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Flavors Increase Adolescents' Willingness to Try Nicotine and Cannabis Vape Products

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Abstract

Background: Certain product characteristics, such as flavor, may increase adolescents' willingness to try vaped nicotine and cannabis (marijuana) products.

Methods: A discrete choice experiment embedded within the 2021–2022 California Teens Nicotine and Tobacco Project Online Survey was administered to a non-probability sample of N=2342 adolescents ages 12–17. Participants were sequentially presented four randomly-generated pairs of hypothetical vape products that varied in device type (disposable, refillable), content (nicotine, marijuana, "just vapor"), and flavor (seven options) and asked which of these (or neither) they would be more willing to try if a best friend offered. Conditional logistic regression quantified associations between product characteristics and participants' selections, including interactions by past 30-day use of e-cigarettes, marijuana, or both.

Results: Candy/dessert, fruit, and fruit-ice combination flavors were all associated with greater willingness to try a vape product (versus tobacco flavor) among participants not using e-cigarettes or marijuana, those using only e-cigarettes, and those co-using e-cigarettes and marijuana. Among participants only using marijuana, the most preferred flavors were no flavor, candy/dessert, and icy/frost/menthol. Among participants not using e-cigarettes or marijuana, model-predicted willingness to try a displayed vape product was greater when products were sweet or fruit flavored than tobacco or unflavored, regardless of whether displayed options contained nicotine (fruit/sweet: 21%, tobacco/unflavored: 4%), marijuana (fruit/sweet: 18%, tobacco/unflavored: 6%), or "just vapor" (fruit/sweet: 29%, tobacco/unflavored: 16%).

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Conflict of Interest Statement

The authors report that there no conflicts to disclose.

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Conclusions: In this online non-probability sample, flavors in nicotine and cannabis vape products increased adolescents' willingness to try them. Comprehensive bans on flavored vapes would likely reduce adolescent use.

Keywords

tobacco control; cannabis; nicotine; electronic cigarettes; adolescent health; survey epidemiology

1. INTRODUCTION

Vaping involves using a small battery-powered device to aerosolize a liquid mixture, wax, powder, or other substance for recreational inhalation. Vaping often refers to using electronic cigarettes (e-cigarettes) to consume nicotine or, less commonly, non-nicotine flavorants. E-cigarettes have been the most used tobacco product among United States (U.S.) high school students since 2014 (Arrazola et al., 2015) with 14.1% of U.S. high school students reporting current e-cigarette use in 2022 (Park-Lee et al., 2022). Public health concerns associated with adolescent vaping include nicotine dependence and adverse respiratory symptoms (Braymiller et al., 2020; Case et al., 2018; Chaffee et al., 2021).

Widespread availability of an extensive array of flavors is an often cited motivator for youth tobacco use, particularly e-cigarette use (Kong et al., 2019; Soneji et al., 2019; Wang et al., 2019). Multiple states and localities have enacted sale bans and other restrictions on flavored e-cigarettes and other tobacco products, but access to and use of flavored tobacco, particularly e-cigarettes, remains widespread at the national level (Chaffee et al., 2022b; Gaiha et al., 2022; Gentzke et al., 2022). While available evidence supports the effectiveness of flavor restriction policies locally, without comprehensive federal regulation, online and cross-border purchases can undermine local actions (Rogers et al., 2022).

Besides nicotine, various other substances can be vaped, including cannabis (marijuana). Vaping cannabis products has also become increasingly popular in recent years, notably among adolescents (Ben Taleb et al., 2020; Tai et al., 2021). Approximately one-third (34.5%) of U.S. 12th-grade students who consumed cannabis in 2018 did so by vaping, compared to 19.8% in 2016 (Tai et al., 2021). Emerging evidence suggests that added flavors in cannabis products, including in vaped liquids, are becoming more common and a potential contributor to youth appeal (Werts et al., 2021). In states where medical or recreational marijuana sales are permitted, restricting flavored products is rarely considered.

Pervasive use of flavored products among adolescents who use e-cigarettes is well documented (Chaffee et al., 2022b; Davis et al., 2021; Gaiha et al., 2022; Soneji et al., 2019; Wang et al., 2019), but few investigations attempt to quantify the influence of flavors on adolescents' willingness to vape, particularly among those who do not vape currently and for vape products containing non-nicotine substances. Discrete choice experiments are well suited to examine the independent contributions of certain product characteristics to potential consumers' perceptions or beliefs (Ryan, 2004). Typically embedded in a survey, a discrete choice experiment may ask participants to choose between two hypothetical products that vary in their attributes as a way of quantifying how each specific attribute affects participants' choices. In previous applications, discrete choice experiments have been

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used to show that adolescents prefer e-cigarettes with non-tobacco flavors (Shang et al., 2018) and relate non-tobacco flavors with lower e-cigarette danger and greater ease-of-use (Chaffee et al., 2020).

