



A preliminary evaluation of synthetic cannabinoid use among adolescent cannabis users: Characteristics and treatment outcomes



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HIGHLIGHTS

- Heavy cannabis-using adolescents may be at increased risk of SC use.
- SC users report both positive SC subjective effects and adverse outcomes.
- SC users endorsed higher rates of cannabis use than SC nonusers.
- SC use was not associated with differential cannabis treatment outcomes.
- Rates of other psychoactive substance use did not vary by SC use.

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ABSTRACT

Little is known regarding the use of synthetic cannabinoids (SC), particularly use among adolescent substance users who may be at higher risk. The present exploratory study seeks to describe SC use and subjective effects among cannabis-using adolescents as well as compare the characteristics of cannabis users who do and do not use SC. Exploratory analyses evaluated cannabis treatment outcomes among SC users and non-users. Participants enrolled in a randomized, controlled intervention for cannabis-using high school students aged 14–19 ($N = 252$) completed questionnaires regarding their use of SC and other substances. Those who used SC in the past 60 days reported subjective effects of SC, consequences, and SC use disorder symptoms. Baseline characteristics, alcohol and other drug use, and treatment outcomes of SC users were compared to participants who never tried SC. Within this sample 29% had tried SC, and 6% used SC recently. Although most reported use at a relatively low rate, 43% of recent SC users reported SC use-disorder symptoms. Positive and negative subjective effects of SC were endorsed, with positive subjective effects reported more often. SC use was associated with more cannabis use, but not more alcohol or other (non-SC and non-cannabis) drug use. SC users did not differ from non-users on cannabis treatment outcomes. This exploratory study described SC use, and compared characteristics and treatment outcomes among SC users and non-users. Negative subjective effects of SC were reported as occurring less often, but SC use was associated with use disorder psychopathology. SC use was associated with more problematic cannabis use at baseline, but was not associated with use of other substances or differences in treatment outcome.

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Synthetic cannabinoids (SC) exploded into the market in the 2000s and mimic many of the psychotropic properties experienced in natural cannabis. Due to the similar effects that users experience, and the inability for standard drug tests to detect SC use, initial research suggests crossover between natural and synthetic cannabis users. Despite the

spike in SC popularity, little attention has been given to this substance and research into the short and long term consequences is scarce.

SC products are varied in their chemical composition and concentrations. This diverse group of substances (Dresen et al., 2010) is often referred to as *spice*, a popular brand when the drug emerged into more widespread public awareness (other street names include K2, Incense, Yucatan Fire, Genie, Moon Rocks, Zohai, etc.). Over 130 types of synthetic cannabinoids have been discovered (European Monitoring Center for Drugs and Drug Addiction, 2015). The current rate of SC use in the general public is difficult to ascertain, particularly because the substance is

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relatively new to the recreational market. Among those who report having tried SC, most endorse only occasional use. An anonymous online survey study found that approximately 17% percent of self-selected U.S. and U.K. adult respondents reported ever having tried SC (Winstock and Barratt, 2013). Among those who used SC within the past 30 days, one-third indicated they had used SC only once, while only 5% reported daily use (Winstock and Barratt, 2013). Epidemiological studies indicate that rates of use, at least among U.S. adolescents, have declined in recent years (Johnston, O'Malley, Miech, Bachman, and Schulenberg, 2015). For example, SC annual use prevalence among 12th graders fell from 11.4% in 2011 to 6% in 2014 (Johnston et al., 2015).

Rates of SC use among adolescents may continue to fluctuate as the legal status of SC and cannabis changes. As of March of 2011, the US Department of Justice placed the most commonly abused synthetic cannabinoids on the Schedule 1 list of the Controlled Substances Act (Drug Enforcement Administration, 2011). Additionally, in the last four years several states passed laws decriminalizing or legalizing recreational cannabis, notably recreational legalization in Colorado, Washington, Oregon, Alaska, and the District of Columbia. Changes in legal status of these substances may lead to significant regional variations in SC demand as well as rates of SC use, particularly among cannabis-using individuals. For example, SC use rates have declined following the federal ban (Johnston et al., 2015). It is possible that this decline in use may be more prominent in states in which recreational cannabis use is legalized, due to increased availability and permissibility of cannabis.

SC use can result in substance use disorders. For example, in a survey of U.S. adults with reported lifetime SC use (Vandrey, Dunn, Fry, and Girling, 2012), a significant minority of users reported symptoms consistent with SC abuse (37%) and dependence (12%). SC use is also accompanied by other drug and alcohol use, most notably cannabis (Vandrey et al., 2012; Winstock and Barratt, 2013).

