Characterizing the predictive validity of measures of susceptibility to future use of combustible, vaporized and edible cannabis products in adolescent never-users

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ABSTRACT

Background and aims The construct of susceptibility to substance use initiation (i.e. cognitive proclivity to future use) is critical for prevention efforts in adolescent populations. This study aimed to provide empirical evidence for the validity of the susceptibility construct for different cannabis products (i.e. combustible, edible or vaporized cannabis), and evaluate whether susceptibility measures are predictive of subsequent initiation. Design Prospective cohort study including baseline data (Spring 2015) and four follow-up surveys administered every 6 months through Spring 2017. Setting Ten schools in the Los Angeles, California metropolitan area. Participants Adolescents [n = 2100; mean age = 16.1; standard deviation (SD) = 0.41; 54% female] who reported never having used any cannabis product at baseline. Measurements We assessed five indices of a susceptibility to use cannabis composite index at baseline, adapted from a validated tobacco use index (intention to use, willingness, curiosity and positive/negative cannabis use outcome expectancies, with four response categories, definitely not [1] to definitely yes [4]), by cannabis product (combustible, edible or vaporized). A composite index was created for each product by averaging responses across the five susceptibility items. Subsequent initiation of use of each cannabis product was assessed at each follow-up wave. Findings Factorial validity for unidimensionality for each five-item index (by product) was confirmed. The composite index for susceptibility to cannabis use was greatest for combustible (mean = 1.44; SD = 0.58), moderate for edible (mean = 1.37; SD = 0.53) and lowest for vaporized cannabis (mean = 1.30; SD = 0.44). The associations of each composite susceptibility index with subsequent initiation of that product and each of the other cannabis products over follow-up (i.e. cross-product associations) were statistically significant, with hazard ratios ranging from 2.30 to 2.80 across 24 months of follow-up (all Ps < 0.05). Conclusions A five-item susceptibility to cannabis use composite index (by product) appears to be useful for characterizing and predicting youth at risk for cannabis use initiation across a spectrum of cannabis products.

Keywords Adolescents, cannabis, combustible cannabis, edible cannabis, measures, prospective cohort, susceptibility, vaporized cannabis.

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INTRODUCTION

The US cannabis policy landscape has changed substantially during the last two decades with the widespread legalization of medical and recreational cannabis use. Legalization and the corresponding commercialization of the cannabis industry has increased availability of a number of different types of cannabis products involving non-combustible methods of administration, which represent a rapidly growing sector of the cannabis market [1,2]. For example, vaporized cannabis products comprised of battery-powered devices capable of heating dry cannabis plant, cannabis oils or cannabinoid concentrates into inhalable aerosols have proliferated, and edible cannabis products, including commercially manufactured snacks, baked goods or candies infused with cannabis, have also become more widely available [2–7].
One of the chief public health priorities in responding to the evolving cannabis marketplace is the prevention of cannabis product use uptake among youth, including, in particular, of alternative cannabis products that may be used by youth unlikely to have otherwise smoked combustible cannabis [7,8]. Recent estimates indicate that while combustible cannabis remains the most commonly-used cannabis product among adolescents, an appreciable proportion of youth also use alternative cannabis products [1,9–11]. Methods to identify youth at risk for future initiation of alternative cannabis products may be vital for the prevention of adolescent cannabis use in the current policy landscape, particularly if alternative products are drawing in new, low-risk youth to cannabis product use. However, data on measures that can identify youth at risk of use of alternative methods of cannabis are lacking.

Survey-based measures of substance use ‘susceptibility’ have long been used to identify youth at risk for tobacco use initiation and have more recently been adapted to alternative tobacco products. Such measures aim to characterize malleable cognitive precursors to substance use uptake that can be targeted in prevention curricula, media campaigns or policy interventions [12,13]. Susceptibility questionnaire items are designed to tap varying levels across the continuum of susceptibility [e.g. responses ‘intention’ to use items may identify youth at the high end of the spectrum (i.e. with intention to use a product soon), while ‘curiosity’ about a substance may identify youth at the low end of the spectrum (i.e. may be open to using a product but have not set intentions to do so)] [12,14]. While youth susceptibility to initiation of combustible cannabis and other substances has been characterized, susceptibility to use of alternative cannabis products such as cannabis edibles or vaporized cannabis has not been previously investigated. Given the unique characteristics of alternative cannabis products [e.g. availability in flavors (vaping) or in common food products (edibles)] that may differentially appeal to youth unlikely to use combustible cannabis products, the evaluation of adapted measures is needed to better understand whether such measures hold utility for identification of at-risk, susceptible youth.