1.1. Objectives:

The present study expands on this prior discrete choice research (Shang et al., 2018) conducted before the emergence of pod and modern disposable e-cigarettes now popular among adolescents (Barrington-Trimis and Leventhal, 2018). Secondarily, this study extends this research framework to evaluate the potential contributions of flavors to adolescents' decisions to use vape products containing cannabis. Data are drawn from the initial wave of the Teens Nicotine and Tobacco (TNT) Project Online Survey (Chaffee et al., 2022a), a statewide survey of California adolescents, which included an embedded discrete choice experiment designed to assess the influence of device type, content, and flavor on adolescents' willingness to try a vape product. In addition, this study aimed to quantify the contribution of flavor to willingness to try vape products of different contents (i.e., nicotine, marijuana, and "just vapor") among adolescent who do not use e-cigarettes or cannabis. Note that while "cannabis" is used in this manuscript to refer to products derived from the cannabis plant, the more familiar term "marijuana" appeared in the TNT Project Online Survey and is used in the manuscript to refer to findings from survey data.

2. METHODS

2.1. Study Sample:

The TNT Project is designed to uncover and understand tobacco, nicotine, and cannabis product use behaviors, perceptions, and terminology among California adolescents ages 12–17 (Chaffee et al., 2022a). This information informs ongoing surveillance, messaging, and evaluation activities in California. The 2021–2022 TNT Online Survey was conducted in two cycles: summer (July-September 2021) and winter (January-February 2022). Only the summer cycle (N=2431) included the discrete choice experiment used for the present analysis. Participants were from a statewide non-probability sample recruited using online commercial panel aggregators. Participants affirmed being ages 12–17 years and residing in California and agreed to complete the survey in English or Spanish. Participants ages 12–13 years were recruited through invitations to their parents. Participants ages 14–17 years were recruited through parents or invited directly. While signed informed consent was not collected to conceal participant identity, a description of the study was provided, and participants answered two related comprehension questions before affirming their intention to continue. Incentive payments varied by panel but typically consisted of redeemable reward points or credits valued at $5 or less. The University of California San Francisco Institutional Review Board approved study procedures.

2.2. Discrete Choice Experiment:

Participants were presented with four pairs of randomly generated hypothetical vape products (in four separate, consecutive items) under a full factorial design and asked, "One of your best friends offers you these two vapes to try. Select which one you would be more willing to try." Each displayed vape was a hypothetical composite that differed at

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random in device type (disposable stick/bar, refillable pen), content (nicotine, marijuana, "just vapor"), and flavor (tobacco, no flavor, icy/frost/menthol, non-icy mint, fruit-ice combination, fruit, dessert/candy). Figure 1 shows an example choice-pair. Additional characteristics and levels were not tested to reduce cognitive burden and to assure that there would be numerous choice-pairs in which the content or flavor of each choice would be the same (see below). The option "neither of these" was also provided. Selecting either one of the vapes over neither was considered willingness to try, building on previously validated smoking susceptibility survey instruments (Evans et al., 1995; Pierce et al., 1996). While willingness has been considered a measure of tobacco use susceptibility among adolescents who do not use tobacco (Evans et al., 1995; Pierce et al., 1996), in this setting, it also represented a preference for one product over another based on product characteristics, thus maintaining relevance both for adolescents who use or do not use tobacco or cannabis. This item was tested for comprehension via cognitive interviewing with 12 California adolescents (6 interviews in English and 6 in Spanish).

Of the 2431 survey participants, excluded from the present analysis were 80 participants whose past 30-day e-cigarette or marijuana use status could not be ascertained and 9 additional participants who did not complete any discrete choice-pairs. The remaining 2342 participants (of whom 99.5% completed all four choice-pairs) yielded 9351 choice-pair selections for analysis.

2.3. Other Variables:

For e-cigarettes and marijuana, past 30-day use was defined as using the product at least one day in the past 30 days. Survey items related to e-cigarette use informed participants that the product "usually contain[s] a nicotine liquid that is vaporized and inhaled" and instructed participants not to consider vaped marijuana in their responses. Past 30-day marijuana use did not distinguish between smoked, vaped, or edible products. Other survey variables considered in this analysis were gender, age, race/ethnicity, and past 30-day use of any other tobacco product (i.e., not e-cigarettes). See Table 1 for covariable category specifications.

