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Use of synthetic cathinones and cannabimimetics among injection drug users in San Diego, California

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Abstract

Background—Use of synthetic cathinones (SC) and cannabimimetics (i.e., “THC homologues” [TH]) is associated with adverse health effects. We investigated the epidemiology of synthetic drug use among a cohort of injection drug users (IDUs) in San Diego, California.

Methods—We used logistic regression analysis to identify correlates of SC and TH use among 485 IDUs enrolled from June 2012 to September 2013.

Results—Seven percent of participants reported ever using SC and 30% reported ever using TH. In multivariate logistic regression, age and recent hospitalization were significantly associated with odds of SC use (Adjusted Odds Ratio [AOR] 0.93, 95% Confidence Interval [C.I.] 0.90, 0.97; and AOR 2.34 95% C.I. 1.00, 5.49, respectively) and TH use (AOR 0.96, 95% C.I. 0.94, 0.98; and AOR 2.62, 95% C.I. 1.47, 4.68, respectively). Use of methamphetamine (AOR 9.35, 95% C.I. 1.20, 72.79) and club drugs in the past six months (AOR 3.38, 95% C.I. 1.17, 9.76) were significantly associated with SC use. Being on probation/parole (AOR 2.42, 95% C.I. 1.44, 4.07), initiating injection drug use with stimulants (AOR 1.89 95% C.I. 1.13, 3.16), and past six-month marijuana (AOR 9.22, 95% C.I. 4.49, 18.96) and prescription drug use (AOR 1.98, 95% C.I. 1.20, 3.27) were significantly associated with TH use.

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Contributors

Author Wagner designed and conducted the statistical analysis and wrote the manuscript. Authors Armenta, Roth, and Garfein provided input on the statistical analysis and feedback and comments on the manuscript. Author Maxwell provided substantive expertise in the formulation of the analysis, and feedback and comments on the manuscript. Authors Armenta and Cuevas-Mota assisted in data collection and were integral to the design and implementation of the study. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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Conclusions—A considerable proportion of IDU use synthetic drugs and may experience harms associated with their use. Findings have implications for criminal justice system management. Prevention efforts should emphasize the risks associated with rapidly changing synthetic formulations, and the potential harms associated with polydrug use.

Keywords

synthetic drugs; cathinones; cannabimimetics; injection drug use

1. INTRODUCTION

In recent years, synthetic drugs of abuse have emerged as a significant public health issue in the U.S. and elsewhere (European Monitoring Centre for Drugs and Drug Addiction, 2013; Maxwell, 2014). While a multitude of synthetic chemicals are available, two primary classes have increasingly become the focus of concern: (1) synthetic/substituted cathinones (SC) and (2) synthetic cannabinoids/cannabimimetics, or “THC homologues” (TH).

Both SCs and THs are typically synthesized as legal compounds and are sometimes referred to as “legal highs” or products labeled “not for human consumption.” SCs have been marketed under monikers such as “bath salts” and “plant food,” while THs are sometimes referred to as “herbal smoking blends,” “incense,” or “synthetic marijuana” (Bruno et al., 2012; European Monitoring Centre for Drugs and Drug Addiction, 2013; Fattore and Fratta, 2011). Since 2012, the US Controlled Substances Act has included some synthetic compounds as Schedule I substances, and emergency scheduling guidelines continue to evolve (US Drug Enforcement Administration, 2014b). However, because of the rapidly changing composition of the ingredients and ability for chemists to manufacture chemical homologues that are functionally similar but not chemically identical, the regulation of these drugs is an ongoing challenge (Maxwell, 2014).

SCs are stimulant-type psychoactive synthetic drugs. Common active ingredients include: 3,4-methylenedioxypyrovalerone (MDPV), 4-methyl-*N*-methylcathinone (mephedrone), 3,4-methylenedioxy-*N*-methylcathinone (methyline), ethcathinones, methcathinones, and flouroamphetamines (Gershman and Fass, 2012; US Drug Enforcement Administration, 2014a). SCs are typically administered orally, or via inhalation (insufflation/snorting) or injection (Karila and Reynaud, 2011; NIDA, 2012b). They have central nervous system stimulant and hallucinogenic effects and have been compared to other stimulants such as cocaine, MDMA, and amphetamines, depending on the compound (Baumann et al., 2012; Gershman and Fass, 2012; Winstock et al., 2011a, 2011b). Repeat exposures to chemical compounds in SCs may have addictive potential (Aarde et al., 2013a, 2013b; Baumann et al., 2012; Winstock et al., 2011a). Clinical effects include: cardiovascular effects (e.g., tachycardia, chest pain); rhabdomyolysis; organ failure; neurological symptoms; psychiatric effects including violent behavior, paranoia, suicidal ideation, hallucinations/delusions, anxiety, and panic attacks; and death (Carbone et al., 2013; Gershman and Fass, 2012; Murray et al., 2012; Wyman et al., 2013; Zawilska and Wojcieszak, 2013).

