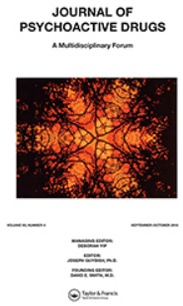

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The Changing Face of Synthetic Cannabinoids in Texas

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ABSTRACT

This article describes the characteristics of individuals who used synthetic cannabinoids and the changes in the user population over time. Data sources include treatment admissions with a primary problem with synthetic cannabinoids reported to the Texas treatment dataset, synthetic cannabinoid exposures reported to the Texas Poison Center Network, and items identified in the National Forensic Laboratory Information System in 2009–2016. Statistically significant trends were identified for race/ethnicity, gender, age, education level, employment status, homelessness, criminal justice problems, use of other substances, lag time between first use and time to treatment, exposure site, chronicity, reason for exposure, and the most common types of cannabinoids. Comparisons were made between the years and the variables in the datasets. Findings suggest that the characteristics of synthetic cannabinoid users and the varieties of these drugs in Texas have changed over time. Data to link individual cases with the changing results of toxicological analysis are needed, as well as targeted prevention and treatment efforts for an aging population who may be at risk of homelessness and also have co-morbid substance use and psychiatric problems.

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Acute exposures; compulsion to use; medical outcomes; synthetic cannabinoids

Introduction

Synthetic cannabinoids are a group of novel designer compounds that have appeared over the past decade as drugs of abuse. Synthetic cannabinoids are intended to imitate tetrahydrocannabinol (THC), the main psychoactive ingredient in marijuana. Individuals use synthetic cannabinoids because they believe the products will result in a marijuana-like high and yet are purported to be safe, legal, and/or undetectable by standard urine toxicology tests (Bonar 2014; Barratt, Cakic, and Lenton 2013; and Fantegrossi et al., 2014). However, synthetic cannabinoid use may result in serious health risks. Adverse effects associated with synthetic cannabinoid use include chest pain, hypertension, tachycardia, palpitations, nausea, vomiting, agitation, confusion, anxiety, dizziness, drowsiness, hallucinations, headache, seizures, tremors, mydriasis, dyspnea, and diaphoresis (Forrester et al. 2011; Hill et al. 2013; Hoyte et al. 2012; Law et al. 2015; Papadopoulos et al., 2017). Users also may be likely to have significant and often preexisting psychiatric and substance use comorbidity (Manseau et al. 2017). Deaths have been linked to synthetic cannabinoid use (Hill et al. 2013; Hoyte et al. 2012; Law et al. 2015; Trecki, Gerona, and Schwartz 2015).

Synthetic cannabinoids first appeared in Texas in 2009, with reports about the effects of exposure to an unknown drug. The raw chemicals were imported from China or other countries and then mixed and placed in little bags for sale in convenience stores and shops selling drug paraphernalia. Over time, the bags have changed from colorful foil packets to plain black baggies and sales are now through street dealers (Maxwell 2017).

The number of specific synthetic cannabinoid compounds has increased as manufacturers and distributors attempt to avoid national, state, and/or local laws by synthesizing new compounds not included in the regulations (Shanks et al. 2012; Trecki, Gerona, and Schwartz 2015). The Special Testing and Research Laboratory of the U. S. Drug Enforcement Administration (DEA) reported that 101 synthetic cannabinoids were identified in the first quarter of 2018, with no new synthetic cannabinoids reported in that quarter (DEA 2018).

Multiple "clusters" or "outbreaks" of adverse health effects or serious outcomes associated with synthetic cannabinoids have been reported in communities in various states in the U.S. over the last few years, with some involving dozens or even hundreds of cases (Centers for Disease Control and Prevention 2013a,

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2013b; Iwanicki et al. 2014; Law et al. 2015; Schwartz et al. 2015; Trecki, Gerona, and Schwartz 2015).

The number and varieties of identified "clusters" appear to be increasing. This may be due to improved reporting, greater media attention, and/or improved cooperation between public health and law enforcement organizations. The increase also may be due to newer compounds having unanticipated adverse effects (Trecki, Gerona, and Schwartz 2015). However, there is currently no mechanism in place to test each substance and link the report to the characteristics of the user and his or her history of drug use, or to judge the severity of the public health threat, since there is no link between the treatment and poison data with the toxicological findings.

