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Current Synthetic Cannabinoid Use among High School Seniors in the US

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Short Title: Synthetic Cannabinoid Use among Adolescents

Abbreviations: Synthetic cannabinoid—SC, Monitoring the Future—MTF, adjusted prevalence ratio—aPR, confidence interval—CI.

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Table of Contents Summary: This paper examines prevalence and correlates of self-reported current (30-day) use of synthetic cannabinoids among high school seniors in the US.

What's Known on This Subject: Synthetic cannabinoids are potent new psychoactive compounds which can result in adverse health outcomes and marijuana users are at high risk for use. Studies have examined use among high school students, but research is lacking regarding current (past-30-day) use.

What This Study Adds: This is the first nationally representative study to examine current use of synthetic cannabinoids. This study found that 3% of high school seniors reported current use and current users also tend to be current users of other drugs.

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3 **Contributor’s Statement**
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6 Joseph J. Palamar: Dr. Palamar conceptualized and designed the study, conducted the statistical
7 analyses, helped draft the initial manuscript, and approved the final manuscript as submitted.
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10 Monica J. Barratt, Leigh Coney, and Silvia S. Martins: Dr. Barratt, Mr. Coney, and Dr. Martins
11 helped draft the initial manuscript and helped interpret results. Dr. Martins mentored Dr. Palamar
12 regarding statistical analysis. All authors critically reviewed the manuscript, reviewed and
13 revised the manuscript, and approved the final manuscript as submitted.
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ABSTRACT

OBJECTIVES: This study examined the prevalence and correlates of current synthetic cannabinoid use among high school seniors in the US.

METHODS: Monitoring the Future, an annual nationally representative survey of high school seniors, began querying current (30-day) synthetic cannabinoid (SC) use in 2014. Data were examined from the two most recent cohorts (2014-2015; $N=7,805$). Prevalence of self-reported use was examined and differences in demographics and recency and frequency of other drug use was compared between current marijuana-only users and current SC (plus marijuana) users using chi-square and generalized linear model using Poisson.

RESULTS: 2.9% of students reported current SC use; 1.4% of students (49.3% of users) reported using on ≥ 3 days in the past month. SC users were more likely to report more recent (and often more frequent) use of LSD, cocaine, heroin, and/or nonmedical use of opioids compared to marijuana-only users. Compared to current marijuana-only users, SC users were more likely to report lower parent education ($P < .05$) and current use of a higher number of illegal drugs other than marijuana ($P_s < .001$). Students using SCs ≥ 10 times in the past month were more likely to be male ($P < .01$), black, frequent marijuana users, and users of multiple other illegal drugs ($P_s < .001$).

CONCLUSIONS: Current SC use is typically part of a repertoire of polydrug use, and is less prevalent among marijuana-only users. Current SC users are at heightened risk of poisoning from use of the newest generation of SCs and from concurrent drug use.

Synthetic cannabinoids (SCs) (a.k.a.: SC receptor agonists) form a heterogeneous group of psychoactive substances that bind to one of the two known cannabinoid receptors¹. While some of these compounds may resemble Δ^9 -tetrahydrocannabinol (THC), the main psychoactive component in marijuana, SCs with completely different chemical structures have been identified. There are at least 14 chemically-diverse families of SCs and they appear to be increasing in potency². The number of such compounds discovered has increased incrementally every year³. Although these compounds are commonly marketed as being similar to marijuana (often under names such as “Spice” and “K2”), the potency is 2–100 times stronger than that of marijuana⁴, and does not contain the anxiolytic and anti-psychotic component of marijuana—cannabidiol