THs can contain a variety of synthetic compounds, including: cannabicyclohexanol; JWH-018, -019, -073; AM 2201; RCS-4; AKB48; STS-135; AB-PINACA; FUB-PB-22;

XLR-11; UR144; and PB-22 (US Drug Enforcement Administration, 2014a). These chemicals are functionally similar to delta9-tetrahydrocannabinol (THC), the active ingredient in marijuana, and are sprayed onto dried, shredded plant material that is smoked (Fattore and Fratta, 2011; NIDA, 2012a). Clinical effects include: nausea; cardiovascular effects (e.g., tachycardia, chest pain); and psychiatric effects including anxiety, agitation/panic attacks, paranoid ideation, suicidal ideation, and hallucinations (Fattore and Fratta, 2011; Thomas et al., 2012; Wells and Ott, 2011). THs may also lead to physical withdrawal and dependence (Zimmermann et al., 2009). Though more rare than with SCs, fatal effects have also been reported (Fattore and Fratta, 2011). THs mimic the effects of THC, but when new variations are created they are usually not detectable using a drug test for cannabis (Berry-Cabán et al., 2012). Therefore, some users seek THs as a substitute for cannabis in order to avoid detection (Maxwell, 2014; Perrone et al., 2013).

To date, little is known about the characteristics of individuals who use synthetic drugs and/or their rationale for use, since the majority of data have been obtained through clinical case reports from Emergency Departments or Poison Centers (e.g., Berry-Cabán et al., 2012; Centers for Disease Control and Prevention, 2013; Jinwala and Gupta, 2012; Maxwell, 2014; Schneir et al., 2011; Thomas et al., 2012). Current knowledge about SCs comes mostly from research among people associated with the “dance music” or “party” scenes. In these studies, SC use has been associated with: sexual minority status, use of other psychedelic and inhalant drugs, and risky behaviors such as binge use and unprotected sex (Bruno et al., 2012; Kelly et al., 2013). Reports of drug use practices among men who have sex with men (MSM) in the United Kingdom include use of mephedrone (an SC) along with other psychoactive substances, including methamphetamine and MDMA, which may contribute to elevated risk for HIV infection (Hunter et al., 2014; Kirby and Thornber-Dunwell, 2013).

Current information about TH use comes mostly from studies among school-aged youth, criminal justice system-involved individuals, and internet users around the world. In these studies, TH use is associated with younger age, polydrug use, and a desire to avoid testing positive for cannabis (Schifano et al., 2009; Vandrey et al., 2012; Wish et al., 2013). School-aged youth participating in the US Monitoring the Future survey reported lower perceptions of harm associated with synthetic drugs compared with other drugs (Johnston et al., 2013).

The European Monitoring Centre for Drugs and Drug Addiction (2013) has voiced concern that injection drug users (IDUs) are using synthetic drugs as a substitute for traditional drugs of abuse (e.g., heroin). IDUs may be at particularly elevated risk for the adverse health effects of synthetic drugs, for at least three reasons. First, use and injection of synthetic drugs may exacerbate injection and non-injection-related consequences. For example, injection of SC has been associated with soft tissue damage such as cellulitis, abscesses, and infection with necrotizing fasciitis (Dorairaj et al., 2012; Russo et al., 2012; Zawilska and Wojcieszak, 2013). The limited available data also suggest that polydrug use (i.e., sequential or simultaneous use of different drugs) is common among users of synthetic drugs (Bruno et al., 2012; Van Hout and Bingham, 2012; Vandrey et al., 2012), and polydrug use is known to be associated with more severe drug dependence, overdose, and HIV/STI risk (Coffin et al., 2003; Lankenau and Clatts, 2005; Leri et al., 2003; Peters et al., 1998). Second, since

they are already established in their drug-using careers, IDUs may have rationales for and experiences of synthetic drug use that differ from those who are newly initiated or who do not use other illicit drugs. Third, IDUs are known to be at risk for HIV via the use of contaminated injection supplies (Garfein et al., 1996), and the stimulant and euphoric effects of synthetic drugs may contribute to behaviors that put users at even greater risk for HIV and other bloodborne and sexually transmitted infections (Bruno et al., 2012; Shoptaw et al., 2013).