Because of the changes in the compounds in synthetic cannabinoid products and the increasing number of "clusters," it might be expected that the demographic and clinical characteristics of synthetic cannabinoid exposures have changed over time, but there is limited information on temporal changes in such exposures.

Methods

This study seeks to describe the characteristics of individuals who used synthetic cannabinoids, the changes in the user population over time, and the motives for use and reactions to the use of the drug. The sources of information on synthetic cannabinoid exposures are the poison center networks, treatment admission records, and identification of the specific cannabinoid by forensic laboratories.

One source of data was the Texas Poison Center Network (TPCN) for calendar years 2010–2016 (n = 3802). The TPCN assists in the management of poisonings or toxic exposures to a variety of substances, including synthetic cannabinoids. The TPCN gathers information on patient demographics, characteristics of the exposure, management, and outcomes. The patient's race/ethnicity is not collected by the TPCN. The centers use a common electronic database to collect information on all calls using codes standardized by the American Association of Poison Control Centers (AAPCC 2007). Although the caller may have known the "nickname" for the drug taken, the results of the toxicological tests could not be linked to the encounter, so the term "synthetic cannabinoid" was used by the poison centers to identify these exposures.

A second Texas dataset used in this article reported on individuals admitted to substance abuse treatment in state-contracted treatment providers for calendar years 2011–2016 (n = 2590). The Clinical Management for Behavioral Health Services (CMBHS) is the Texas component of the national Treatment Episode Data Set (TEDS) of the Substance Abuse and Mental Health Services Administration (SAMHSA). Variables of interest were chosen from the standardized TEDS dataset to provide demographic data not available in the poison dataset, such as race and ethnicity and other important characteristics of individuals entering treatment. The term "synthetic cannabinoids" was added to the CMBHS list of drugs in 2011; it is not yet collected by the national TEDS dataset. Because of confidentiality restrictions on client-level treatment data, staff from the Health and Human Services Commission (HHSC) worked with the author to analyze data on characteristics of treatment admissions and provided the results to the author.

A third dataset, DEA's National Forensic Laboratory Information System (NFLIS), provided information on the top two cannabinoids identified each year in Texas from 2009 to 2016 (n = 32,687). NFLIS collects drug identification results and associated information from drug cases submitted to and analyzed by federal, state, and local forensic laboratories. In Texas, all of the laboratories of the Texas Department of Public Safety and forensic laboratories affiliated with eight metropolitan law enforcement units participate.

Because the three datasets were deidentified, the records could not be matched. SAS 9.4 was used to analyze the treatment and poison datasets for all variables of interest. All analysis was done using SAS, and statistical tests included means and Pearson correlation coefficients.

Results

Table 1 itemizes the number of exposure cases reported to Texas poison centers, treatment admissions, and synthetic cannabinoid items seized and identified by toxicology laboratories in the state. Exposures reported to the poison centers fluctuated from year to year with no clear trend, while the number of cases from the treatment programs and forensic laboratories increased over the time of the study.

Characteristics of the users

Table 2 shows that the mean ages of users in treatment and poison center datasets increased over time. The gender of the users varied, with the proportion of males in the poison dataset increasing while the proportion of males entering treatment decreased.

The overall proportion of those admitted to treatment who were White increased from 2011 to 2016, the

Table 1. Cases of synthetic cannabinoids reported to Texas poison centers, treatment admissions to publicly-funded programs, and items identified in Texas Forensic Laboratories: 2009–2016.

	Poison Centers[1]	Treatment Admissions[2]	Items Identified[3]
2009			2
2010	507	0	79
2011	595	36	2038
2012	474	154	4171
2013	464	413	4163
2014	782	499	5500
2015	684	708	6004
2016	296	780	6675
TOTALS	3802	2590	32687

[1]Texas Poison Network.
[2]Treatment admissions to facilities in the Texas CMBHS system.
[3]National Forensic Laboratory Information System.

proportion of Blacks/African Americans decreased, and the proportion of Hispanics/Latinos was stable.