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3 (CBD);⁵ therefore, these compounds typically do not mimic effects of natural marijuana as
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5 widely thought. SCs are sprayed onto dried plant matter, and sold as “herbal incense”, sold as
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7 “legal” marijuana labeled “not for human consumption”, or alternatively, are available as
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9 powders, and sold as “research chemicals”⁶.
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13 The high potency of SCs and over-activation of CB1 receptors are a likely cause of wide-
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15 ranging adverse effects commonly associated with use⁷. A systematic review of 106 studies
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17 recorded 4000 cases of SC use in medical literature and poison centre data. Common adverse
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19 effects included tachycardia (37–77%), agitation (16–41%), nausea (13–94%), generalized tonic-
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21 clonic seizures (4%–15%), 27 deaths, and psychiatric problems such as first-episode psychosis⁸.
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23 Additionally, SCs were analytically confirmed in cases of convulsions⁹, seizures¹⁰, acute kidney
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25 injury¹¹, acute cerebral ischemia,¹² and myocardial infarction¹³. The rate of emergency medical
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27 treatment (EMT) seeking following use has been estimated to be 30 times the rate of EMT
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29 following marijuana use¹⁴. In a study comparing presentations during emergency department
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31 visits, SC cases were found to have more “pronounced neurotoxicity and cardiotoxicity”
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33 compared with marijuana cases¹⁵.
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39 SC use has been found to be strongly associated with marijuana use¹⁶, with some studies
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41 reporting $\geq 95\%$ of past-year SC users reporting lifetime marijuana use¹⁶⁻¹⁸. Almost all past-year
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43 users have also been, or currently are, marijuana users,¹⁷⁻¹⁹ and a recent longitudinal study of
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45 adolescents found that marijuana use predicted SC use, but SC use did not predict marijuana use,
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47 suggesting marijuana use usually precedes SC use²⁰. In addition, frequency of marijuana use has
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49 been found to be one of the strongest correlates of SC use¹⁶. However, one study found that 93%
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51 of users preferred marijuana over SCs and users rated SCs more highly regarding negative
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53 effects¹⁷. While previous studies have shown robust associations between lifetime use of other
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3 drugs and past-year and lifetime use of SCs^{16,21}, more information is needed regarding how
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5 recency of use of other drugs relates to SC use in order to better inform prevention.
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8 The prevalence of SC use has been found to be relatively high in young US populations.
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10 A study examining data from Monitoring the Future (MTF), a nationally representative sample
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12 of high school students in the US, found that in 2011-2013, 10.1% of high school seniors
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14 reported past-year use of SCs, with 3% of high school seniors reporting more frequent use (used
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16 ≥ 6 times)¹⁶. A steady decline prevalence of past-year use among high school seniors has been
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18 observed, with 11.4% reporting use in 2011, and 3.5% reporting use in 2016^{22,23}; however, SCs
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20 still appear to be relatively attractive to some younger people, where past-year use in 2016 was
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22 reported by 2.7% of 8th graders, 3.3% of 10th graders, and 3.5% of 12th graders.^{22,24}
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27 Due to the potential harms associated with SC use, data on prevalence of use is necessary
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29 to understand which users are still at risk. To date, all national prevalence studies in the US have
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31 focused on lifetime²¹ or past-year use^{16,22}. Data on *current* use—commonly defined²⁵ by national
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33 surveys as use within the past 30 days—is needed to determine which individuals are at highest
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35 risk for use and more immediate adverse outcomes (since discontinuation is common with most
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37 individuals who had tried SCs in their lifetime or past year do not continue use)¹⁶. Current use is
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39 also an important focus because newer and more dangerous SC compounds continue to emerge²
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41 and poisonings related to use have remained prevalent^{26,27} despite decreasing prevalence of use.
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45 Thus, the aim of this paper is to determine risk factors for current use of SCs in a nationally
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47 representative sample of high school seniors with a particular focus on recency of use of other
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49 drugs. Since SC use is closely tied with marijuana use, we sought to differentiate risk of current
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51 SC users (who report marijuana use) from current marijuana users—a population at high risk for
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53 initiating SC use.
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Methods

Procedure

MTF is an annual nationally representative survey of high school students in the US²³. A different cross-section of students is surveyed each year, sampled from approximately 130 public and private schools throughout the 48 contiguous states. A multi-stage random sampling procedure is used in which geographic areas are selected; then schools within areas are selected, followed by classes within schools. About 15,000 high school seniors are surveyed every year, and students are surveyed via six different survey forms, which are distributed randomly. Only survey Forms 2 and 5, however, query current (30-day) use of SCs (neither of which query past-year or lifetime use). Therefore, current use is only assessed in about a third of the sample. MTF began asking about current SC use in 2014 and both available years of data (2014-2015) were aggregated for analysis. MTF protocols were approved by the University of Michigan Institutional Review Board (IRB) and these secondary analyses were exempt from review of the first authors' IRB.