Given the ongoing clinical and public health concern over the use of synthetic drugs, the aims of the current study were to (1) investigate the prevalence of synthetic drug use, (2) identify behavioral and demographic correlates of use, and (3) describe the rationale for use and behavioral and health consequences of SC and TH use in a sample of IDUs.

2. METHODS

2.1. Sample

Data for the current study were drawn from the baseline interview of an ongoing longitudinal study of IDUs recruited in San Diego, California. A full description of the study methods is available elsewhere (Robertson et al., 2014). Briefly, a convenience sample of IDUs was recruited through street- and venue-based outreach, targeted advertising, flyers, and peer referrals. Eligibility criteria included: (1) being at least 18 years of age, (2) having evidence of injecting illicit drugs in the past 30 days (confirmed by observation of injection stigmata or other physical evidence of injecting), (3) being able to converse in English or Spanish, (4) living in San Diego with no plans to move in the next 2 years, and (5) not currently participating in any intervention studies. Participants completed a brief eligibility screener administered by study staff in a private location. Eligible individuals were invited to participate and provided written informed consent. The Institutional Review Board of the University of California San Diego approved all study procedures.

2.2. Measures

Data were collected using interviewer-administered Computer Assisted Personal Interviews (CAPI) on a laptop computer. Use of SCs and THs was assessed with two questions that asked about any lifetime use. Because these drugs can contain a variety of chemical compounds and are known by a range of different brand names, we provided examples of brand names and chemicals that were common at the time of assessment (2012–13). For example, the question assessing SC use asked, “Have you ever used bath salts/synthetic cathinones (e.g., mephedrone, MDPV, methylone)? They are sometimes known by brand names like Vanilla Sky, Purple Wave, or Bliss. They might also be called plant food.” The question assessing TH use asked, “Have you ever smoked synthetic cannabinoids? (e.g., Spice, K2, Genie, etc.) They are also known as ‘synthetic THC’ or ‘synthetic marijuana.’”

Among those who reported use of SCs and THs, we assessed: (1) age at first use, (2) what other drugs have similar effects (check all that apply), (3) route of administration (SC only), (4) whether the user had ever been hospitalized or sought medical care due to the effects of the drug, (5) the source from which the respondent obtained the drugs (response options included: internet, friends/acquaintances, sex partners, strangers, family members, adult

store, gas station or convenience store, head shop, drug dealer, other), (6) rationale for first use (response options included: curiosity, to avoid testing positive on a drug test, to avoid the legal risks associated with using other drugs, to use something safer than other drugs, because this drug was more available than other drugs, because this drug was less expensive than other drugs, and other, which was later further categorized into two additional options [thought they were a different drug and peer influence]), and (7) whether the respondent believes that the drugs are legal in California. Each of the questions was asked separately for SCs and THs.

The questionnaire also included basic demographic items, including: age, sex, sexual orientation, race/ethnicity, homelessness status, experiences with the criminal justice system (parole/probation), and other drug use in the previous six months. Additionally, we asked about drug first injected, receptive syringe sharing in the past six months, experience of a non-fatal drug overdose in the past six months, the number of regular and/or casual sexual partners, and condom use with those partners. Two questions assessed healthcare utilization: receipt of medical care in an emergency room (ER) in the past six months and hospitalization for any reason in the past six months.

Participants provided blood samples that were tested for HIV and hepatitis C virus (HCV) infection, as described elsewhere (Robertson et al., 2014), and received pre- and post-test counseling according to US Centers for Disease Control and Prevention guidelines. Participants who tested positive received referrals for follow-up medical care.

2.3. Analysis

Data for this analysis were drawn from 485 participants recruited between June 2012 and September 2013. We conducted all analyses separately for SCs and THs. First, we calculated descriptive statistics for all variables of interest, including measures of central tendency and dispersion. Individuals reporting ever using each drug were compared to those reporting no use using Chi-square tests or Fischer's Exact Tests for proportions and Wilcoxon Rank Sums tests for medians. Then, we conducted backwards stepwise logistic regression for each of our dependent variables (lifetime use of SCs and lifetime use of THs). Each model included independent variables significant at the $p < 0.10$ level from the bivariate comparisons. Models were trimmed until all remaining covariates were significant at the $p < 0.05$ level.