Those who came to treatment with a primary problem with synthetic cannabinoids were less likely to be high school graduates, and more likely to be unemployed, experiencing homelessness, or living in a shelter or unknown living situation. Individuals who entered treatment in 2011 had higher rates of involvement in the criminal justice or legal system (86.1%), including recent arrests, time in jail, or on probation or parole than did those in 2016 (51.0%, $p = 0.0004$).

Drug use patterns

At treatment admission, individuals report their primary, secondary, and tertiary drugs used. Of those using synthetic cannabinoids, some 94%–99% reported smoking the drug, with the remainder reporting oral use. Daily smoking of the drug did not vary over time. Marijuana was the second drug of choice, but its use, as well as use of alcohol, decreased over time. Use of cocaine and/or crack increased.

Among poison center exposures, the exposure sites where the patients used the drug changed. In 2010, 75% of the cases occurred in the patient's home or another residence (16% unknown location and 3% in a public area). By 2016, 60% were exposed at home or at another residence, 27% were exposed in an unknown place, and 6% in a public area ($p < .0001$).

Among treatment admissions, the "lag," the years between age at first use of a synthetic cannabinoid and admission to treatment, showed that those individuals entering treatment in 2011 were among the "first generation" to use these new drugs. Over time, the lag between first use and need for treatment shortened from 6.1 years to 3.9 years.

During 2016, the most common sources of referral to treatment for synthetic cannabinoid users were probation (28%), self-referral (27%), family protective service agencies (8%), and family members (7). In the sample of synthetic cannabinoid users, the proportion with a criminal justice or legal problem decreased from 86.1% in 2011 to 51% in 2016.

For poison center exposures, the reaction to using the drug also changed over time. Those who reported an acute exposure (defined as taking the drug one time and suffering an ill effect) decreased,

Table 2. Characteristics of synthetic cannabinoid users at admission to treatment or reported by poison centers for exposure to synthetic cannabinoids.

Admissions to Treatment	**CY2010**	**CY2011**	**CY2012**	**CY2013**	**CY2014**	**CY2015**	**CY2016**	***P***
% Black or African American		22.2	9.1	5.3	8.6	12.0	14.0	0.0007
% Hispanic or Latino		44.4	24.7	35.6	38.9	42.8	43.1	< .0001
% Male		75.0	73.4	75.1	69.9	71.2	68.3	0.0257
Lag (years from first use to treatment)[a]		6.1	3.9	2.5	3.0	3.5	3.9	0.0662
Mean age at admission (years)		20.7	22.6	23.2	23.7	24.0	26.1	< .0001
School grade completed		11.1	11.0	11.2	10.9	10.6	10.7	0.0002
% With a criminal justice legal problem[b]		86.1	64.9	55.2	55.7	58.6	51.0	0.0004
% Unemployed		44.4	36.4	45.5	43.7	49.4	47.7	< .0001
% Used Daily		38.9	44.8	41.2	38.7	38.8	45.3	0.1570
% Homeless		66.7	45.5	50.8	52.3	65.0	65.5	< .0001
% Also used alcohol		16.7	16.9	12.8	10.8	11.3	7.8	0.0002
% Also used cocaine or crack		5.5	5.8	4.6	6.4	5.6	9.1	0.0095
% Also used marijuana		25.0	34.4	41.4	35.7	34.6	31.5	0.0307
Exposures Reported to Poison Center	**CY2010**	**CY2011**	**CY2012**	**CY2013**	**CY2014**	**CY2015**	**CY2016**	***P***
Mean age (years)	23.6	22.6	22.0	22.3	23.8	24.0	25.5	< .0001
% Male	75.0	75.1	76.0	76.7	80.2	80.9	80.8	0.0002
% Used at home[c]	75.0	68.4	73.0	70.7	65.1	65.6	59.6	< .0001
% Acute exposure[d]	85.8	83.0	76.4	67.0	61.8	65.5	63.0	< .0001
% Intentional use[e]	59.0	59.5	81.8	62.0	61.5	66.0	50.4	0.0324