2.4. Survey Weights:

To enhance generalizability, two types of post-stratification survey weights were applied. Geographic-demographic weights used American Community Survey Public Use Microdata Sample files for California 2015–2019 to estimate cross-classified population count totals for sex, race/ethnicity, and California region for initial post-stratification weights. Raking was used to adjust the initial weights for sex, age, race/ethnicity, and California region to the full cross-classification of all post-stratification factors with the Rake_and_Trim_G4_V5 SAS macro (Izrael D, 2017) and SAS 9.4 (SAS Institute, Cary, NC). Trimming excessively large weights was unnecessary with raking converging in only two iterations. Data quality weights reduced the influence of potentially lower quality responses that may occur with online panel sampling (Miller et al., 2020). Quality measures within the survey included a ReCAPTCHA challenge, attention check, and location tracking. Eligible survey responses were assigned a probability of passing all quality checks using multivariable regression modeling using predictors such as time-of-day. The inverse of that probability was assigned as a quality weight. Responses failing minimum quality standards were excluded. Final

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survey weights were the product of geographic-demographic and quality weights (Chaffee et al., 2022a).

2.5. Statistical Analysis:

Conditional logistic regression was used to quantify the independent contributions of vape product characteristics to participants' willingness to try while maintaining the within-person matching of each choice-pair. A positive regression coefficient indicates how much the characteristic (e.g., flavor: fruit) increased the log-odds of selecting that product compared to reference (e.g., flavor: tobacco), holding all other characteristics constant. Negative coefficients indicate a characteristic independently decreased willingness to try. Models were estimated using generalized estimating equations to account for clustering of up to four choice-pairs per participant (exchangeable working correlation structure). Interaction terms were added to models to assess differences according to participant past 30-day use of e-cigarettes or marijuana (non-use, only e-cigarettes, only marijuana, co-use). Coefficients were considered statistically significant if 95% confidence intervals excluded the null value.

Secondary analyses aimed to quantify the contribution of vape flavors to the probability of selecting either of the displayed vape composites instead of neither. Selection of one of the composite products (i.e., not neither) was considered an indicator of willingness to try a product (any willingness). Choice-pairs were categorized according to the flavor options displayed (e.g., both choices fruit or sweet, both choices tobacco or unflavored). Generalized estimating equation logistic regression models for any willingness were fitted with flavor by e-cigarette/marijuana use status interaction terms and adjustment for gender, age, race/ethnicity, and other tobacco use. Adjusted marginal probabilities were generated using the margin command in Stata 16.1 (Statcorp, College Station, TX). To isolate further flavor effects from content effects, we examined the adjusted marginal probability of willingness to try a vape in choice-pairs where both vapes in the pair were identical in their content. Restricting analysis to choice-pairs of the same content decreased the sample size such that this analysis was only feasible among participants who did not use e-cigarettes or marijuana.

3. RESULTS

3.1. Participant Characteristics:

Table 1 shows survey-weighted characteristics of the study population. On average, participants who did not use e-cigarettes or marijuana were younger and less likely to use other (non e-cigarette) tobacco products than were participants who used e-cigarettes or marijuana. Compared to participants who used only e-cigarettes, participants who used only marijuana were more likely to be female and identify as Hispanic/Latino but less likely to use other tobacco products.

3.2. Discrete Choice Experiment, Main Findings:

The presence of flavors increased willingness to try a vape product in all groups; however, the specific flavors and product characteristics associated with willingness differed according to participant e-cigarette and marijuana use status (Figure 2). Participants who

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used marijuana preferred refillable devices over disposables. Participants who did not use e-cigarettes or marijuana were averse to trying a vape containing marijuana or nicotine; participants who used only e-cigarettes were disinclined to try a vape that contained marijuana; but participants who co-used e-cigarettes and marijuana preferred vapes with marijuana and vapes with nicotine over "just vapor" vapes (Figure 2). Fruit, fruit-ice combination, and candy/dessert flavors were associated with greater willingness among participants who did not use e-cigarettes or marijuana, and all flavors (including no flavor) were preferred over tobacco flavor among participants who used only e-cigarettes and participants who co-used e-cigarettes and marijuana (Figure 2). Participants who used only marijuana preferred no flavor, icy/frost/menthol, and candy/dessert flavors over tobacco flavor.