3. RESULTS

3.1. Characteristics of SC and TH use

The median age of the overall sample was 45 years (interquartile range [IQR]: 22–53, range: 18–70; data not shown). Of the 485 respondents providing data for this study, 31(7%) respondents reported ever using SCs and 146 (30%) reported ever using THs (Table 1). Twenty-four individuals (5%) reported use of both SCs and THs (data not shown). Of those who reported SC use, 77% also used THs; of those who reported TH use, 17% also used SCs (data not shown).

Among SC users (n=31), the average age at first use of SCs was 33 years (IQR: 25, 38; Table 1). Most reported curiosity as their primary rationale for use (58%). Nearly a quarter reported that they used SCs for the first time because they thought they were a different drug (usually methamphetamine). The most common route of administration was injecting (48%), followed by snorting (36%), and smoking (23%). Eighty-four percent (n=26) reported administering the drugs via a single route of administration, while sixteen percent (n=5) reported administering SCs via two routes (data not shown). The most common sources for obtaining SCs was from friends (32%) or gas station convenience stores (32%), though a variety of other sources were reported. No respondents reported obtaining SCs from the internet or adult stores. Half of IDUs in this sample who had used SCs responded affirmatively when asked “Is this drug legal in California?” Only one participant reported hospitalization due to the effects of SCs.

Among TH users (n=146; Table 1), the average age at first use was 37 years (IQR: 28, 47). The primary rationale for use was curiosity (49%), followed by greater availability than other drugs (usually marijuana, 20%), and desire to avoid testing positive on a drug test (15%). The most common source for THs was friends (38%), followed by gas station/convenience stores (20%), and head shops/smoke shops (18%). None reported obtaining THs from the internet. Sixty percent of those who had used THs responded affirmatively when asked whether THs are legal in California, and two (1%) reported being hospitalized due to the effects of THs.

3.2. Correlates of Synthetic Cathinone Use

In bivariate analysis, respondents who reported ever using SCs were statistically significantly younger than those who did not (34 years vs. 45 years, $p<0.0001$; Table 2). Current use of other drugs was common among SC users, who were more likely than non-users to report past six month use of marijuana (87% vs. 66%, $p=0.02$), methamphetamine (97% vs. 77%, $p=0.009$), hallucinogens or inhalants (23% vs. 6%, $p=0.0005$), club drugs (i.e., ketamine or ecstasy, 23% vs. 5%, $p<0.0001$), and prescription drugs (77% vs. 51%, $p=0.004$). IDUs who used SCs were more likely to have initiated injection drug use with stimulants (61% vs. 40%) and less likely to have initiated injection drug use with heroin (26% vs. 46%; $p=0.05$) compared to non-users.

3.3. Correlates of THC Homologue Use

In bivariate analysis, respondents who reported ever using THs were significantly younger than non-users (38 years vs. 47 years, $p<0.0001$; Table 3). They were also more likely to be male (81% vs. 71%, $p=0.02$), homeless (75% vs. 58%, $p=0.0004$), and currently on parole or probation (37% vs. 26%, $p=0.009$). TH users were more likely than non-TH users to report use of a variety of other substances in the past six months, including alcohol (80% vs. 62%, $p<0.0001$), marijuana (92% vs. 57%, $p<0.0001$), cocaine or crack (37% vs. 27%, $p=0.02$), methamphetamine (90% vs. 73%, $p<0.0001$), hallucinogens or inhalants (12% vs. 5%, $p=0.009$), and prescription drugs (66% vs. 47%, $p<0.0001$). Users of THs were more likely than non-users to have initiated prescription drug use with stimulants (51% vs. 36%) and less likely to have initiated injection drug use with heroin (39% vs. 47%; $p<0.003$). In terms of behavioral and health outcomes, IDUs who reported use of THs were more likely than

non-users to report injecting drugs with a previously used syringe in the past six months (i.e., receptive syringe sharing; 58% vs. 46%, $p=0.01$). Those who reported TH use were also more likely to report receiving medical care in an emergency room (44% vs. 30%, $p=0.003$) and being hospitalized in the past six months (28% vs. 16%, $p=0.005$).