[a]Lag is the years between first use of the drug and admission to this treatment episode.
[b]Has criminal justice problem such as arrest, in jail, on probation or parole.
[c]For this episode, person used at home rather than in school, public site, etc.
[d]Acute exposure is taking the drug once and suffering an ill effect, while chronic would be having taken the drug regularly while having ill effects.
[e]Exposure was categorized as unintentional (codes 50–57) or intentional, including misuse and abuse (codes 58–61).

while chronic use (taking the drug regularly or continuously while having ill effects) increased, as did intentional use. The relationship between chronic use and intentional misuse was significant (p = < .0001). The major problems suffered after exposure to a synthetic cannabinoid included cardiac problems (56%), gastrointestinal problems (27%), and miscellaneous problems (15%).

Of the poison center patients followed to a medical outcome using AAPCC codes, Figure 1 shows that 6% reported no effects and 21% reported minor effects (described as the patient exhibiting some symptoms as a result of the exposure, but they were minimally bothersome and resolved rapidly). Another 40% reported moderate effects, which were defined as more pronounced, more prolonged, or of a systematic nature which was not life-threatening and the patient returned to a pre-exposure state with no residual disability. Ten percent reported major effects, which were defined as exhibiting symptoms that were life-threatening or resulted in significant residual disability that might be long-term or permanent. Between 2010–2016, the poison centers reported six deaths due to use of synthetic cannabinoids.

As Figure 1 shows, the largest number of moderate and major outcomes due to the use of the drug occurred in 2014 and 2015, and Table 3 shows that the synthetic cannabinoids XLR-11 and either AB-Fubinaca or AB-Chminaca were the mostly likely to be available during that period of time.

Discussion

Limitations include generalizability, as data were collected in only one state, Texas. In addition, the individuals in each dataset were deidentified so the records could not be merged, but the two separate datasets provided additional information on the characteristics of the users, their reasons for use (and continued use), and the medical outcomes.

The CMBHS treatment dataset only includes publicly funded clients and does not include individuals who were treated in inpatient hospital facilities or by private physicians or clinics. The number of cases may be underreported because the persons reporting the data may not have understood the many nicknames and chemical names of these synthetic drugs, and all reports may not be accurate. Even after CMBHS added a category of "synthetic cannabinoid," some persons submitting the forms may not have recognized terms such as "Spice," "FUB-AMB," or "XLR-11" as synthetic cannabinoids.

Events involving synthetic cannabinoids could also be underreported because reporting such exposures to the poison center is not mandatory. When an outbreak affects a number of persons in a public area or the effects are especially serious, the patients may be transported directly to the emergency room and the cases may not be reported to the poison center. In other instances, the substances may or may not have been sent to laboratories capable of identifying the chemical components. Linking the identity of the substance with the episode would enhance the ability of poison centers