3.3. Any Willingness Probabilities by Flavor:

Participants indicated willingness to try one of the displayed vape products (i.e., did not selecting "neither") in 30.8% of completed choice-pairs (Table 2). After adjusting marginal percentages for gender, age, race/ethnicity, and other tobacco use, participants who did not use e-cigarettes or marijuana were the least likely to indicate willingness to try a vape (25.4%), while participants who co-used e-cigarettes and marijuana were the most likely (71.0%). Among participants who did not use e-cigarettes or marijuana, choice-pairs that included at least one fruit or sweet flavored vape option resulted in selection of a vape (any willingness) in 26.5% to 29.8% of choice-pairs, compared to only 13.9% of choice-pairs when both vape options were unflavored or tobacco flavor (Table 2).

3.4. Any Willingness Probabilities by Flavor and Content:

Among adolescents who did not use e-cigarettes or marijuana, the presence of flavors increased willingness to try a vape (i.e., not select "neither") regardless of whether that vape contained nicotine, marijuana, or "just vapor" (Table 3). For all content types, participants were more likely to select a vape to try when at least one of the choices was sweet or fruit flavored compared to both choices being unflavored or tobacco flavor (Table 3). For example, if both displayed vape choices were fruit or sweet flavored and contained "just vapor," non-using participants were willing to try a vape in 28.9% of choice-pairs, compared to 15.7% of tobacco/unflavored choice-pairs (Table 3).

4. DISCUSSION

In this study, adolescents were more willing to try a fruit, candy or dessert, fruit-ice combination, mint, or cooling flavored vape product than a tobacco flavored vape product, independent of vape device type and content. Flavors increased willingness to try a product among participants who did not use e-cigarettes or marijuana, those who only used e-cigarettes, and those who co-used e-cigarettes with marijuana. Although based on a hypothetical scenario, these results provide additional evidence that flavors encourage adolescent vaping (Harrell et al., 2017; Villanti et al., 2019) and add new evidence to suggest that flavors in cannabis products may also enhance adolescent appeal, a potential area for further research. While this study did not test a policy intervention directly, the findings

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imply that effective regulations to prohibit or remove access to flavored e-cigarettes would reduce adolescent interest in e-cigarette use.

Flavored tobacco product use continues to be highly common among adolescents nationally (Gentzke et al., 2022; Soneji et al., 2019), despite growing numbers of states and localities enacting restrictions on flavored tobacco sales (Gaiha et al., 2022; Rogers et al., 2022). In California, where two dozen localities had implemented some form of tobacco flavor ban by 2019 (Andersen-Rodgers et al., 2021), flavored tobacco products remain accessible to most adolescents (Zhu SH, 2021). Reducing youth access to flavored tobacco will require not only policy comprehensiveness in geographic coverage but also coverage of all flavors appealing to youth, including mint and cooling flavors, regardless of whether explicitly characterized as menthol (Davis et al., 2021; Leventhal et al., 2021). In 2020, the U.S. Food and Drug Administration announced its intention to prioritize enforcement against e-cigarettes of certain types and flavors but not disposable devices and not menthol (Food and Drug Administration, 2020). Subsequently, and along with e-cigarette maker Juul Labs 2019 decision not to market mint products, mentholated e-cigarette market share rose dramatically (Diaz et al., 2021), as did youth use of disposable e-cigarettes (Gaiha et al., 2022). Similarly, tobacco industry claims that newly marketed “synthetic” nicotine products are exempt from federal regulation (Jordt, 2021) underscore the importance of crafting policies that limit exceptions, loopholes, and opportunities for industry circumvention.

The prevalence of flavored cannabis product use among adolescents and the potential role of flavors in influencing cannabis use has been less extensively studied than flavored tobacco, including e-cigarettes. Cannabis products, including oils, wraps, and cannabis flower are often marketed using flavorful or fragrant descriptors (Luc et al., 2020). In a regional study of California high school students, 58% of participants who vaped marijuana reported vaping a flavored marijuana product (Werts et al., 2021). In the present study, participants who currently used only marijuana most preferred “no flavor” vapes, but cooling flavors and candy/dessert flavors also increased willingness to try.

In this discrete choice analysis, adolescents who did not use e-cigarettes or marijuana indicated greater willingness to use a vape product that contained “just vapor” as opposed to nicotine or marijuana. However, misperceptions and confusion among adolescents, particularly those with less knowledge about e-cigarettes, may result in adolescents using nicotine e-cigarettes but mistakenly believing that they are using a nicotine-free e-cigarette (Pepper et al., 2018). Clearer public communication on e-cigarette contents, including through warning and labeling requirements, could reduce youth interest in use.