3.4 Multivariate regression results

In multivariate logistic regression, age was independently and negatively associated with reporting lifetime use of SCs (Adjusted Odds Ratio [AOR] 0.93 per one year increase in age; 95% Confidence Interval [C.I.] 0.90, 0.97; Table 4). Those who reported past 6 month use of methamphetamine (AOR 9.35, 95% C.I. 1.20, 72.79) and club drugs (AOR 3.38, 95% C.I. 1.17, 9.76) had higher odds of reporting SC use. Finally, IDUs who reported being hospitalized in the past six months for any reason were twice as likely to report lifetime SC use (AOR 2.34; 95% C.I. 1.00, 5.49).

Age was also significantly and negatively associated with odds of TH use (AOR 0.96 per 1 year increase in age, 95% C.I. 0.94, 0.98; Table 4). Those who reported being on parole or probation were 2.42 times as likely to report TH use (95% C.I. 1.44, 4.07). Compared to those who initiated injection drug use with heroin, IDUs who initiated injection drug use with stimulants were nearly twice as likely to report TH use (AOR 1.89, 95% C.I. 1.13, 3.16). Past six month marijuana use (AOR 9.22, 95% C.I. 4.49, 18.96) and prescription drug use (AOR 1.98, 95% C.I. 1.20, 3.27) were associated with higher odds of reporting TH use. Finally, being hospitalized in the past six months for any reason was significantly associated with increased odds of TH use (AOR 2.62, 95% C.I. 1.47, 4.68).

4. DISCUSSION

In this sample of IDUs, a substantial proportion reported use of SCs, THs, or both. Those reporting SC and TH use were significantly younger than their counterparts who did not report use. Nonetheless, the average age at first use in both groups was over 30 years old, suggesting that this is not a phenomenon that is limited to school-aged or transitional-aged youth. The average ages at which participants reported first using SCs and THs were within one year of the median age of the sample, suggesting that use of these synthetic drugs is a recent phenomenon despite ongoing legal efforts to limit their availability.

SCs can be administered via several routes, including snorting (insufflation), oral ingestion, or smoking (Karila and Reynaud, 2011). Nearly half of IDUs in this sample who had used SCs reported injecting them, though we did not collect information about whether the injections were subcutaneous, intravenous, or intramuscular. The high prevalence of injection as a route of administration is perhaps not surprising, given that this was a sample of IDUs who were already experienced in this practice. However, injection of SCs has the potential to cause serious harm (Russo et al., 2012). Qualitative interviews with eleven Irish IDUs who injected mephedrone (an SC) revealed that several suffered burning, skin erosion, soft tissue infections, blood clots, and wounds at the injection site (Van Hout and Bingham, 2012).

At least half of synthetic drug users in this cohort believed that the drugs were legal in California at the time of this survey (2012–2013). “Bath salts” and many other compounds have been included as Schedule I substances in the Federal Controlled Substances Act since 2012 (Sacco and Finklea, 2013), and since 2011 the sale and distribution of a number of SC and TH compounds has been illegal in California (California Health and Safety Code § 11357.5, 2011a,b). However, our findings suggest that these drugs are available through a number of commercial and non-commercial outlets, and that the public’s knowledge about their legal status may be inadequate. The dynamic legal environment surrounding these drugs, including evolving scheduling guidelines and the manufacture of chemical homologues to circumvent those guidelines, will require further research to inform public education campaigns and enforcement efforts.

Users of SCs or THs were significantly more likely to report use of a number of other substances, particularly marijuana, stimulants such as methamphetamine and cocaine/crack, hallucinogens, club drugs (ketamine and ecstasy), and prescription drugs. In multivariate logistic regression, methamphetamine and club drug use were associated with SC use, while marijuana and prescription drug use were associated with TH use. The effects of SCs have been compared to MDMA, cocaine, and methamphetamine, while the effects of TH have been compared to marijuana. Therefore, it might be that IDUs are experimenting with synthetic drugs based on their similarity to other traditional drugs of abuse that they were already using. Experimentation with new and emerging synthetic drugs may compound drug-related risks (Wagner et al., 2013), particularly since the chemical structures of synthetic drugs are rapidly changing due to evolving legal restrictions (Maxwell, 2014). A 2014 case report of exposure to a new TH – ADB-PINACA, sold under the brand name “black mamba” – suggests that newer generations of synthetic drugs may be more potent and have more deleterious health effects than earlier generations (Monte et al., 2014).