In the current study, we use data from a prospective cohort of adolescents in the Los Angeles metropolitan area to provide the first characterization of the susceptibility to initiation construct among combustible, edible and vaporized cannabis products in never cannabis users. Given evidence that socio-demographic differences in use are non-equivalent among different types of cannabis products [15,16], we additionally examine whether differences in susceptibility to each cannabis product differ by socio-demographic characteristics, findings of which are relevant to inform targeted population-specific prevention efforts. Finally, we examine the association of susceptibility indices with subsequent initiation of cannabis use across each product (combustible, edible and vaporized) over 24 months of follow-up.

METHODS
Design
To examine the primary aims of the study, we used longitudinal data from five waves of our prospective cohort of youth, collected every 6 months from 10th to 12th grade (Spring 2015–Spring 2017). We examined the prevalence of, and correlates with, susceptibility to cannabis use at the baseline wave (10th grade) among those who had not used cannabis products, and then examined prospective associations of baseline susceptibility with subsequent initiation of use of each cannabis product over the subsequent four waves (24 months) of the study.

Participants and procedures
Data were drawn from the Happiness and Health Study—an ongoing prospective cohort study of substance use in adolescence and early adulthood [17]. Students from 10 high schools in the Los Angeles, CA metropolitan area were recruited for participation in the study. Schools were selected on the basis of their student body’s diverse demographic characteristics and proximity to the study institution. Of the eligible 9th grade students enrolled in the participating schools in Fall 2013 (n = 4100), a total of 3396 (82.8%) provided assent and parental consent and were enrolled into the cohort. Paper-and-pencil surveys were administered on-site at participating high schools every 6 months from 9th to 12th grade (Spring 2017). We first collected information on use and susceptibility to use of edible and vaporized cannabis products in Spring 2015 (10th grade assessment), which served as the baseline in the current study. The current analytical sample included participants who reported no prior use of any cannabis product at the Spring 2015 (baseline) assessment (n = 2100). Of these students, 2088 completed at least one of the four semi-annual follow-up surveys over the subsequent 24 months [Fall 11th grade survey (n completed survey = 2028), Spring 11th grade (n = 1995), Fall 12th grade (n = 2008), Spring 12th grade (n = 212)], and were included in analyses of cannabis use initiation. The University of Southern California Institutional Review Board approved the study.

Measures
Susceptibility to combustible, vaporized and edible cannabis use
At the Spring 10th grade survey, separate five-item sets were used to assess susceptibility to each of three cannabis products [15] (a) combustible cannabis, ‘smoking marijuana (pot, weed, hash, reefer or bud)’, (b) edible cannabis,
ceptible of chotomized the susceptibility measures, where a response to cannabis use). In sensitivity analyses, we di-

ceptibility to cannabis use (i.e. no expectations of aversive effects from 1 to 4. The anticipated aversive effects item was reverse-coded such that higher scores represented lower susceptibility to cannabis use (i.e., no expectations of aversive responses to cannabis use). In sensitivity analyses, we dichotomized the susceptibility measures, where a response of 'definitely not/strongly agree' was considered 'not susceptible', and a response of 'probably not/disagree', 'probably yes/agree' or 'definitely yes/strongly agree' was considered 'susceptible'.

**Combustible, vaporized and edible cannabis product use initiation**

At each survey, participants reported whether they ever used combustible, edible and vaporized cannabis products (in separate items). Participants were considered to have initiated use of a product if they reported lifetime use at any follow-up wave. A composite variable was created to evaluate initiation of any cannabis product, where those who initiated use of combustible, edible or vaporized cannabis were considered to have ever initiated any cannabis product; those who had not initiated use of any of the three products were categorized as having not initiated any cannabis use.