The present findings affirm the results of earlier discrete choice experiments that showed adolescent preference for flavored e-cigarettes (Shang et al., 2018) and demonstrated that flavored e-cigarettes were perceived as less dangerous and with greater curiosity (Chaffee et al., 2020). The present results show that flavor preferences extend to cannabis-containing vape products. Estimated adjusted marginal percentages helped to quantify adolescents’ willingness to try a vape product under various scenarios.

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Using adjusted marginal percentages, the magnitude of the flavor effect was substantial. While participants who did not use e-cigarettes or marijuana were less likely than participants who currently used either or both products to indicate willingness to use, flavors (particularly fruit and sweet flavors) meaningfully increased their willingness, regardless of device content. Among participants who did not use e-cigarettes or marijuana that faced two hypothetical devices containing "just vapor," the presence of fruit or sweet flavors resulted in a near doubling of the probability of indicating willingness to try one of them compared to only tobacco or unflavored devices (29% vs. 16%). Similar increases in willingness to try fruit or sweet vape devices over tobacco or unflavored devices were also observed when both devices contained nicotine (21% vs. 4%) or both contained marijuana (18% vs. 6%). While not directly translatable to real-world tobacco initiation decisions, reductions in initial product trial of this magnitude would presumably result in large declines in adolescent product experimentation and subsequent use. Similarly, among participants who currently used e-cigarettes, flavors were strongly associated with product preferences. Participants who had used only e-cigarettes in the past 30-days indicated any willingness to try a hypothetical product in >70% of scenarios when a sweet/fruit option was presented but in just 42% of scenarios when only unflavored or tobacco options were shown, suggesting that eliminating flavors could also lead to less product appeal among adolescents who currently vape.

In November 2022, California voters passed a referendum allowing implementation of a statewide comprehensive ban on flavored tobacco products, including e-cigarettes (Ghafouri and Landaverde, 2022). The results of the present study suggesting that adolescents are less willing to try unflavored nicotine vapes is a promising indication that a statewide flavor ban would contribute to reduced tobacco use among youth.

Some limitations deserve consideration to contextual study results. Online panels rely on non-probability sampling, and although prior assessments suggest that commercial online panels are representative of the general population (Heen et al., 2014), the present results may not necessarily generalize to all California adolescents. Use of post-stratification weights should enhance the generalizability of this sample. The discrete choice experiments presented participants with hypothetical choices that do not account for all possible decision-making influences in a real-world situation. For instance, the brand, appearance, and nicotine concentration of the vape devices were not specified. However, making choices with only limited information is arguably not dissimilar from the tobacco initiation experiences of many adolescents (Couch et al., 2017; Less et al., 2021). All use behaviors were self-reported and not verified, although previous research supports the validity of measuring tobacco use in anonymous surveys (Ramo et al., 2011). Finally, adolescents who used marijuana in the past 30 days were not separated by method of use (e.g., vaped, smoked, or edible).

5. CONCLUSIONS

In this study, non-tobacco flavors in vape products increased the willingness of adolescents to try them. This finding applied to participants who were not currently using e-cigarettes or marijuana, regardless of whether a vape product contained nicotine, marijuana, or neither

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substance. Comprehensive bans on flavored vape products, including those containing nicotine or cannabis and covering all flavors, including mint and cooling flavors, would likely reduce adolescents' willingness to try and continue to use these products.