Despite substantial overlap in the proportion of SC users who also used TH, some important differences emerged in the independent correlates of use. Most significantly, being on parole/probation was significantly associated with use of TH, but not SC. This corroborates earlier findings from a review of 200 international websites, which reported that TH appealed to users because it is difficult to detect in drug tests (Schifano et al., 2009). This has critical implications for the management of criminal justice system-involved individuals, since most are subject to drug testing by urinalysis as a condition of their parole/probation. If TH is being used preferentially in order to avoid penalties associated with positive drug tests, new solutions for monitoring and treating drug use among offenders will be needed.

Many respondents reported that they mistook SCs or THs for other drugs (usually methamphetamine or marijuana, respectively). Given the clinical case reports of significant toxicity and adverse effects of these drugs, up to and including fatal intoxication (Berry-Cabán et al., 2012; Centers for Disease Control and Prevention, 2013; Jinwala and Gupta, 2012; Schneir et al., 2011; Thomas et al., 2012), the potential for users to inadvertently consume these substances is of particular concern. This may explain our finding that recent hospitalization for any reason was independently associated with use of both SC and TH, yet few IDUs reported being hospitalized specifically due to the effects of SCs or THs. Unknown or unrecognized side effects of SCs or THs might be responsible for effects that

result in emergency department or hospital utilization, but are not recognized as resulting from the drugs.

4.1. Limitations

Our data were obtained from a cross-sectional observational study in which our measure of synthetic drug use assessed lifetime use, and other independent variables were assessed within the past six months. Since the majority of participants initiated synthetic drug use within the past year, we suspect that most synthetic drug use was relatively recent. However, we cannot establish order of precedence for the associations we report and make no assumptions about causality. Longitudinal studies are needed to elucidate trajectories of use and provide more evidence for temporal associations. Because our data were collected from a cohort of relatively older IDUs in one California city, findings from this study may not generalize to other users of SCs or THs who are younger or live in other cities, to persons who do not inject drugs, or to other vulnerable populations that might have a high prevalence of use, such as MSM (Hunter et al., 2014). However, given the potential for increased physical harm associated with use of these drugs among established drug users, the clinical significance of our findings has merit. We assessed use of SCs and THs using several descriptions of the drugs and multiple brand names; however, brand names and chemical compositions change often, which could have led to some misclassification. We also only asked about two types of synthetic drugs, though there are several other synthetic chemical compounds present on the U.S. drug market (e.g., phenethylamines, tryptamines, and 2-C series; Forrester, 2013; Sanders et al., 2008). Future studies should conduct formative research to ensure they are using the most up-to-date nomenclature and assessing the most current set of synthetic drugs. We were also limited in our ability to assess clinical outcomes, since our data were obtained from a study that was behavioral in nature and we were unable to employ objective measures of drug use. More research into the clinical consequences of synthetic drug use, including biological measures (e.g., kidney or liver function tests, urinalysis for synthetic drugs) and medical record reviews might help elucidate the scope of health consequences.

4.2 Conclusion

Findings from this analysis suggest that a meaningful proportion of IDUs use synthetic drugs such as SCs and THs, and may experience harms associated with their use. Analysis of the rapidly evolving legislative environment, including differences and similarities between state and federal drug control policies, is needed to inform structural interventions. In addition to legislative and law enforcement efforts to reduce the availability of synthetic drugs, education and prevention efforts aimed at current and future users are needed. Such prevention efforts should emphasize the potential harms associated with combining multiple substances, as well as educating users about the legal restrictions of these drugs that are already in effect.

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Table 1

Characteristics of Synthetic Drug Use among IDUs in San Diego (n=485).