Despite reported risks of SC use, few studies have investigated SC users, with even less exploration of SC use and consequences among adolescents (Castellanos, Singh, Thornton, Avila, and Moreno, 2011; Johnston et al., 2015). Although adolescents report relatively low perception of risk for experimental SC use (Johnston et al., 2015), they may be at greater risk for developing SC-related psychopathology than adult users. Furthermore adolescent substance users in particular warrant further attention as previous research has suggested that individuals who use other substances, especially cannabis and alcohol, may be at an elevated risk for SC use (Castellanos et al., 2011; Vandrey et al., 2012; Winstock and Barratt, 2013). Given that cannabis users are more likely to use SC, it is possible that SC users are more problematic users of cannabis.

If SC users are indeed more problematic cannabis users, such individuals may have differing cannabis treatment outcomes than those who do not use. No known study has evaluated this relationship. Additionally, no known study has investigated the subjective effects of SC among adolescent users. This investigation aims to fill a gap in the literature by describing SC use, subjective effects, and differences in cannabis treatment outcomes among a sample of heavy cannabis-using adolescents, thus informing future studies in this area.

Recent studies have also investigated the subjective effects of SC. Approximately 87% of adult respondents report experiencing a positive effect from SC use (e.g., feeling high), while 40% have reported negative or unwanted outcomes from use such as dry mouth, fatigue, lightheadedness, memory problems, and racing heart (Vandrey et al., 2012). Another study, which asked adult participants to compare the subjective effects of SC to natural cannabis, found the effects of SC are generally characterized as less pleasant than those of cannabis (Winstock and Barratt, 2013). However, subjective positive and negative experiences are rarely included in research. Serious negative effects of SC are documented within case studies which report adverse health effects, such as seizures or tachycardia (Harris and Brown, 2013;

Simmons, Cookman, Kang, and Skinner, 2011), as well as paranoia or psychotic symptoms (Every-Palmer, 2011; Harris and Brown, 2013; Oluwabusi, Loback, Aktar, Youngman, and Ambrosini, 2012; Simmons et al., 2011) and even mortality (European Monitoring Center for Drugs and Drug Addiction, 2015). The frequency at which these severe negative effects occur is unknown.

This paper used baseline data from the Teen Marijuana Check-Up-4 (TMCU), a recently completed randomized controlled trial in Seattle, Washington, aimed at motivating change in cannabis use within a voluntary sample of cannabis-using adolescents. Given the reports of SC use among cannabis users (Vandrey et al., 2012; Winstock and Barratt, 2013), it was expected that cannabis users would be more likely to use SC and experience negative consequences associated with use. The sample of cannabis-using adolescents, 75% of whom met diagnostic criteria for a cannabis use disorder, was also expected to be more likely to develop psychopathology related to SC use. This preliminary study had three goals: (1) to describe SC use and characteristics and subjective experiences of SC users in a sample of at-risk teen cannabis users; (2) to compare SC users to non-users on demographic variables, cannabis use and related problems, and perceived need for substance use treatment; and (3) to explore differences in cannabis treatment outcomes among SC users and non-users.

1. Methods

The parent trial was designed to evaluate the efficacy of adding check-ins to a Motivational Enhancement (MET) intervention for cannabis-using adolescents (Walker et al., submitted manuscript, 2016). Procedures were approved by institutional review boards at the University of Washington (UW HSD # 41405) and Virginia Tech (VT IRB # 10-556).

1.1. Participants

Participants were recruited from six high schools within the Seattle, Washington area. A total of 668 adolescents expressed interest in the study. Eligibility criteria included being at least 14 years of age; cannabis use on 9 or more days of the past 30; enrollment as either a freshman, sophomore, or junior; availability to complete follow-ups; and absence of a major medical or psychiatric condition that would impact participation. Of the 460 individuals who attended a screening appointment, 15 (3%) decided not to participate. An additional 178 were determined to be ineligible for a variety of reasons including using cannabis fewer than 9 days of the past 30 ($n = 154$; 34%), not being available to participate for the next year ($n = 27$; 6%), and a medical or psychiatric condition which would prevent participation ($n = 3$; 0.7%). In addition, students in their senior year of high school ($n = 19$; 4%) were excluded because they would not be in school to participate in all of the check-ins, resulting in 252 participants interested and eligible to participate in the trial. Participants ranged in age from 14 to 17 (mean = 15.84; $SD = 0.96$) and were cannabis users, smoking an average of 37.07 days of the 60 preceding baseline ($SD = 15.06$). The majority of the sample (75.0%) met diagnostic criteria for a cannabis use disorder. The sample was predominantly male (68%). Participants were primarily Caucasian (59%), while 19.8% identified as multi-racial, 6.0% African American, 4% identified as Asian, and 11% identified as other. Additionally, 10% of the sample identified as Hispanic or Latino.

1.2. Procedures

Adolescent cannabis users were recruited in Seattle area high schools via classroom presentations, lunch room information tables, and referrals from school staff or friends. The study was described as an opportunity to discuss and receive feedback about their cannabis use. All screening, baseline assessments, and intervention sessions took place in the schools. Students were able to express interest in the

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