**Socio-demographic characteristics**

At study enrollment, self-administered questionnaires completed by participants were used to assess age, gender, race/ethnicity [Asian, black/African American, Hispanic/Latino, white, multi-ethnic/multi-racial, other (selected either: American Indian/Alaska Native, Native Hawaiian/Pacific, or do not self-identify with any race/ethnicity categories provided)], highest parental education (i.e. ≤ 8th grade, some high school, high school graduate, some college, college graduate, graduate degree) and eligibility for free or reduced lunch (designated for students of families with incomes ≤ 185% the US poverty line). As in previous work [15], we defined high family socio-economic status (SES) as having met both of the following conditions: (a) parental education equal or higher than some college degree and (b) ineligible for free or reduced lunch (family income > 185% poverty line).

**Data analysis**

**Characterizing susceptibility in the overall sample**

The distribution of item-level susceptibility indicators (i.e. willingness to use, intention to use, curiosity, anticipated pleasurable effects, anticipated aversive effects) were first described for each cannabis product in the overall sample of never cannabis users at baseline. To create a composite susceptibility index, we used confirmatory factor (CFA) analyses to test the latent structure of covariance among the 15 items (five items × three products). We compared the fit of our proposed model based on prior research of susceptibility indices [12,14] (a three-factor model that includes one factor per product, i.e. separate composite susceptibility indices for each cannabis product) relative to two alternative models with plausible latent structures: (1) a single-factor model represented [i.e. a composite index based on 15 survey questions (five susceptibility items × each of the three products); Supporting information, Fig. S2] and (2) a five-factor model [i.e. a composite susceptibility variable across the three cannabis products, separately for each susceptibility indicator (intention, willingness, curiosity, positive anticipated effects, negative effects); Supporting information, Fig. S3]. To enhance model fit, we allowed the residuals for certain indicators to be correlated. As shown in Figs S1–S3 and Table S1, the three-factor model (i.e. using one composite susceptibility measure for each cannabis product) best fitted the data based on low root mean square error of approximation (RMSEA = < 0.08) [20], and high comparative fit index (CFI > 0.95) [21] and Tucker–Lewis Index (TLI > 0.95) [21]. The three-factor composite susceptibility to cannabis use index (created by taking the arithmetic mean of the respective item scores, separately by cannabis product) showed adequate internal consistency in the sample for each factor (Cronbach’s alpha: combustible = 0.76, edible = 0.73, vaporized = 0.65). In sensitivity analyses, we additionally created a composite index separately for each cannabis product based on the dichotomous susceptibility scores for each susceptibility item. CEs were conducted using Mplus 8 [22] with the TYPE = COMPLEX command to adjust for potential bias in standard errors (SE) and χ² computation due to the lack of independence between observations within schools. We also conducted all analyses using bootstrapping to correct for potential optimism.
bias in measures of predictive ability. Bias-corrected 95% confidence intervals (CIs) were computed using 1000 bootstrapped re-samples for each estimate, and the results remained unchanged.

To characterize within-person differences in susceptibility to use among cannabis products, the effects of product type (combustible versus edible versus vaporized) on item-level responses and the mean composite score (based on CFA results) were tested using Kruskal–Wallace and one-way within-participant analyses of variance (ANOVA), respectively.

**Demographic differences in susceptibility**

Generalized estimating equation (GEE) [23] linear regression models were used to test for demographic differences in cannabis use susceptibility composite scores. We modeled the association of each demographic characteristic (age, gender, race/ethnicity, SES) with each within-person cannabis susceptibility composite measure, including a random effect for participant ID to account for correlated outcome measures. We additionally evaluated whether the association of demographic characteristics with within-participant differences in susceptibility composite scores differed by product by including an interaction term for within-subject susceptibility × demographic characteristics.

**Association of susceptibility indexes with subsequent use initiation**

Cox regression models were used to test the association between each susceptibility composite score and time to first initiation of each product (i.e. within 6, 12, 18 and 24 months of baseline) among never cannabis users at baseline in separate models. All models were adjusted for demographic characteristics (age, gender, race/ethnicity, SES), and included school as a fixed effect. We assessed whether associations differed by school, by including an interaction term for susceptibility × school in all models; all P-values were > 0.25, indicating that there was no substantive difference among schools included in the analysis. Missing covariate data were accounted for using a multiple-imputation approach [24]. Five multiply imputed data sets were created, and the parameter estimates from the models tested in each imputed data set were pooled and presented as a single estimate. In sensitivity analyses, we examined the association of each susceptibility composite score with any initiation of each cannabis product by wave 8 using logistic regression models adjusted for the same demographic covariates among never cannabis users at baseline. Association estimates from GEE linear regression models and Cox regression models were reported as unstandardized regression weights (bs) and hazard ratios (HRs), respectively, with 95% CIs. Logistic regression models are reported as odds ratios (ORs) and 95% CIs. P-values from two-tailed tests were considered statistically significant after correction for multiple testing using the Benjamini–Hochberg procedure to maintain a study-wide false discovery rate of 0.05 [25]. Statistical analyses were conducted using SPSS version 23. The analysis plan for this paper was not preregistered; thus, all results should be considered exploratory.