	Synthetic Cathinones (n=31; 6.5%)		THC Homologues (n=146; 30.2%)	
	N	%	N	%
Age first used (Median, IQR)	33	25, 38	37	28, 47
Why did you first use this drug?				
Curious about its effects	18	58.1	70	49.0
Wanted to avoid testing positive on a drug test	4	12.9	21	14.7
Wanted to avoid legal risk associated with drugs like heroin, cocaine, meth or marijuana	1	3.2	4	2.8
Wanted to use something safer than drugs like heroin, cocaine, meth or marijuana	0	0	3	2.1
They were more available than other drugs	3	9.7	29	20.3
They were less expensive	1	3.2	6	4.2
Thought they were a different drug	7	22.6	6	4.6
Peer influence	1	3.2	13	8.9
Other	1 ^a	3.2	4 ^b	2.7
How have you used this drug?				
Injected	15	48.4	c	
Snorted	11	35.5	c	
Smoked	7	22.6	c	
Swallowed	2	6.5	c	
Anal insertion	1	3.2	c	
Where have you obtained this drug? (n=22; n=104)				
Internet	0	0	0	0
From a friend	7	31.8	39	37.5
From a stranger	1	4.6	6	5.8
From a family member	0	0	6	5.8
Bought in adult store	0	0	3	2.9
Bought at gas station or convenience store	7	31.8	21	20.2
Bought in head shop or smoke shop	3	13.6	19	18.3
Bought from drug dealer	2	9.1	3	2.9
Other ^d	2	9.7	7	4.8
Is this drug legal in California? (Yes; n=24; n=123)	12	50.0	74	60.2
Ever hospitalized because of the effects of this drug?	1	3.2	2	1.4

^a e.g., to enhance sex^b e.g., recreational, substitute for marijuana (but no reason given)^c not asked^d e.g., "found it in the street"

Table 2

Demographic and behavioral characteristics of IDUs in San Diego who report ever using Synthetic Cathinones (N=480)

	Used Synthetic Cathinones (n=31; 6.5%)			No Synthetic Cathinone use (n=449; 93.4%)		
	N	%		N	%	p-value*
Median age in years (IQR)	34	26, 41		45	34, 53	<0.0001
Male	26	83.9		330	73.5	0.20
Heterosexual (vs. gay/bi/queer)	24	77.4		355	79.4	0.79
Hispanic	5	16.1		133	29.6	0.10
Race						
Asian	0	0.0		6	1.3	0.67
Black	2	6.5		55	12.3	0.56
American Indian	0	0.0		30	6.7	0.25
Native Hawaiian/API	0	0.0		6	1.3	0.99
White	26	83.9		304	67.7	0.06
Other/mixed	5	16.1		85	18.9	0.70
Homeless (past 6 months)	24	77.4		279	62.1	0.09
Currently on parole or probation (n=475)	12	38.7		127	28.6	0.23
Drugs used in past 6 months						
Alcohol (n=479)	25	80.7		300	67.0	0.11
Marijuana (n=458)	27	87.1		282	66.0	0.02
Heroin (injection or non-injection; n=471)	25	80.7		298	67.7	0.13
Drug combinations (cocaine, meth, heroin; n=480)	12	38.7		131	29.2	0.26
Cocaine or crack (injection or non-injection; n=466)	11	35.5		128	29.4	0.48
Methamphetamine (n=462)	30	96.8		330	76.6	0.009
Hallucinogens or Inhalants (n=480)	7	22.6		27	6.0	0.0005
Club drugs (ketamine, ecstasy; n=480))	7	22.6		21	4.7	<0.0001
Prescription drugs (opioids, tranquilizers, barbiturates; n=480)	24	77.4		229	51.0	0.004
Drug first injected (n=480)						0.05
Heroin	8	25.8		205	45.7	
Stimulants (methamphetamine or cocaine/crack)	19	61.3		178	39.6	

	Used Synthetic Cathinones (n=31; 6.5%)		No Synthetic Cathinone use (n=449; 93.4%)		p-value*
	N	%	N	%	
Prescription pills	2	6.5	14	3.1	
Other (mixtures or others not mentioned)	2	6.5	52	11.6	
Receptive syringe sharing past 6 months (n=480)	19	61.3	220	49.0	0.19
Overdosed in past 6 months (n=480)	3	9.7	36	8.0	0.74
Had a regular sex partner in past 6mo (n=478)	17	54.8	256	57.3	0.79
Frequency of condom use with regular partner (1 = never, 5 = always; n=273)	1	1, 1	1	1, 1	0.93
Median # of casual partners in past 6mo (n=477)	1	0, 3	0	0, 2	0.08
Frequency of condom use with casual partners (1 = never, 5 = always; n=186)	1	1, 4	1	1, 4	0.62
HIV positive (n=462)	4	12.9	37	8.6	0.34
HCV positive (n=462)	18	58.1	292	67.8	0.27
Received care in an ER in past 6 months (n=477)	14	45.2	150	33.6	0.19
Hospitalized in past 6 months (n=477)	10	32.3	84	18.8	0.07

