flavour descriptions mentioned, and searched online for manufacturers’ flavour descriptions when specific e-liquid names were available; otherwise, we relied on participants’ verbatim descriptions of their flavours. After searching the literature for existing schemes, we classified the names and...
descriptions into the following categories: tobacco, mint and menthol, alcoholic beverage, non-alcoholic beverage, candy, dessert/sweets, nuts/spices, fruit, and unflavoured. See Table 1 for category descriptions and specific examples from participants.

Where the e-liquid name or flavour description comprised multiple flavour categories (e.g., fruit and dessert), we adapted the prioritisation scheme described by Yingst based on the e-liquid name and manufacturers’ or participants’ flavour description (see Table 1 for the prioritisation order). We independently double-coded the list of e-liquid names and flavour descriptions with disagreements resolved through discussion. See Supplementary file 1 for the prioritised classifications used in this study.

Variety-seeking

We assessed e-liquid and flavour category variety-seeking in several ways (Table 2). Between participants, we looked across all interviews (individually, and by subgroup according to flavour category purchased at intake: tobacco, and only non-tobacco flavours. We also explored interview-specific e-liquid and flavour category use. We used modes as the measure of central tendency; means were inappropriate given the data’s skewed nature. Medians were also inappropriate as, by definition, 50% of participants would be classified as variety-seeking, regardless of the median value.

Across all interviews, we compared each participant’s total number of unique e-liquid/flavour descriptions (and flavour categories) to the sample’s overall e-liquid (and flavour category) mode. We classified participants as “overall e-liquid variety-seeking” (or “overall flavour category variety-seeking”) when their respective totals were above the sample’s respective mode. When there was more than one modal value, we used the highest mode to classify
participants. We also applied these classifications and definitions by subgroup, according to e-liquid flavour category purchased at intake (tobacco, and only non-tobacco flavours).

For each interview, we followed a similar classification procedure and definitions, substituting interview-specific participant totals and sample modes (“interview-specific e-liquid variety-seeking”, “interview-specific flavour category variety-seeking”). We also explored “within-person flavour category variety-seeking” by comparing flavour categories reported at later interviews with categories reported at earlier interviews. Where applicable, we noted category changes at specific interviews.

RESULTS

Forty-five participants attended an intake session; 32 completed at least four interviews over approximately 12 weeks and are included in the current analysis (n=29 completed all five interviews over approximately 18-20 weeks). Table 3 describes the included participants’ characteristics. The sample ranged from 19–56 years, 18 were female, and nine self-identified as Māori (indigenous peoples of New Zealand). Cigarettes per day at baseline ranged from 1–44, with one participant also smoking dokha, a Middle Eastern tobacco product smoked in a midwakh pipe.36 Before study intake, 20 had tried e-cigarettes (≥ 1 puff) at least once, including two who had unsuccessfully used a first generation e-cigarette in attempts to stop smoking. At their final interview, 13 reported smoking daily, and four reported social, or occasional, smoking only.

E-liquids and flavour categories
Figure 1 shows the number of individual e-liquids or flavour descriptions, and flavour categories (colour coded), purchased at intake and reported at each follow-up interview, by participant. For example, “Bonnie” purchased a single e-liquid classified as non-alcoholic beverage at her intake session. Approximately two weeks later, at her second interview, she reported using seven different e-liquids or verbatim flavour descriptions, which were classified into five flavour categories (non-alcoholic beverage, tobacco, candy, alcoholic beverage, dessert/sweets).

Table 4 shows the modes, ranges, and number of participants classified as variety-seeking for e-liquid use and flavour categories, reported for the overall sample (n=32), and by subsample according to flavour category purchased at intake (tobacco, n=12; only non-tobacco, n=20); across all interviews, and for each interview.

Supplementary file 2 lists the proprietary e-liquid names, and verbatim flavour descriptions, reported by each participant at each interview. For example, “Bonnie” (p.3) purchased a proprietary “Cherry Cola” e-liquid at her intake session, and at her second interview reported using five proprietary e-liquids (Cherry Cola, Cream, Vanilla Beanie, Shalin’s Milk, Hasseltoff) and two liquids where she provided flavour descriptions only (“whisky” and “cigar”).