**RESULTS**

**Descriptive results**

Students in the analytical sample were, on average, aged 16.1 [standard deviation (SD) = 0.41] years, 54% female, and diverse with regard to SES (46% high, 54% low) and race/ethnicity [Asian: 21.8%, black/African American: 4.3%; Hispanic: 42.9%; white: 17.3%; multi-ethnic/multi-racial: 6.7%; other race/ethnicity: 7.0% (other: American Indian/Alaska Native, n = 18, Native Hawaiian/Pacific, n = 95 or do not self-identify with any race/ethnicity categories provided, n = 32); see Table 1]. Compared to the analytical sample, students excluded from analyses were more likely to be low SES (54.4 versus 71.3%, P < 0.001) and Hispanic (42.9 versus 59.0%, P < 0.001), and less likely to be Asian (21.8 versus 8.2%, P < 0.001).

**Characterization of cannabis use susceptibility indices in overall sample**

**Within-product cross-item comparisons**

Overall, the distribution of responses for each item were positively skewed, with most students reporting little or no susceptibility (i.e. ‘definitely not’ or ‘probably not’ responses to intention to use items) and smaller but appreciable proportions of youth reporting higher levels of susceptibility (i.e. ‘probably yes’ or ‘definitely yes’; Table 2). Overall, mean susceptibility scores were successively greater for intention, willingness and curiosity items, which is consistent with the concept that intention to use taps the high end of the susceptibility continuum (most susceptible youth) and curiosity taps a lower end of the continuum. While expected aversive effect responses were still positively skewed, with more youth reporting definitely or probably yes to an expectation of experiencing aversive effects when using cannabis products, this indicator generated a more balanced distribution of responses, with approximately 24–27% of participants reporting probably or definitely not to expected aversive response.

**Composite susceptibility measure evaluation**

CEAs verified the appropriateness of the scoring algorithm of calculating the mean per item score among the five
susceptibility items for each product by demonstrating that a three-factor model (one factor per product, each represented by five unique susceptibility indicators with no item cross-loading) provided a superior fit relative to two alternative models (see Supporting information, Figs S1–S3, Table S1). With the exception of the expected aversive effects item, which had modest factor loadings (0.36–0.39), each of the other four indicators had factor loadings of 0.74 or higher on their respective product’s latent susceptibility factor. Cross-factor correlations were high (> 0.68), indicating that susceptibility to use of one cannabis product relative to each students’ respective peers corresponded to the susceptibility to use of the other products relative to peers.

Cross-product comparisons

Cross-product comparisons showed that in the overall sample, both the overall susceptibility composite score and individual mean scores within each item were highest for combustible cannabis use, moderate for edible products and lowest for vaporized cannabis for most indicators (see superscripts for estimates in Table 2), with small effect sizes for cross-product differences observed (0.07–0.14 differences in mean scores across the products).

Demographic differences in cannabis use susceptibility by product type

Overall, the composite susceptibility indices for each cannabis product were similar by gender, age and family SES, and in adjusted regression models these variables were generally not significantly associated with susceptibility to cannabis use averaged among the three products. Those of a Hispanic ethnicity (relative to Asian participants) reported higher levels of susceptibility on the composite index averaged across the three products ($b = 0.20$, $P < 0.001$; Supporting information, Table S2); no other differences by race/ethnicity were observed.

The difference in susceptibility to combustible versus vaporized cannabis products was significantly amplified in Hispanic and multi-ethnic youth versus Asian youth ($P < 0.05$; see Fig. 1). In addition, greater comparative susceptibility to edible versus vaporized cannabis was observed for females versus males, and for Hispanic, white, and multi-ethnic/multi-racial racial groups versus Asian youth. Few differences in susceptibility to combustible versus edible cannabis were observed, although the difference was again amplified in Hispanic versus Asian participants. We did not observe any significant relative differences in susceptibility among different cannabis products by SES.