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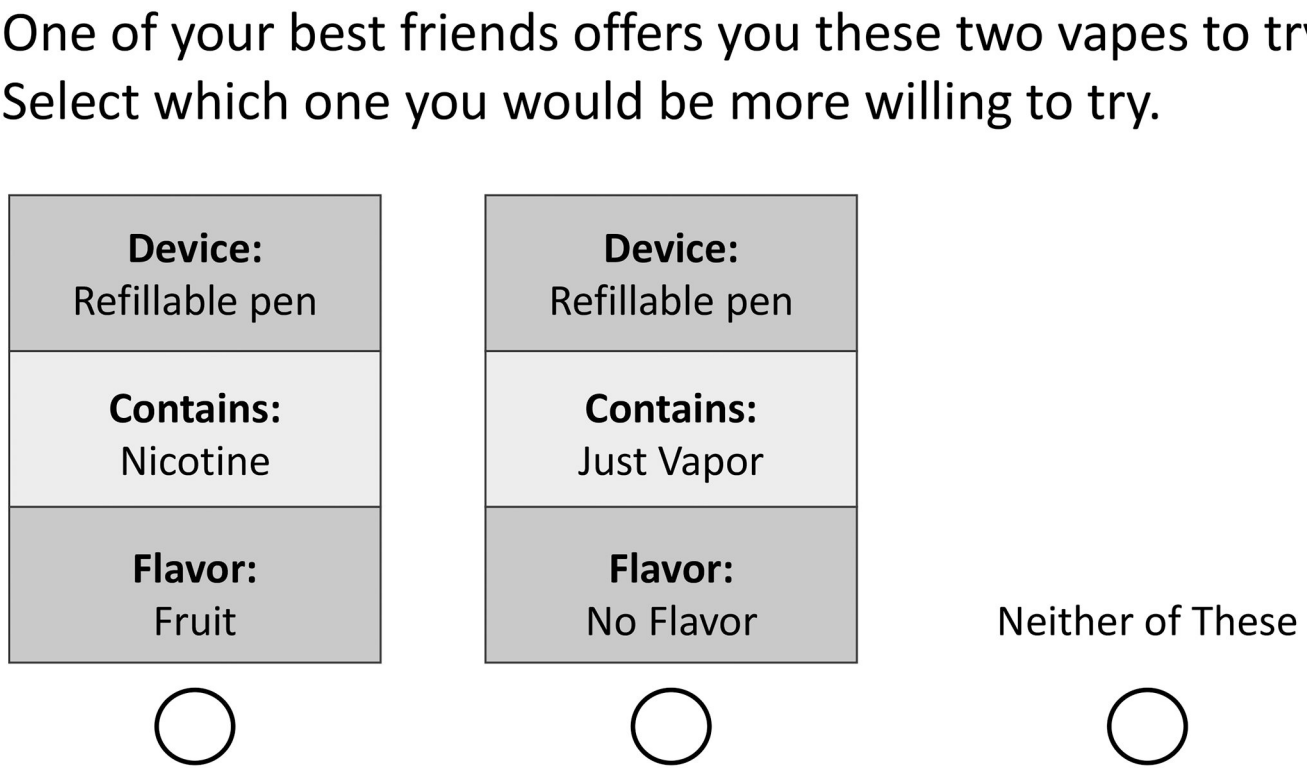

Figure 1. Example discrete choice item displayed to study participants

Figure displays a single choice-pair of hypothetical vape products displayed to participants. Participants were shown four such pairs of randomly generated hypothetical vape products in four separate, consecutive items. The characteristics of each composite product differed at random in device type (disposable stick/bar, refillable pen), content (nicotine, marijuana, "just vapor"), and flavor (tobacco, no flavor, icy/frost/menthol, non-icy mint, fruit-ice combination, fruit, dessert/candy). Prior to viewing the choice-pairs, participants were shown text stating, "Imagine that one of your best friends offered you some vapes to try. Your friend has more than one kind. The survey will mix and match some choices your friend could offer you. Sometimes, the survey might show options that are the same in some ways. For each question, select which one you would be more willing to try. If you would not try either one, you can choose neither of these." Figure image is simulated; actual survey items differed slightly in font and color.