Over the study period, participants named or described 118 individual e-liquids and flavour descriptions; however, some descriptions may have referred to named proprietary e-liquids (e.g., “lemoncake” may have referred to “Sansa’s Lemoncake” e-liquid, or another unnamed e-liquid). In these cases, we itemised the supplied description as a separate e-liquid for coding purposes. We do not know the total number of e-liquids available for purchase during the study period as participants were free to purchase liquids from any physical or online retailer.
Figure 1 and Table 4 show that across interviews for the whole sample, participants reported using one to more than 20 different e-liquids or flavour descriptions (mode: 4; n=16 participants classified as “overall e-liquid variety-seeking”), and 1–6 flavour categories (mode: 2; n=18 classified as “overall flavour category variety-seeking”). The most commonly reported flavour categories were fruit (used by n=24 participants over the study period) and tobacco (n=18), followed by dessert/sweets (n=15), mint/menthol (n=12), candy (n=11), and non-alcoholic beverages (n=10). All other flavour categories had two or fewer participants reporting use over the study period.

Table 4 shows that, by interview for the overall sample, the number of participants classified as “interview-specific variety-seeking” increased after intake for both e-liquids and flavour categories. Participants who purchased only non-tobacco flavoured e-liquids at intake (n=20) drove these increases over time for both measures, especially from intake to interview 2 (approximately two weeks after intake), when the number of these participant classified as variety-seeking increased two to three fold. By contrast, the number of participants classified as variety-seeking among those who purchased a tobacco flavoured e-liquid at intake remained reasonably steady over time for both measures.

Exploring “within-person flavour category variety-seeking” across interviews, the Figure shows that six participants reported no additional flavour categories at later interviews. Among the 26 participants reporting ≥ 1 category additional to those purchased at intake, 11 first reported a new category at interview 2, eight first reported at interview 3, seven at interview 4, and none at interview 5. Among these 26 participants, most reported a new category at only one or two interviews, and only one reported new categories at every follow-up interview.
Study intake e-liquid trial and purchase (n=32)

During each participants’ intake session, approximately 39 individual e-liquid flavours were available to sample at the specialist e-cigarette retailer; however, the exact number may have varied slightly depending on the specific testers available, and e-liquid introductions and deletions over the study period.

During the shop visit (data not shown), participants sampled 0–13 individual e-liquids (modes: 4 and 5), and sampled 0–6 flavour categories (modes: 1 and 3). The most commonly sampled categories were tobacco (n=17 participants), fruit (n=20), dessert/sweets (n=15), non-alcoholic beverages (n=10), and mint/menthol (n=8).

Participants purchased 1–3 e-liquids (mode: 1; n=10 participants “intake-specific e-liquid variety-seeking”), and 1–3 flavour categories (mode: 1; n=7 “intake-specific flavour category variety-seeking”). The most commonly purchased categories were tobacco (n=12 participants), fruit (n=7), mint/menthol (n=6), and dessert/sweets and non-alcoholic beverages (both n=5). Generally, participants reported continuing use of the flavour categories purchased at intake during their follow-up interviews, although the specific proprietary e-liquids and flavour descriptions within those categories often changed over time. Eight participants abandoned their initially purchased flavour category or categories by their last interview.

E-liquid pathways among purchasers of tobacco flavoured e-liquids at intake (n=12)

Of the 12 participants who bought a tobacco flavoured e-liquid at intake, nine purchased only a tobacco flavour, while three also purchased an additional one or two non-tobacco flavour categories at intake. Across interviews, the total number of unique e-liquids/flavour
descriptions ranged from 1–8 (mode: 2), with up to five reported at specific interviews. The total number of flavour categories ranged from 1–4 (mode: 2), with up to four reported at specific interviews. Compared to the overall sample (Table 4), we classified seven participants as “overall e-liquid variety-seeking”, and four as “overall flavour category variety-seeking”. The number of participants classified as interview-specific variety-seeking remained generally steady over time for both measures.

Eleven of these participants reported using tobacco flavours at interview 2, with eight using this category at all interviews (three used only tobacco flavours throughout the study). Across all interviews, nine participants reported additional flavour categories at least once; fruit (n=7 participants) was the most popular additional category, followed by dessert/sweets (n=4) and mint (n=3). Three participants abandoned tobacco flavours by their final interview.