* Comparisons made using Chi-square tests or Fisher's Exact Tests for proportions and Wilcoxon Rank Sums tests for medians

Table 3

Demographic and behavioral characteristics of IDUs in San Diego who report ever using THC Homologues (N=484)

	Used THC Homologues (n=146; 30.2%)				No THC Homologue use (n=338; 69.8%)			
	N	%	N	%	p-value*			
Median age (IQR)	38	30, 48	47	37, 54	<0.0001			
Male	118	80.8	239	70.7	0.02			
Heterosexual (vs. gay/bi/queer)	110	75.9	273	81.0	0.20			
Hispanic	38	26.0	100	29.6	0.43			
Race								
Asian	3	2.1	3	0.9	0.29			
Black	12	8.2	45	13.3	0.11			
American Indian	8	5.5	24	7.1	0.51			
Native Hawaiian/API	4	2.7	3	0.9	0.12			
White	106	72.6	225	66.6	0.19			
Other/mixed	30	20.1	61	18.1	0.52			
Homeless (past 6 months)	109	74.7	195	57.7	0.0004			
Currently on parole or probation (n=479)	54	37.2	85	25.5	0.009			
Drug use in past 6 months								
Alcohol (n=483)	117	80.1	209	62.0	<0.0001			
Marijuana (n=461)	126	92.0	186	57.4	<0.0001			
Heroin (injection or non-injection; n=475)	92	64.8	234	70.3	0.24			
Drug combinations (cocaine, meth, heroin)	49	33.6	94	27.8	0.20			
Cocaine or crack (injection or non-injection; n=470)	52	37.1	88	26.7	0.02			
Methamphetamine (n=465)	124	89.9	238	72.8	<0.0001			
Hallucinogens or Inhalants	17	11.6	17	5.0	0.009			
Club drugs (ketamine, ecstasy)	12	8.2	16	4.7	0.13			
Prescription drugs (opioids, tranquilizers, barbiturates)	96	65.8	157	46.5	<0.0001			
Drug first injected					0.003			
Heroin	57	39.0	158	46.8				
Stimulants (methamphetamine or cocaine/crack)	75	51.4	123	36.4				

	Used THC Homologues (n=146; 30.2%)		No THC Homologue use (n=338; 69.8%)		
	N	%	N	%	p-value*
Prescription pills	6	4.1	10	3.0	
Other (mixtures or others not mentioned)	8	5.5	47	13.9	
Receptive syringe sharing past 6 months	85	58.2	155	45.9	0.01
Overdosed in past 6 months	15	10.3	24	7.1	0.23
Had a regular sex partner in past 6mo (n=482)	80	55.2	196	58.2	0.54
Frequency of condom use with regular partner (1 = never, 5 = always; n=276)	1	1.1	1	1.1	0.94
Median # of casual partners in past 6mo (n=471)	1	0.3	0	0.1	0.003
Frequency of condom use with casual partners (1 = never, 5 = always; n=186)	1	1.3	1	1.4	0.51
HIV positive (n=466)	11	7.7	30	9.3	0.57
HCV positive (n=466)	88	61.5	225	69.7	0.09
Received care in an ER in past 6 months (n=481)	64	44.1	101	30.1	0.003
Hospitalized in past 6 months (n=481)	40	27.6	55	16.4	0.005

* Comparisons made using Chi-square tests or Fisher's Exact Tests for proportions and Wilcoxon Rank Sums tests for medians

Table 4

Demographic and behavioral characteristics independently associated with ever using synthetic cathinones or THC Homologues among IDUs in San Diego, CA.

	Synthetic Cathinones (N=453)		THC Homologues (N=437)	
	Adjusted Odds Ratio	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval
Age (years)	0.93	0.90, 0.97	0.96	0.94, 0.98
Currently on parole or probation	--	--	2.42	1.44, 4.07
Drug first injected				
Heroin (ref)	--	--	ref	ref
Stimulants	--	--	1.89	1.13, 3.16
Prescription pills	--	--	0.60	0.15, 2.33
Other	--	--	0.48	0.19, 1.23
Marijuana use past 6 months	--	--	9.22	4.49, 18.96
Prescription drug use past 6 months	--	--	1.98	1.20, 3.27
Methamphetamine use past 6 months	9.35	1.20, 72.79	--	--
Club drugs use past 6 months	3.38	1.17, 9.76	--	--
Hospitalized in past 6 months	2.34	1.00, 5.49	2.62	1.47, 4.68