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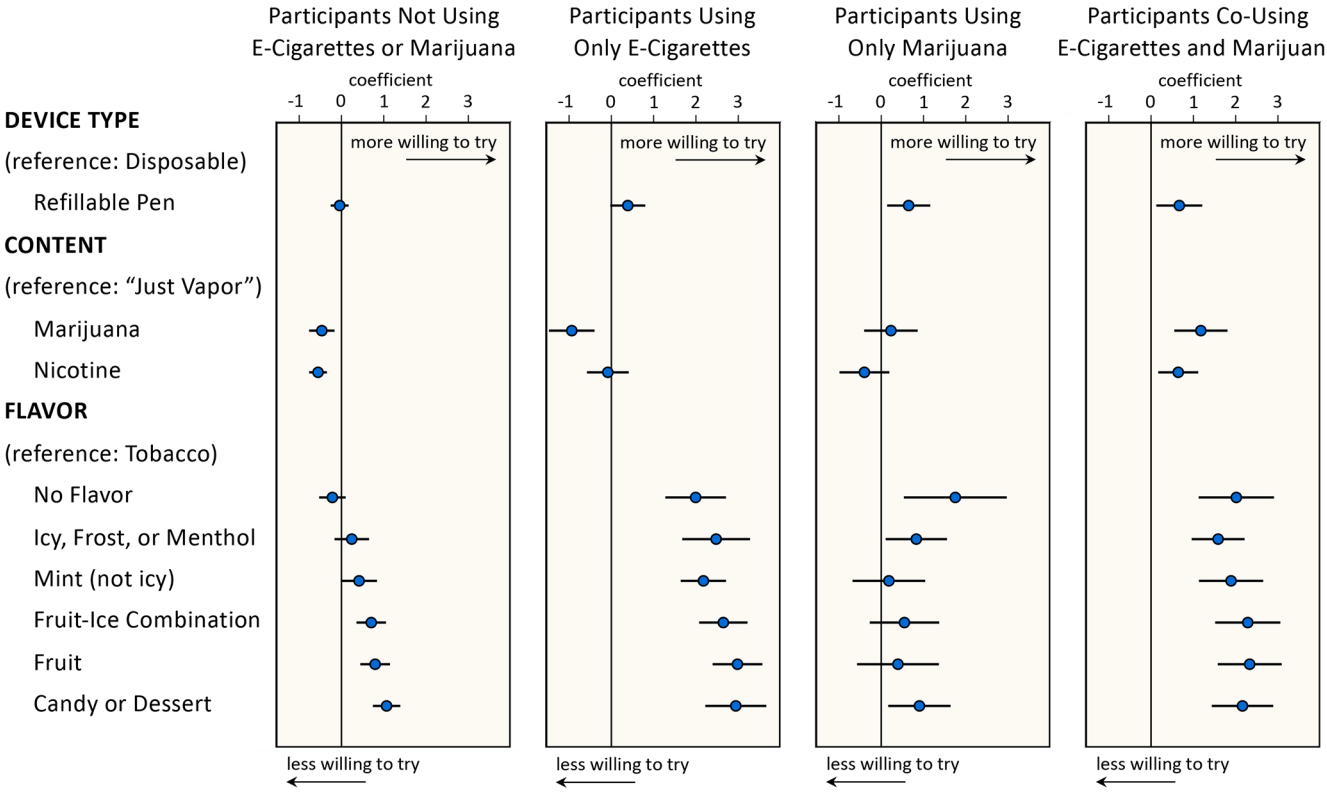

Figure 2. Adolescents' willingness to select a vape device, discrete choice experiment results

Figure displays coefficients from a conditional logistic regression model in a discrete choice experiment. Coefficient point estimates (filled dots) and 95% confidence intervals (horizontal lines) indicate how much the attribute level in question (e.g., flavor: fruit) increased or decreased the log-odds of a displayed vape product being selected relative to the reference level (e.g., flavor: tobacco), adjusted for all other displayed vape attributes. For each displayed choice-pair, participants were asked which they would use if a best friend offered. Positive values indicate characteristics (relative to reference) that independently contributed to greater probability of selection. Point estimates were considered statistically significant if 95% confidence intervals did not intersect with zero (the null value).

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Table 1.

Participant characteristics, California adolescents 2021

	Total Sample[1,2] N=2342 100%	**Participants Not Using E-Cigarettes or Marijuana N=1638 79.5%**	**Participants Using E-Cigarettes Only N=291 6.3%**	**Participants Using Marijuana Only N=113 7.0%**	**Participants Co-Using E-Cigarettes and Marijuana N=300 7.2%**
Gender, %					
Male	38.1	37.7	46.6	27.3	46.8
Female	59.3	59.8	53.4	67.3	50.2
Other identity[3]	2.6	2.5	<0.1	5.5	3.0
Age, %					
12–13 years	34.3	36.3	25.8	34.4	19.6
14–15 years	32.1	33.1	32.1	15.8	37.2
16–17 years	33.6	30.6	42.0	49.8	43.2
Race/Ethnicity, %					
Asian	12.1	13.7	14.7	1.0	2.7
Black	4.9	5.1	3.4	3.6	4.6
Hispanic/Latino	52.4	50.9	44.3	73.7	56.2
White	23.2	22.1	35.3	15.6	32.2
More than one race	5.4	6.0	2.2	3.2	4.1
Other[4]	2.0	2.2	0.2	2.9	0.3
Other Tobacco[5] Use, %					
Yes (past 30 days)	13.1	3.8	50.2	24.2	72.0
No (past 30 days)	86.9	96.2	49.8	75.8	28.0

1. Restricted to participants to complete ≥1 discrete choice-pair and with known e-cigarette and marijuana past 30-day use status

2. Samples sizes for each row variable may be less than the total due to missing data

3. Includes transgender, “something else,” and “I’m not sure yet”

4. Categories collapsed due to small sample size: Includes American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and “other”

5. Includes cigarettes, big cigars, little cigars or cigarillos, hookah, moist snuff, chewing tobacco, snus, nicotine pouches, nicotine tablets or lozenges, and/or heated tobacco products

Note: All percentages weighted for data quality and representation to the California age 12–17 population

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Table 2.