Six participants in this subsample reported smoking daily at their final interview.

E-liquid pathways among purchasers of only non-tobacco flavoured e-liquids at intake (n=20)

Among the 20 participants who purchased only non-tobacco flavoured e-liquid at intake, fruit (n=6 participants), non-alcoholic beverage (n=5), mint/menthol (n=5), dessert/sweets (n=4), and candy (n=3) flavours were all reported. Across interviews, the total number of unique e-liquids/flavour descriptions ranged from two to more than 20 (mode: 4), with up to “more than eight” reported at specific interviews. The total number of flavour categories ranged from 1–6 (mode: 3), with up to five reported at specific interviews. Compared to the overall sample (Table 4), we classified 14 participants as “overall e-liquid variety-seeking”, and 9 as “overall flavour category variety-seeking”. The number of participants classified as
interview-specific variety-seeking increased substantially (a two to three-fold increase) from intake to interview two, and remained relatively high at later interviews for e-liquid variety-seeking, but dropped off steadily for flavour category variety-seeking.

Flavour category use was heterogeneous among this group. However, most participants (n=16) continued using the flavour category purchased at intake at all interviews. Nine participants reported using a tobacco flavour at least once after intake, however only two used this category at every subsequent interview. Only one person reported using only one (non-tobacco) flavour category at every interview.

Seven participants in this subsample reported smoking daily at their final interview, with four smoking socially, or occasionally, only.

DISCUSSION

Among the 32 participants analysed, tobacco flavoured e-liquids were the most commonly purchased individual flavour category at intake. Most participants who selected these e-liquids still used this category at their last interview, either alone or alternating with other, non-tobacco, flavour categories. Other flavours commonly chosen at intake were fruit, mint/menthol, dessert/sweets, and non-alcoholic beverages. Among participants who chose only non-tobacco flavoured e-liquids at intake, a minority also used tobacco flavoured e-liquids after their intake sessions, usually reporting use at only one or two interviews before reverting to sole use of non-tobacco flavour categories. Regardless of the flavour category chosen at intake, most participants were still using this category at study exit, although the specific e-liquids and flavour descriptions reported within those categories often changed over time. By subgroup according to flavour categories chosen at intake, participants who chose only
non-tobacco flavoured e-liquids were classified as “variety-seeking” more often than those who chose tobacco flavoured liquids. Very few participants used only a single flavour category across all interviews; those who did often selected a tobacco flavour at intake. Our within-person findings suggest a variety-seeking continuum.

Few published studies explore e-liquid flavour use over time, and this analysis is the first to our knowledge to follow smokers from the beginning of an attempt to transition from smoking to e-cigarette use. Our study is also the first to use an intensive follow-up design, where assessments were separated by weeks rather than years. The findings mirror a study by Du et al. using two waves of data collected online across several years (2012–2014 and 2017–2019). This study used a sample of existing e-cigarette users (84% were exclusive users at baseline; 21% study retention), and found tobacco, menthol and mint flavours were the most commonly preferred flavours at baseline, while chocolate, candy and other sweets were most preferred at follow-up. The authors also reported consistent proportions of participants preferred menthol, mint, fruit, non-alcoholic beverages, clove/spice, and alcoholic beverage flavours; a large decline in the proportion preferring tobacco; and a large increase in the proportion preferring chocolate, candy and other sweets, or “all other flavours”. A substantial minority preferred the same flavour category at follow-up as at baseline. While these results suggest some movement from tobacco flavours to non-tobacco flavours, most participants were exclusive e-cigarette users at baseline, thus the study provides limited insights into flavour choices among smokers at the beginning of a transition to e-cigarettes.

A longitudinal study of young adults also analysed two waves of data, but did not explicitly collect information on use of tobacco-flavoured e-liquids (inferring use of this category based on responses to other questions). This study found the proportion of participants at wave two reporting non-tobacco and non-menthol flavoured e-liquids was higher for both those
who did not report past-month e-cigarette use at wave one, and those who were past-month smokers at wave one.