Measures

Current SC use was assessed via the following question: "During the last 30 days, on how many occasions (if any) have you taken 'synthetic marijuana' ('K2,' 'Spice') to get high?" Answer options were: 1) none, 2) 1-2 days, 3, 3-5 days, 4), 6-9 days, 5) 10-19 days, and 6) 20-30 days. A dichotomous variable was coded, indicating whether 30-day use was reported and another was coded to indicate whether SCs were reportedly used on ≥ 3 days (vs. 0-2 days) to indicate higher-frequency use. Frequency of use was also recoded into a variable indicating use on 1-2 days, 3-9 days, and on ≥ 10 days. Students were also asked about lifetime, past-year, and

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3 current (past-30-day) use of various other drugs. A variable was coded to indicate current
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5 marijuana-only use vs. marijuana use plus current SC use. To determine recency of use of other
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7 drugs, lifetime, past-year, and 30-day use of alcohol, LSD, opioids (nonmedical use), cocaine,
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9 and heroin, were recoded to indicate 1) no lifetime use, 2) lifetime use but not past-year use, 3)
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11 past-year use but not 30-day use, and 30-day use. Variables were also coded to indicate
12
13 frequency of lifetime use of other drugs which were categorized into never used, used 1-2 times,
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15 and used ≥ 3 times, and a count variable was also coded to indicate number of illegal drugs used
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17 (currently) other than marijuana. To assess perception of risk associated with marijuana use,
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19 students were asked, “How much do you think people risk harming themselves (physically or in
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21 other ways), if they smoke marijuana occasionally?” Answer options were: 1) no risk, 2) slight
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23 risk, 3) moderate risk, 4) great risk, and 5) can’t say. On Form 2 only, students were also asked
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25 the same question regarding 1) risk of trying SCs once or twice, and 2) risk of using SCs
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27 occasionally. Dichotomous variables were coded to indicate “great risk”²⁴ (versus all other
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29 responses with “can’t say” coded as missing).
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37 Regarding demographic characteristics, students were asked their age (predefined by
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39 MTF as <18 vs. ≥ 18 years), sex, and race/ethnicity (predefined as black, white, and Hispanic).
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41 To examine parent educational attainment (a common indicator of socioeconomic status), the
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43 mean score for both parents (or a raw score if only one parent) was coded into tertiles
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45 representing low (1.0-3.0), medium (3.5-4.0), and high (4.5-6.0) education²⁸⁻³⁰. Coding of
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47 sociodemographic variables was based on previous MTF analyses and all have been shown to be
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49 correlates of drug use^{16,30-32}.
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55 *Statistical Analyses*

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3 Prevalence of self-reported use was estimated using all cases with SC data ($N = 7,805$).
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5 Each covariate was then examined in a bivariable manner, comparing demographic and other
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7 drug use characteristics between marijuana-only users and SC (plus marijuana) users using Rao-
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9 Scott chi-square tests³³. Characteristics for the full sample and for those not reporting current use
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11 of marijuana or SCs were also computed for descriptive purposes. All demographic and drug use
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13 covariates were then fit into a multivariable generalized linear model using Poisson and log link
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15 with current SC use (plus marijuana use) compared to current marijuana-only use as the
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17 outcome. Missingness was addressed in the model as in previous MTF analyses by entering an
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19 additional category for each covariate to prevent casewise deletion, and ensuring that results
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21 match those from a model utilizing the case-complete dataset.^{16,32,34,35} Bivariable tests were then
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23 repeated for each covariate, but comparing frequency of use of each other drug. Finally,
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25 bivariable tests were conducted to determine whether there were differences between covariates
26
27 according to frequency of current SC use. Bonferroni corrections were utilized when appropriate
28
29 for multiple comparisons. All analyses were design-based for survey data³⁶ using survey sample
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31 weights provided from MTF. Stata 13.1 software (StataCorp, College Station, TX) was utilized
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33 for all analyses.
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43 Results