### Association of cannabis use susceptibility with subsequent use initiation over follow-up

By the end of the 24 months of follow-up, the cumulative incidence of initiation of any product was 27.5% overall, and was highest for combustible (24.2%), followed by edible (16.8%) and vaporized (10.4%) cannabis (see Table 3). Susceptibility composite scores for each product type in 10th grade were significantly associated with time to initiation of cannabis use over follow-up for all products (see Table 4). The association estimates among all susceptibility measures (to each product) and for initiation of each product were relatively similar in magnitude—a 1-unit increase in mean susceptibility score was associated with a 2.2 to 2.9 greater hazards of initiation during follow-up. Results were similar when using a dichotomized (versus continuous) measure for each susceptibility item, with effect estimates ranging from 2.0 to 3.2 greater hazards of initiation associated with susceptibility. The effect estimates

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**Table 1** Demographic characteristics of participants included (versus not included) in the analytical sample.

<table>
<thead>
<tr>
<th></th>
<th>Analytical sample (n = 2100)</th>
<th>Excluded from analysis (n = 1077)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%) or mean (SD)</td>
<td>n (%) or mean (SD)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1131 (53.9%)</td>
<td>584 (54.2%)</td>
<td>0.85</td>
</tr>
<tr>
<td>Age</td>
<td>16.1 (0.4)</td>
<td>16.1 (0.4)</td>
<td>0.26</td>
</tr>
<tr>
<td>Low SES</td>
<td>995 (54.4%)</td>
<td>659 (71.3%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>451 (21.8%)</td>
<td>86 (8.2%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Black</td>
<td>90 (4.3%)</td>
<td>59 (5.6%)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>889 (42.9%)</td>
<td>621 (59.0%)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>359 (17.3%)</td>
<td>148 (14.1%)</td>
<td></td>
</tr>
<tr>
<td>Multi-ethnic/multi-racial</td>
<td>139 (6.7%)</td>
<td>68 (6.5%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>145 (7.0%)</td>
<td>71 (6.7%)</td>
<td></td>
</tr>
</tbody>
</table>

*a* Available sample size for the analytical sample is $n = 2090$ and for those excluded from analyses is $n = 1064$.

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Addiction
using the dichotomized measure were slightly higher for the association of susceptibility to combustible or edible cannabis with initiation of each cannabis product and slightly lower for the association of susceptibility to vaporized cannabis with initiation of each product relative to estimates using a continuous susceptibility measure, although differences were not statistically significant. Sensitivity analyses examining the association of susceptibility to cannabis with any initiation of each cannabis product by wave 8 were moderately stronger, with each 1-unit increase in mean susceptibility score associated with a 2.8 to 3.7-fold greater odds in the initiation of a cannabis product by wave 8 (Supporting information, Table S3).

**DISCUSSION**

Overall, students in the current study reported highest susceptibility to combustible cannabis, followed by edible cannabis, with lowest susceptibility reported for vaporized cannabis. The initiation rates across the sample followed a similar pattern—the rates of initiation were highest for combustible cannabis, followed by edible and vaporized
The association of susceptibility to a given product with subsequent initiation of that product was strong and observed for all products; moreover, susceptibility to any type of product was associated with similar odds of initiation of any product.

The higher rates of susceptibility and subsequent initiation of combustible cannabis versus edible or vaporized cannabis could be the result of a number of different factors. Combustible cannabis may be more accessible to youth than other forms of cannabis. First, combustible cannabis is more widely used than other forms [15,26–29], which could increase overall popularity and availability to youth who are generally unable to purchase such products legally. Combustible cannabis has also been on the legal (and illegal) market for a longer period of time than some alternative cannabis products (e.g. vaporized cannabis) [30,31]. Secondly, combustible cannabis may be easier to access than vaporized cannabis (due to relative prevalence of use); vaporized cannabis requires purchasing additional equipment for use (i.e. a vaporizer) and can be price prohibitive [32–34]. Finally, youth may be more interested in combustible cannabis for the high that is generated from use of that product versus other products. Youth have often reported adverse experiences with using edible cannabis products, which can be challenging to dose [35,36], easy to use in excessive amounts [6,36,37] which can lead to unpleasant psychological effects, [38,39] and the time between administration and peak effects is substantially longer for edible cannabis (30 minutes to 4 hours) than for combustible cannabis (a few seconds to 20 minutes) [35,40–42]. Despite differences in the prevalence of susceptibility and of initiation of all three cannabis products, use of each of the three cannabis products was not negligible and efforts should be made to target all cannabis products in prevention campaigns to prevent adverse consequences of cannabis use to the public health of youth.