While tentative, these early findings suggest more nuanced e-liquid flavour pathways than those espoused by e-cigarette advocates, who have argued that people using an e-cigarette to switch from smoking start with tobacco flavoured e-liquids and diversify from there. Like Du et al., we found evidence of flavour diversification; nonetheless, a substantial minority of our participants preferred tobacco flavours throughout the study period.

Advocates’ arguments assume that intrinsically-motivated variety-seeking remains constant over time, hence smokers should have access to a wide variety of e-liquid flavours to motivate uptake and continued use. However, our findings suggest flavour use among e-cigarette users exists on a variety-seeking continuum, with few participants at either extreme (i.e., only one e-liquid or flavour category ever reported vs. new e-liquids and flavour categories reported at every interview), and most describing variety-seeking choices between approximately two to twelve weeks after commencing e-cigarette use.

Our findings suggest policies allowing diverse flavours at specialist stores only would support the variety-seeking we observed. This policy could also create opportunities to couple e-liquid purchasing occasions with cessation advice during the important first months of a transition attempt, including the possible need for experimentation to identify appealing flavours, and satisfying nicotine levels and device settings. Earlier work has documented the role specialist e-cigarette retailers may play in assisting smokers, and providing peer-based (i.e., salesperson) point-of-sale behavioural support during the first few months of an e-cigarette-assisted transition attempt could increase the odds of transition.

Our study has several limitations and some strengths. The analysis was restricted to participants who completed at least four interviews, meaning 13 of the 45 enrolled
participants (29%) were lost to follow-up before this milestone. Aside from the recording of e-liquid flavours during the initial shop visit, all data were self-reported and, although participants were asked to bring their current e-liquids to interviews, many did not. We thus could not conduct any validity checking of participants’ e-liquid use and did not use biochemical verification of their self-reported smoking status. We often relied on participants’ verbatim descriptions of flavours, which might not be accurate characterisations, though, conversely, reflect what participants thought they were tasting. Our study design makes it difficult to know if participants reported all e-liquids or flavours used, with a few expressly unable to recall all flavours tried. Recommendations from shop staff may have influenced participants’ flavour choices, if they chose to buy e-liquid from a physical retailer. However, such interactions are indicative of real life decision making processes many e-cigarette users will encounter. While participants were able to sample from approximately 39 different e-liquid flavours during their initial shop visit, the sample flavours were predominately fruit and dessert/sweets, which may have influenced participants’ choices. However, all flavour categories used in this analysis were available for in-shop sampling during the initial shop visit. During follow-up interviews, we probed why participants had selected specific flavours and how they made these choices; however, participants’ self-awareness and insight varied. We therefore lack systematically reported information on how social (e.g., peer and family) and marketing factors (e.g., discounts, promotions, advertising) influenced flavour choices. Finally, the findings arise from a secondary analysis of interview transcripts from the “parent” Smoking-to-Vaping study, which was designed primarily as an in-depth qualitative exploration of smoking-to-vaping transitions. Thus, theoretical saturation, rather than statistical power, drove the study’s sample size considerations, and the small sample means we lack sufficient power to conduct inferential analyses,
such as formal assessment of participants’ baseline characteristics and their association with the findings. The small sample size also means we are unable to assess associations of flavour choices and smoking status at study exit, although we note that a recent study reported current use of tobacco or menthol flavours may be associated with dual use.\textsuperscript{40}

Despite these limitations, we believe our study makes two important contributions. The intensive longitudinal approach provided a novel opportunity to explore patterns with much more granularity than other published studies, which typically are cross-sectional in design, or assess e-liquid flavour use at only two, widely separated, periods. To the best of our knowledge, our study is the first to propose an empirical definition of variety-seeking. We hope that this data-derived definition will stimulate discussion, debate, and further research, and lead to robust measures of this important construct.