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45 Current (30-day) SC use was reported by 2.9% of students and there was not a significant
46
47 difference in prevalence by year ($P = .73$). Eight out of ten (80.6%) SC users also reported
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49 current marijuana use, 91.1% reported past-year use, and 95.6% reported lifetime marijuana use.
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51 The 40 SC users who reported no current marijuana use were omitted from bivariable and
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53 multivariable analyses.
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3 Figure 1 presents the proportions of marijuana and SC users in the analytic sample.
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5 Nearly one in ten students (9.3%) reporting current marijuana use also reported current SC use.
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7 Table 1 presents sample demographics and self-reported drug use, as well as comparisons
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9 between current marijuana and SC (plus marijuana) use. Compared to current marijuana-only
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11 users, students reporting SC use were more likely to have parents with lower educational
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13 attainment ($P = .02$). Compared to marijuana-only users, SC users were more likely to report use
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15 and more recent/current use of each drug with exception of alcohol ($P_s < .01$). Specifically,
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17 compared to marijuana-only users, prevalence of current use of other drugs was substantially
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19 higher among SC users for LSD (14.8% vs. 3.4%), opioids (13.6% vs. 5.7%), cocaine (10.6% vs.
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21 3.3%), and heroin (5.9% vs. 0.1%). SC users were also more likely than marijuana-only users to
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23 report high perception of risk of using marijuana occasionally ($P < .01$), and less likely to report
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25 high perception of risk of trying SCs and using SCs occasionally ($P_s < .025$). Results were
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27 similar when examining these associations in a multivariable manner (Table 2). Specifically,
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29 compared to marijuana-only users, SC users had significantly lower prevalence of having parents
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31 with higher education ($P < .05$), and SC users had significantly higher prevalence of reporting
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33 current alcohol use ($P < .01$), and SC users also had increased prevalence of current use of
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35 number of other illegal drugs increased ($P_s < .001$).
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43 As shown in Table 3, compared to marijuana-only users, SC users were more likely to
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45 report use and more frequent lifetime use (used ≥ 3 times) of LSD (12.7% vs. 4.9%), cocaine
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47 (13.0% vs. 5.7%), and heroin (9.0% vs. 0.6%).
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50 Finally, among those reporting current SC use (Table 4), those reporting use on ≥ 10 days
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52 were more likely to identify as male ($P < .01$) or black ($P < .001$). Likewise, those reporting SC
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54 use on ≥ 10 days were also more likely to report current use of marijuana ≥ 20 times in the past
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3 month—with nearly half (48.9%) reporting such high-frequency marijuana use ($P < .01$). While
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5 8 out of 10 students reporting SC use on ≥ 10 days reported not using any of the four other illegal
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7 drugs in the past 30 days, the proportion reporting use of 2-4 other drugs grew as frequency of
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9 SC use increased ($P < .001$).
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12 13 14 15 **Discussion**