The consistency of associations among all susceptibility measures and all products suggests that susceptibility measures targeted to a specific product may not be needed; an overall cannabis susceptibility measure may be as useful as individual measures in identifying youth at risk for subsequent initiation of any cannabis product. In national surveys with limited space for survey items, utilization of a single overall cannabis susceptibility measure may be sufficient. However, continued research is needed to understand how differences in susceptibility to different products may vary among subpopulations of youth. For example, the higher susceptibility scores among all products for Hispanic youth suggest that culturally tailored prevention messages aimed at reducing cannabis use in this population may have a substantial impact overall and in closing existing gaps in the public health of youth by ethnicity.

### Table 3  Cumulative percentage of use for each cannabis product at 6-, 12-, 18- and 24-month follow-up.

<table>
<thead>
<tr>
<th>Follow-up time-point</th>
<th>Combustible initiation</th>
<th>Edible initiation</th>
<th>Vaporized initiation</th>
<th>Any product initiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-month</td>
<td>4.1%</td>
<td>2.4%</td>
<td>1.9%</td>
<td>5.7%</td>
</tr>
<tr>
<td>12-month</td>
<td>11.0%</td>
<td>7.6%</td>
<td>3.7%</td>
<td>13.9%</td>
</tr>
<tr>
<td>18-month</td>
<td>16.3%</td>
<td>11.0%</td>
<td>5.7%</td>
<td>19.4%</td>
</tr>
<tr>
<td>24-month</td>
<td>24.2%</td>
<td>16.8%</td>
<td>10.4%</td>
<td>27.5%</td>
</tr>
</tbody>
</table>
Table 4  Associations of susceptibility to cannabis use with time to subsequent cannabis use initiation, by cannabis product.

<table>
<thead>
<tr>
<th>Association with initiation of respective cannabis product over 24-month follow-up, hazard ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Combustible initiation</strong></td>
</tr>
<tr>
<td>Susceptibility to combustible</td>
</tr>
<tr>
<td>Susceptibility to edible</td>
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<tr>
<td>Susceptibility to vaporized</td>
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</table>

**Continuous susceptibility measures**

<table>
<thead>
<tr>
<th>Dichotomous susceptibility measures</th>
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<tbody>
<tr>
<td>Susceptibility to combustible</td>
</tr>
<tr>
<td>Susceptibility to edible</td>
</tr>
<tr>
<td>Susceptibility to vaporized</td>
</tr>
</tbody>
</table>

*Results are from adjusted Cox regression models including the respective products susceptibility composite scores (range = 1–4; see Table 1 and Methods). Respondents’ demographic characteristics (i.e. age, gender, race/ethnicity, SES) and school fixed effects. All Ps < 0.001.*

Declarations of interests

None.

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Author Contributions

Jessica Barrington-Trimis: Conceptualization; funding acquisition; investigation; methodology; project administration; resources; software; supervision; visualization.

Dayoung Bae: Conceptualization; formal analysis; investigation; methodology; visualization. Sara Schiff: Investigation; project administration; visualization. Jordan Davis: Investigation; methodology; supervision; visualization.

Jennifer Unger: Investigation; methodology; project administration; resources; supervision; visualization. Adam Leventhal: Conceptualization; data curation; funding acquisition; investigation; methodology; project administration; resources; supervision; validation; visualization.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1 Model fit comparison
Table S2 Association of demographic characteristics with susceptibility to cannabis use

Table S3 Associations of susceptibility to cannabis use with ever use of cannabis by wave 8, by cannabis product.

Figure S1 3-Factor CFA of susceptibility to cannabis use by susceptibility indicators
Fig S2 Single factor CFA of susceptibility to cannabis use
Fig S3 5-factor CFA of susceptibility to cannabis use.