While our study does not allow us to draw conclusions about flavour use and smoking outcomes, future research with much larger sample sizes could explore associations between flavour choices and cessation outcomes. Qualitative studies using Kahn’s variety-seeking framework could also explore motivations for flavour use and whether variety-seeking reflects an on-going search for satiation or indicates satisficing.\textsuperscript{29} Knowledge from studies such as these could clarify the role flavour variety plays in transitions from smoking to e-cigarette use and identify the groups for which variety is important. For policy makers operating in the absence of such evidence, our findings support a nuanced regulatory approach that recognises variety-seeking while mitigating the effects widely available diverse flavours have on e-cigarette appeal among young people and non-smokers.
Figure title

Figure 1. Individual proprietary e-liquids/verbatim flavour descriptions (number), and categorised flavour classifications (colours), reported by participants who attended at least four interviews, by initially purchased flavour category

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Table 1. E-liquid flavour classification categories and prioritisation order

| Category name       | Description                                      | Examples of proprietary e-liquids and verbatim flavour descriptions reported by participants |
|---------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------|
| Tobacco             | With or without characterising flavours (e.g., spices, rum) | Mild Black “cigar”                                                                          |
| Mint and menthol    | Mint and menthol, without characterising flavours | So Fresh So Clean “mint”                                                                    |
| Alcoholic beverage  |                                                  | “Kahlua and dark chocolate” “mojito”                                                        |
| Non-alcoholic beverage |                                              | Caffiend “cola”                                                                             |
| Candy               | Sweet food items normally eaten with fingers/hands | Sour Patch “marshmallow”                                                                     |
| Dessert/sweets      | Sweet food items normally eaten with utensils    | Custard Cure “marshmallow chocolate meringue”                                               |
| Nuts/spices         |                                                  | Hazelmel                                                                                    |
| Fruit               |                                                  | Stoned Fruits “apple papaya”                                                                |
| Unflavoured         | No added flavouring ingredients                 | Nude                                                                                       |

*Quote marks (" ") denote participants’ verbatim flavour descriptions*
Table 2. Between-participant and within-participant variety-seeking definitions used in the study

| Between-participant e-liquid/flavour description, and flavour category, variety-seeking | Analysis | Classified as variety-seeking if: |
|---|---|---|
| Across all interviews | | |
| • Overall e-liquid variety-seeking | Total number of unique e-liquids/flavour descriptions reported by participant across all interviews compared to the overall sample’s e-liquid mode | Participant’s total number of e-liquids > overall sample’s mode |
| • Overall flavour category variety-seeking | Total number of flavour categories reported by participant across all interviews compared to the overall sample’s flavour category mode | Participant’s total number of flavour categories > overall sample’s mode |
| Interview-specific | | |
| • Interview-specific e-liquid variety-seeking | Interview-specific number of unique e-liquids/flavour descriptions reported by participant compared to the overall sample's interview-specific e-liquid mode | Participant’s interview-specific number of e-liquids > overall sample’s interview-specific mode |
| • Interview-specific flavour category variety-seeking | Interview-specific number of flavour categories reported by participant compared to the overall sample’s interview-specific flavour category mode | Participant’s interview-specific number of flavour categories > overall sample’s interview-specific mode |

All measures reported for the overall sample (n=32), and subgroups according to e-liquid flavour category purchased at intake (tobacco, n=12; only non-tobacco, n=20)

Within-participant flavour category variety-seeking across all interviews
We compared flavour categories reported at later interviews with categories reported at earlier interviews. Where applicable, we noted changes in categories at specific interviews.
## Table 3. Characteristics of the participants included in the current analysis (n=32)