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17 This is the first nationally representative study to examine current (past-30-day) use of
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19 SCs. Other large-scale studies have focused on past-year and lifetime use, but research was
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21 needed on those at highest risk for immediate adverse outcomes—current users. Three percent of
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23 high school seniors in the US reported current use of these compounds and 1.4% of high school
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25 seniors reported using on ≥ 3 days in the past month (constituting half of current users). This
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27 finding is important because it implies that half of current users report using SCs more than once
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29 or twice, which may suggest more than just mere “experimentation”. In fact, a fifth of current
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31 users reported use on 20-30 days in the past 30 days, suggesting daily or almost-daily use. Males,
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33 black students, and users of various other drugs were identified to be at particular risk for
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35 frequent SC use. A previous study of past-year SC use in MTF found that black students were
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37 actually at lower risk for use (until controlling for other covariates)¹⁶. These findings suggest that
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39 risk profiles appear to be different for students who are trying SCs and for those who are using
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41 currently and/or frequently.
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48 This study corroborated previous studies in that SC use is closely tied to marijuana use¹⁶⁻
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50 ²⁰ with 8 out of 10 current SC users also reporting current marijuana use. This study also found
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52 that nearly half of frequent SC users reported using marijuana ≥ 20 times during the past month,
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54 further highlighting links between these drugs and suggests those who may be dependent on
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3 marijuana may be more likely to engage in frequent SC use. Since so few current SC users deny
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5 lifetime marijuana use, and a recent study found that marijuana use predicts SC use but not vice-
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7 versa²⁰, it is important determine which marijuana users are at risk for using these new
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9 potentially dangerous compounds. Results pertaining to other drug use suggest that current SC
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11 use appears to be part of a more extensive polydrug use repertoire involving other illegal drugs
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13 that are less prevalent among marijuana-only users. Temporal order of drug initiation could not
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15 be determined, but these associations suggest the need to target marijuana users who also use
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17 other drugs in order to help prevent initiation of SCs.
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22 While fewer SC users perceived that SC experimentation and occasional use are of great
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24 risk of harming themselves “physically or in other ways” (compared to marijuana-only users),
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26 SC users were more likely than marijuana-only users to report high perception of risk of using
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28 marijuana occasionally. This finding may indicate a lack of knowledge about the relative health
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30 risks of SC compared with marijuana. While marijuana itself is not risk-free, the current state of
31
32 the literature on SC-related harms clearly indicates that SC products are becoming more
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34 dangerous, as new generations of SC that are more potent and bind more heavily to cannabinoid
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36 receptors are replacing first and second generations². If there are students using SCs because they
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38 genuinely believe they are less risky than marijuana, this misconception should be addressed
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40 through better education programs stressing the greater danger posed by SC. It is possible,
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42 however, that the high perception of risk associated with marijuana use was regarding risk of
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44 arrest rather than direct health risks as marijuana is a Schedule I drug in the US. More research is
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46 needed to determine the extent to which marijuana users are likely to resort to SC use in order to
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48 evade arrest, or positive drug tests, or the stigma associated with use of illegal drugs.
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Limitations are noted. Current use was not queried among 8th or 10th graders and it was not queried on the same randomized survey forms that ask about past-year use. SC use was only queried on two of six survey forms. To help ensure generalizability of findings, we confirmed that there were no significant differences by any covariate between the survey forms used in these analyses and the other four forms that did not ask about current SC use. While other drugs queried have been validated in recent decades by MTF²⁴, a limitation is that current SC use is a new variable that does not appear to have been tested in other MTF analyses. Missing data was an issue, in part, because MTF surveys are administered via paper and pencil and MTF does not provide race/ethnicity data for students identifying as any race/ethnicity other than white, black, or Hispanic. This was addressed in our multivariable model similar to how this has been addressed in many previous analyses^{16,32,34,35}. Adolescents who dropped out of school were not surveyed, and given that this study was cross-sectional, temporal associations could not be examined. Since higher frequency (use ≥ 6 times) current SC use and lifetime use of other drugs was rare, models could not be used to examine associations in a multivariable manner with precision. The usual limitations applicable to survey studies also apply: that use is self-reported and therefore relies upon memory and may be affected by social desirability, and there was no analytic confirmation of self-report drug use.

Although prevalence of past-year SC use has been decreasing in recent years^{22,23}, we estimate that 3% of high school seniors have used in the past month. These are students who are at current risk of experiencing adverse health outcomes from the newest generation of SCs and also due to concurrent use of other drugs. While previous studies have found that marijuana users are at high risk for use, this study determined risk factors among current marijuana users that increase risk of current use and higher-frequency use of SCs. Prevention needs to focus primarily

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on marijuana users—especially marijuana users with risk factors discovered in this analysis.
Marijuana users who use other drugs in particular are at highest risk for currently using SCs so
particular focus needs to be paid to these individuals at high risk.

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TABLE 1 Bivariable Tests Examining Demographics and Recency of Use of Other Drugs According to Current Synthetic Cannabinoid and Marijuana Use