Any willingness to try a vape, by flavor choices and e-cigarette/marijuana use status

	Total Sample[1]		Participants Not Using E-Cigarettes or Marijuana[2,3]		Participants Using E-Cigarettes Only[2]		Participants Using Marijuana Only[3]		Participants Co-Using E-Cigarettes and Marijuana[2,3]	
Flavor Choice-Pair Displayed	**n[4]**	**%[5]**	**n[4]**	**%[5]**	**n[4]**	**%[5]**	**n[4]**	**%[5]**	**n[4]**	**%[5]**
All choice-pairs	8995	30.8	6290	25.4	1121	63.9	440	35.3	1144	71.0
Both Fruit/Sweet[6]	1688	33.0	1206	27.5	209	76.0	84	38.6	189	69.1
Fruit/Sweet + Minty[7]	2181	35.8	1497	29.8	284	81.5	116	45.2	284	73.7
Fruit/Sweet + Tobacco/ Unflavored[8]	2127	32.2	1512	26.5	240	70.5	102	40.5	273	74.5
Both Minty	748	28.5	519	21.9	114	69.4	25	33.2	90	61.8
Minty + Tobacco/Unflavored	1481	26.4	1034	23.1	174	50.1	69	12.8	204	58.2
Both Tobacco/Unflavored	770	21.1	522	13.9	100	41.6	44	31.3	104	69.9

1. N=2250 individuals and n=8995 choice-pairs with known e-cigarette and marijuana past 30-day use status and no missing covariable values

2. Past 30-day e-cigarette use status was based on responses to a survey item that described products that “usually contain a nicotine liquid that is vaporized and inhaled” and instructed participants not to consider vaped marijuana in their responses

3. Past 30-day marijuana use status was defined regardless of method of delivery (e.g., vaped, smoked, or edible)

4. Number of choice-pairs completed in each combination of flavor pairs and participant e-cigarette/marijuana use categories

5. Percent to select one of the two choice-pairs (i.e., “neither” not selected). Percentages are model-predicted from survey-weighted repeated measures generalized estimating equation logistic regression models adjusted for gender, age, race/ethnicity, and other tobacco product use

6. Fruit/Sweet flavor options: fruit, candy/dessert, or fruit-ice combination

7. Minty flavor options: mint or icy/frost/menthol

8. Tobacco/Unflavored flavor options: tobacco or no flavor

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Table 3.

Any willingness to try a vape, by flavor choices and content choices (participants who did not use e-cigarettes or marijuana)

			Choice-Pair Content					
	All Participants Not Using E-Cigarettes or Marijuana[1]		Both "Just Vapor"		Both Nicotine		Both Marijuana	
Flavor Choice-Pair Displayed	**n**[2]	**%**[3]	**n**[2]	**%**[3]	**n**[2]	**%**[3]	**n**[2]	**%**[3]
Both Fruit/Sweet[4]	1206	24.1	125	28.9	141	21.1	124	18.4
Fruit/Sweet + Minty[5]	1497	26.4	173	28.7	173	21.2	170	23.2
Fruit/Sweet + Tobacco/Unflavored[6]	1512	23.1	145	27.3	172	19.2	191	23.2
Both Minty	519	18.9	56	14.9	50	15.8	74	14.2
Minty + Tobacco/Unflavored	1034	19.9	139	22.5	116	11.1	127	19.7
Both Tobacco/Unflavored	522	11.7	56	15.7	58	3.9	58	6.2

1. N=1573 individuals (n=6290 choice-pairs) with no use of e-cigarettes or marijuana in the past 30-days and no missing covariable values

2. Number of choice-pairs completed in each combination of flavor pairs and participant e-cigarette/marijuana use categories

3. Percent to select one of the two choice-pairs (i.e., "neither" not selected). Percentages are model-predicted from survey-weighted repeated measures generalized estimating equation logistic regression models adjusted for gender, age, race/ethnicity, and other tobacco product use

4. Fruit/Sweet flavor options: fruit, candy/dessert, or fruit-ice combination

5. Minty flavor options: mint or icy/frost/menthol

6. Tobacco/Unflavored flavor options: tobacco or no flavor

Notes: Model predicted probabilities will differ between "participants not using e-cigarettes or marijuana" in Table 2 and Table 3 because marginal adjustment for gender, age, race/ethnicity, and other tobacco product use in Table 2 accounts for the total sample and Table 3 is restricted to participants not using e-cigarettes or marijuana. Dissimilar content choice-pairs (e.g., nicotine + marijuana) are not displayed in Table 3 to isolate flavor effects.