| Pseudonym | Gender | Age* | Highest completed education | Ethnicity | # Cigarettes/day reported at intake | Time to first cigarette at intake | E-cigarette experience before intake | Smoking reported at last interview |
|-----------|--------|------|-----------------------------|-----------|----------------------------------|----------------------------------|------------------------------------|----------------------------------|
| Clara     | F      | 19   | High school                 | Māori     | 42–44                            | ≤ 5 mins                         | No                                 | Yes                              |
| Lily†     | F      | 19   | Certificate/diploma         | NZE       | 14–15                            | 6–30 mins                        | No                                 | Occasional only                   |
| Abigail   | F      | 22   | High school                 | NZE       | 1                                | > 60 mins                        | Yes                                | No                               |
| Louise‡   | F      | 23   | High school                 | NZE       | 6                               | 6–30 mins                        | Yes                                | Yes                              |
| Amanda†   | F      | 26   | Bachelor’s degree           | Asian     | 4                               | > 60 mins                        | Yes                                | Yes                              |
| Charlette†| F      | 27   | No formal qualification     | Māori, NZE| 20                              | ≤ 5 mins                         | Yes                                | No                               |
| Andrea‡   | F      | 29   | High school                 | Māori, NZE| 22–27                            | ≤ 5 mins                         | Yes                                | Yes                              |
| Bonnie†   | F      | 31   | Bachelor’s degree           | NZE       | 7–9                             | ≤ 5 mins                         | Yes                                | Yes                              |
| Jasmine†  | F      | 37   | Bachelor’s degree           | NZE       | 22–23                            | ≤ 5 mins                         | Yes                                | Yes                              |
| Lottie†   | F      | 38   | No formal qualification     | Māori     | 12–14                            | 6–30 mins                        | No                                 | No                               |
| Helen†    | F      | 44   | High school                 | European  | 5–8                             | 31–60 mins                       | Yes                                | Yes                              |
| Evie†     | F      | 45   | High school                 | Māori     | 9–13                            | > 60 mins                        | No                                 | No                               |
| Sonya†    | F      | 47   | High school                 | NZE       | 18–24                            | ≤ 5 mins                         | Yes                                | Yes                              |
| Ella†     | F      | 50   | Certificate/diploma         | Māori, NZE| 29                              | ≤ 5 mins                         | No                                 | Social only                       |
| Lexie     | F      | 51   | Bachelor’s degree           | NZE       | 17–18                            | 6–30 mins                        | Yes, quit attempt                  | Yes                              |
| Eleanor   | F      | 52   | Certificate/diploma         | NZE       | 14–15                            | ≤ 5 mins                         | Yes, quit attempt                  | No                               |
| Nancy     | F      | 52   | High school                 | NZE       | 10–11                            | > 60 mins                        | Yes, quit attempt                  | No                               |
| Hannah‡   | F      | 55   | Certificate/diploma         | Māori, NZE| 19–21                            | ≤ 5 mins                         | Yes, quit attempt                  | No                               |
| Oscar†    | M      | 20   | High school                 | Asian     | 3, plus 3 dokha bowls‡           | 6–30 mins                        | No                                 | No                               |
| George‡   | M      | 20   | High school                 | NZE       | 9–10                            | 31–60 mins                       | Yes                                | Yes                              |
| Noah†     | M      | 24   | High school                 | NZE       | 13                               | 6–30 mins                        | Yes                                | Yes                              |
| Ryan      | M      | 26   | Bachelor’s degree           | NZE       | 10–14                            | 6–30 mins                        | Yes                                | No                               |
| Teddy†    | M      | 31   | High school                 | Māori     | 12                               | ≤ 5 mins                         | Yes                                | No                               |
| Pseudonym | Gender | Age * | Highest completed education | Ethnicity | # Cigarettes/day reported at intake | Time to first cigarette at intake | E-cigarette experience before intake | Smoking reported at last interview |
|-----------|--------|-------|-----------------------------|-----------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|
| Tyler     | M      | 32    | High school                 | NZE       | 18–24                             | ≤ 5 mins                          | Yes                               | Social only                      |
| Arthur†   | M      | 36    | Bachelor’s degree           | NZE       | 5                                 | > 60 mins                         | Yes                               | Social only                      |
| Dylan     | M      | 39    | Certificate/diploma         | NZE       | 24–28                             | 6–30 mins                         | No                                | No                               |
| Andrew†   | M      | 40    | Certificate/diploma         | European  | 11–15                             | ≤ 5 mins                          | No                                | No                               |
| Michael† | M      | 48    | High school                 | Māori     | 12–13                             | > 60 mins                         | Yes                               | No                               |
| Leo†      | M      | 49    | Post-graduate degree        | European  | 14–17                             | > 60 mins                         | No                                | No                               |
| Blake     | M      | 52    | Certificate/diploma         | European  | 22                                | 6–30 mins                         | No                                | Yes                              |
| Logan†    | M      | 53    | No formal qualification     | NZE       | 34–>36)                           | 6–30 mins                         | No                                | Yes                              |
| Mason     | M      | 56    | High school                 | NZE       | 11–12                             | ≤ 5 mins                          | No                                | No                               |