	Full Sample (N = 7,517), Weighted %	Used Neither (n = 5,851, 78.1%), Weighted %	Marijuana-Only (n = 1,502, 19.9%), Weighted %	Marijuana + Synthetic Cannabinoids (n = 164, 2.0%), Weighted %	<i>P</i> (Marijuana-Only vs. Marijuana + Synthetic Cannabinoids)
Age					.45
<18	43.1	43.1	43.3	39.7	
≥18	56.9	56.9	56.7	60.3	
Sex					.44
Male	46.5	45.0	51.7	55.5	
Female	53.5	55.0	48.3	44.5	
Race/Ethnicity					.06
White	66.4	66.2	68.0	57.1	
Black	14.8	15.0	13.7	15.9	
Hispanic	18.9	18.8	18.3	26.9	
Parent Education					.02
Low	30.7	29.9	32.2	45.0	
Medium	27.2	27.2	27.4	24.7	
High	42.1	42.9	40.4	30.3	
Recency of Other Drug Use					
Alcohol					.01 ^{a,b}
Never Used	35.0	43.1	6.7	3.0	
Lifetime, but not Past 12 Months	4.8	5.6	1.8	1.6	
12-Month, but not past 30 Days	23.5	24.4	21.1	10.6	
Past 30 days	36.7	26.9	70.4	84.8	
LSD					<.0001 ^b
Never Used	96.0	99.1	86.1	75.8	
Lifetime, but not Past 12 Months	1.4	0.5	4.9	1.9	
12-Month, but not past 30 Days	1.5	0.3	5.6	7.6	
Past 30 days	1.0	0.1	3.4	14.8	
Opioids (nonmedical)					<.01

Never Used	90.9	95.6	75.3	65.4	
Lifetime, but not Past 12 Months	3.5	2.2	8.5	6.5	
12-Month, but not past 30 Days	3.7	1.6	10.6	14.5	
Past 30 days	1.9	0.6	5.7	13.6	
Cocaine					<.001
Never Used	95.8	98.6	86.5	77.6	
Lifetime, but not Past 12 Months	1.8	1.0	4.6	6.0	
12-Month, but not past 30 Days	1.4	0.2	5.6	5.8	
Past 30 days	0.9	0.1	3.3	10.6	
Heroin					<.0001 ^b
Never Used	99.4	99.8	98.7	89.8	
Lifetime, but not Past 12 Months	0.3	0.1	0.7	2.7	
12-Month, but not past 30 Days	0.2	0.0	0.5	1.6	
Past 30 days	0.2	0.1	0.1	5.9	
Perceived Risk of Using Marijuana					<.01
Occasionally					
Not High	82.6	78.7	96.3	91.0	
High	17.4	21.3	3.7	9.0	
Perceived Risk of Trying Synthetic Cannabinoids ^c					.02
Not High	55.5	54.1	58.2	74.3	
High	44.5	45.9	41.8	25.7	
Perceived Risk of Using Synthetic Cannabinoids Occasionally ^c					<.01
Not High	45.2	44.2	46.1	67.1	
High	54.8	55.8	53.9	32.9	

Covariates in bivariable comparisons had missing data ranging from 0.0% to 5.1% with exception of race/ethnicity, which was missing 16.2% of cases as MTF does not provide this data for students identifying as races/ethnicities other than white, black, or Hispanic. Percentages reflect case-complete data for each comparison. The 40 students who reported current synthetic cannabinoid use, but no current marijuana use were excluded from these analyses. A Bonferroni correction was utilized for multiple testing for five drugs ($\alpha = .01$) and for multiple testing of perceived risk associated with synthetic cannabinoid use ($\alpha = .025$).

^a Alcohol use not significant when applying Bonferroni correction for multiple testing for five drugs ($\alpha = .01$)

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^b At least one cell contains small sample size (e.g., < 5 participants), but specificity test was conducted collapsing categories (e.g., no lifetime use and lifetime, but not past 12-month use) and p-values were identical

^c Perceived risk associated with SC use was only queried in half of the analytic sample

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TABLE 2 Multivariable Model Examining Correlates of Self-Reported Current Synthetic Cannabinoid Use.

	aPR	95% CI
Age		
<18	1.00	
≥18	1.03	0.72-1.47
Sex		
Male	1.00	
Female	0.93	0.65-1.35
Race/Ethnicity		
White	1.00	
Black	1.11	0.60-2.05
Hispanic	1.23	0.77-1.97
Parent Education		
Low	1.00	
Medium	0.76	0.48-1.20
High	0.63	0.40-1.00
Alcohol Use in Past 30 days		
No	1.00	
Yes	2.09	1.20-3.64
Illegal Drugs Other Than Marijuana		
Used 0	1.00	
Used 1	2.18	1.44-3.29
Used 2-4	3.57	2.12-6.02
Perceived Risk of Using Marijuana Occasionally		
Not High	1.00	
High	1.50	0.87-2.59

Current marijuana-only use was the comparison group to synthetic cannabinoid (plus lifetime marijuana) use. aPR = adjusted prevalence ratio, CI = confidence interval. Missing data indicators were included to account for missing data. Results were nearly identical for model of case-complete data.