NZE: New Zealand European; *Based on birth year and year of study enrolment; †2018 participant; ‡Dokha is a Middle Eastern tobacco product smoked in a midwakh pipe.
Table 4. Unique proprietary e-liquid/verbatim flavour descriptions and flavour category modes, ranges and number of participants classified as variety-seeking, across all interviews and by interview, for the overall sample (n=32), and subgroups according to e-liquid flavour category purchased at intake (tobacco n=12; only non-tobacco n=20)

| By flavour category purchased at intake | Overall sample’s mode (n=32) | # Variety-seeking participants | Mode (range) | # Variety-seeking participants | Mode (range) | # Variety-seeking participants |
|----------------------------------------|-----------------------------|--------------------------------|--------------|--------------------------------|--------------|--------------------------------|
| Tobacco (n=12)                         | 4 (1–<>20)                  | 16                             | 2 (1–8)      | 2                              | 4 (2–<>20)  | 14                             |
| Only non-tobacco (n=20)                | 1 (1–3)                     | 10                             | 1 (1–3)      | 4                              | 1 (1–3)     | 6                              |
|                                        | 1 (0–7)                     | 21                             | 1 (1–5)      | 3                              | 2 (0–7)     | 18                             |
|                                        | 1 & 2 (0–<>8”)               | 12                             | 1 (0–3)      | 2                              | 2 (0–<>8”)  | 10                             |
|                                        | 1 (0–<>7”)                   | 21                             | 1 (1–3)      | 5                              | 1, 2, 3     | 16                             |
|                                        | 2 (0–<>7”)                   | 15 (n=29)                      | 1 (0–3)      | 3 (n=11)                       | 2 (0–<>7”)  | 12 (n=18)                      |

Flavour categories

| All interviews                         | 2 (1–6)                     | 18                             | 2 (1–4)      | 4                              | 3 (1–6)     | 14                             |
| Intake                                 | 1 (1–3)                     | 7                              | 1 (1–3)      | 3                              | 1 (1–2)     | 4                              |
| #2 (approx. week 2)                    | 1 (0–5)                     | 15                             | 1 (1–4)      | 3                              | 1 (0–5)     | 12                             |
| #3 (approx. week 6)                    | 1 (0–4)                     | 18                             | 1 (0–3)      | 5                              | 1 & 2 (0–4) | 13                             |
| #4 (approx. week 12)                   | 1 (0–4)                     | 19                             | 1 (1–2)      | 4                              | 3 (0–4)     | 15                             |
| #5 (approx. week 18) ‡                 | 1 (0–4)                     | 11 (n=29)                      | 1 (0–3)      | 3 (n=11)                       | 1 (0–4)     | 8 (n=18)                       |

*Number of participants reporting greater than the overall sample’s (highest) mode; † Quote marks (" ") denote when participants were unable to specify an exact number; ‡ n=3 participants lost to follow up before interview 5

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| Name       | Purchased at intake session | Interview 2 (approx. week 2) | Interview 3 (approx. week 6) | Interview 4 (approx. week 12) | Interview 5 (approx. week 18) | Smoking reported at last interview | Total number of unique e-liquids | Total number of flavour categories |
|------------|----------------------------|-----------------------------|-----------------------------|-------------------------------|-----------------------------|----------------------------------|---------------------------------|----------------------------------|
| Hannah     | 1                          | 1                           | 2                           | 1                             | 1                           | No                               | 3                               | 1                                |
| Leo        | 1                          | 1                           | 1                           | 1                             | 1                           | No                               | 2                               | 1                                |
| Mason      | 1                          | 1                           | 1                           | 1                             | 1                           | No                               | 1                               | 1                                |
| Clara      | 1                          | 1                           | 1                           | 1                             | 2                           | Yes                              | 2                               | 2                                |
| Blake      | 1                          | 1                           | 1                           | 1                             | 1                           | Yes                              | 2                               | 2                                |
| Lexie      | 1                          | 1                           | 1                           | 2                             | 1                           | Yes                              | 3                               | 2                                |
| Andrew     | 2                          | 1                           | 2                           | 2                             | 1                           | No                               | 4                               | 3                                |
|Sonya       | 1                          | 1                           | 2                           | 1                             | –                           | No interview                     | Yes                             | 2                                |
| Noah       | 1                          | 2                           | 3                           | 3                             | 1                           | Yes                              | 5                               | 2                                |
| Ryan       | 2                          | 2                           | 2                           | 2                             | 2                           | No                               | 4                               | 3                                |
| Eleanor    | 2                          | 2                           | 5                           | 3                             | 2                           | No                               | 8                               | 4                                |
| Amanda     | 3                          | 1                           | 1                           | No vaping                     | 1                           | – No interview                   | Yes                             | 4                                |
| Jasmine     | 1                          | –                           | No vaping                    | – No vaping                   | – No vaping                   | 1                                | Yes                             | 2                                |
| Arthur     | 1                          | 3                           | 1                           | > 7                           | 2                           | Social only                      | 9                               | 5                                |
| Dylan      | 1                          | 5                           | 4                           | 4                             | 4                           | No                               | >6                               | 4                                |
| Ella       | 3                          | 3                           | 2                           | 1                             | 2                           | Social only                      | 6                               | 2                                |
| Helen      | 2                          | 2                           | 2                           | 3                             | –                           | No interview                     | Yes                             | 4                                |
| Bonnie     | 1                          | 7                           | 8                           | 5                             | 5                           | Yes                              | 18                              | 6                                |
| Tyler      | 1                          | 3                           | 3                           | 3                             | 1                           | Social only                      | 4                               | 3                                |
| Michael    | 1                          | 2                           | 1                           | 2                             | 2                           | No                               | 3                               | 2                                |
| Name     | Purchased at intake session | Interview 2 (approx. week 2) | Interview 3 (approx. week 6) | Interview 4 (approx. week 12) | Interview 5 (approx. week 18) | Smoking reported at last interview | Total number of unique e-liquids | Total number of flavou r categories |
|----------|-----------------------------|-------------------------------|-----------------------------|-------------------------------|-------------------------------|-----------------------------------|---------------------------------|----------------------------------|
| George   | 3                           | 3                             | 3                           | 2                             | 1                             | Yes                               | 10                             | 3                                |
| Andrea   | 1                           | 4                             | 7                           | – No vaping                   | – No vaping                   | Yes                               | 10                             | 5                                |
| Oscar    | 1                           | 5                             | 4                           | 2                             | 2                             | No                                | 7                              | 4                                |
| Charlotte| 2                           | 6                             | 7                           | 3                             | 3                             | No                                | 17                             | 4                                |
| Evie     | 1                           | 1                             | 3                           | 1                             | 2                             | No                                | 4                              | 2                                |
| Lottie   | 1                           | 2                             | 5                           | 6                             | 5                             | No                                | 13                             | 6                                |
| Louise   | 1                           | 2                             | 2                           | 2                             | 2                             | Yes                               | 3                              | 1                                |
| Nancy    | 3                           | 3                             | 1                           | 3                             | 1                             | No                                | 7                              | 2                                |
| Lily     | 1                           | 2                             | 7                           | 4                             | 2                             | Occasional                       | 12                             | 3                                |
| Teddy    | 1                           | 4                             | 4                           | 6                             | – No interview                | No                                | 10                             | 4                                |
| Abigail  | 1                           | 8                             | 5                           | 7                             | No                            | >2                                | 0                              | 5                                |
| Logan    | 3                           | 2                             | 1                           | 1                             | Yes                           | 5                                | 3                              | 3                                |

*2018 participant

**Figure 1.** Individual proprietary e-liquids/verbatim flavour descriptions (number), and categorised flavour classifications (colours), reported by participants who attended at least four interviews, by initially purchased flavour category

**Legend**
- **Red**: Tobacco
- **Orange**: Candy
- **Green**: Mint/menthol
- **Blue**: Dessert/sweets
- **Yellow**: Non-alcoholic beverage
- **Black**: Alcoholic beverage
- **Purple**: Nut/spice
- **Pink**: Unflavoured
- **Green**: Tobacco
- **Orange**: Candy
- **Yellow**: Non-alcoholic beverage