TABLE 3 Bivariable Tests Examining Frequency of Lifetime Use of Other Drugs According to Current Synthetic Cannabinoid and Marijuana Use

	Full Sample, Weighted %	Used Neither, Weighted %	Marijuana-Only, Weighted %	Marijuana-Only + Synthetic Cannabinoids, Weighted %	<i>P</i> (Marijuana Only vs. Marijuana + Synthetic Cannabinoids)
Alcohol					
Never Used	34.9	42.8	6.7	3.0	.17
Used 1-2 Times	9.4	10.8	4.2	3.2	
Used 3 or More Times	55.8	46.4	89.1	93.8	
LSD					
Never Used	96.0	99.1	86.0	75.4	<.001
Used 1-2 Times	2.5	0.5	9.1	11.9	
Used 3 or More Times	1.5	0.4	4.9	12.7	
Opioids (nonmedical)					
Never Used	90.9	95.6	75.2	64.8	.03 ^a
Used 1-2 Times	4.0	2.4	9.4	10.8	
Used 3 or More Times	5.2	2.0	15.4	24.4	
Cocaine					
Never Used	95.8	98.6	86.5	76.9	<.01
Used 1-2 Times	2.5	1.0	7.8	10.2	
Used 3 or More Times	1.7	0.4	5.7	13.0	
Heroin					
Never Used	99.3	99.8	98.7	89.3	<.0001 ^b
Used 1-2 Times	0.2	0.1	0.7	1.7	
Used 3 or More Times	0.4	0.1	0.6	9.0	

A Bonferroni correction was utilized for multiple testing for five drugs ($\alpha = .01$)

^a Nonmedical opioid use not significant when applying Bonferroni correction for multiple testing for five drugs ($\alpha = .01$)

^b At least one cell contains small sample size (e.g., < 5 participants), but a specificity test was conducted collapsing categories (i.e., used 1-2 times and used 3 or more times) and p-value was identical

TABLE 4 Characteristics of Synthetic Cannabinoid Users According to Frequency of Self-Reported Current Use

	Used 1-2 Days (<i>n</i> = 122, 50.3%), Weighted %	Used 3-9 Days (<i>n</i> = 55, 20.4%), Weighted %	Used ≥10 Days (<i>n</i> = 57, 29.3%), Weighted %	<i>P</i>
Age				.72
<18	39.4	33.2	33.2	
≥18	60.6	66.8	66.8	
Sex				<.01
Male	47.2	64.5	77.9	
Female	52.8	35.5	22.1	
Race/Ethnicity				<.001
White	56.7	55.1	36.0	
Black	6.4	23.5	43.4	
Hispanic	36.9	21.3	20.6	
Parent Education				.36
Low	44.3	36.3	52.1	
Medium	25.8	38.1	17.2	
High	29.9	25.6	30.7	
Current (30-Day) Use of Other Drugs				
Alcohol				.87
No	27.6	23.0	28.3	
Yes	72.4	77.0	71.7	
Marijuana				<.01
Used 0 times	19.1	14.7	24.2	
Used 1-19 times	58.9	61.2	26.9	
Used 20 or more times	22.0	24.1	48.9	
Illegal Drugs Other Than Marijuana				<.001
Used 0	85.8	59.0	79.7	
Used 1	12.0	29.0	6.2	
Used 2-4	2.2	12.1	14.2	
Perceived Risk of Using Marijuana				.35
Occasionally				

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Not High	93.5	87.3	86.4	
High	6.5	12.7	13.6	
Perceived Risk of Trying Synthetic Cannabinoids				.36
Not High	81.0	62.4	72.7	
High	19.0	37.6	27.3	
Perceived Risk of Using Synthetic Cannabinoids Occasionally				.08
Not High	72.4	39.6	50.3	
High	27.6	60.4	49.7	

Current use of the four illegal drugs other than marijuana (LSD, cocaine, opioids, and heroin) were collapsed into a count variable to account for too few participants in some cells.

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