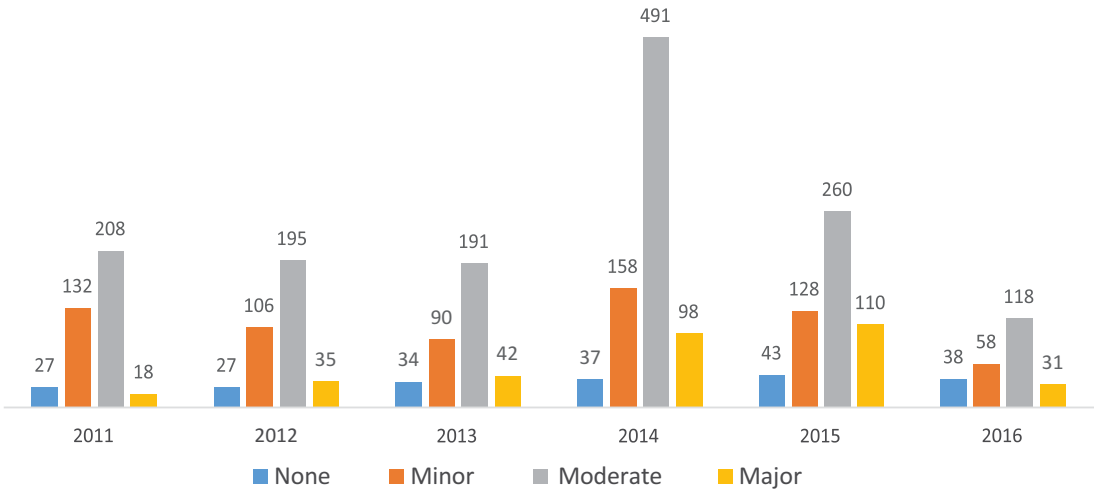

Figure 1. Medical outcomes of synthetic cannabinoid exposures as reported by Texas Poison Center Network: 2011–2016.

Minor effects—patient had symptoms but these were minimally bothersome and resolved rapidly.

Moderate effects were more pronounced or prolonged but not life-threatening and patient returned to a pre-exposure state with no residual disability.

Major effects were life-threatening or with significant or residual disability that was long-term or permanent.

Table 3. DEA's National Forensic Laboratory Information System: Top two synthetic cannabinoid items identified in Texas forensic laboratories and reported to NFLIS: 2009–2016.

2009		
	JWH-018 (1-PENTYL-3-(1-NAPHTHOYL)INDOLE)	2
2010		
	JWH-018 (1-PENTYL-3-(1-NAPHTHOYL)INDOLE)	69
	JWH-073 (1-BUTYL-3-(1-NAPHTHOYL)INDOLE)	3
2011		
	AM-2201 (1-(5-FLUOROPENTYL)-3-(1-NAPHTHOYL) INDOLE)	607
	JWH-018 (1-PENTYL-3-(1-NAPHTHOYL)INDOLE)	305
2012		
	AM-2201 (1-(5-FLUOROPENTYL)-3-(1-NAPHTHOYL) INDOLE)	1565
	XLR-11 (1-(5-FLUOROPENTYL-1H-3-YL)(2,2,3,3-TETRAMETHYLCYCLOPROPYL)METHANONE)	905
2013		
	UR-144 ((1-PENTYLINDOL-3-YL)-(2,2,3,3-TETRAMETHYLCYCLOPROPYL)METHANONE)	314
	XLR-11 (1-(5-FLUOROPENTYL-1H-3-YL)(2,2,3,3-TETRAMETHYLCYCLOPROPYL)METHANONE)	3041
2014		
	AB-FUBINACA	1089
	XLR-11 (1-(5-FLUOROPENTYL-1H-3-YL)(2,2,3,3-TETRAMETHYLCYCLOPROPYL)METHANONE)	1584
2015		
	AB-CHMINACA (N-[(1S)-1-(AMINOCARBONYL)-2-METHYLPROPYL]-1-(CYCLOHEXYLMETHYL)-1H-INDAZOLE-3-CARBOXAMIDE)	1925
	XLR-11 (1-(5-FLUOROPENTYL-1H-3-YL)(2,2,3,3-TETRAMETHYLCYCLOPROPYL)METHANONE)	1084
2016		
	5-FLUORO-ADB	1871
	FUB-AMB	2727

and treatment programs to know more about the drugs that they are encountering and to tailor responses to certain varieties of the drug.

A system that could tie together the poison exposure cases and the information about the identity of the drug could be expensive, but reporting the street names or "nicknames" of the cannabinoids by the poison centers would be a start. Knowledge of the side-effects of these drugs which may be life-threatening or leaving significant residual disability would be helpful, not only for treatment providers, but also for prevention information efforts and the harm reduction specialists who work to prevent use of the dangerous drugs. In addition, having additional information from poison centers and treatment facilities about the harmful effects of the drug could lead to earlier scheduling of the drug. Both federal and state authorities have the power to schedule a drug, and because of their knowledge of the problems locally, the state may schedule a substance in advance of federal action. In addition, negative media coverage, such as the emphasis on the dangers of "Flakka" in Florida, encouraged the government of China to ban alpha-PVP and 115 other novel psychoactive substances on October 1, 2015 (Hall 2017).

In addition to synthetic cannabinoids, the other drugs most commonly used included marijuana, alcohol, and cocaine/crack. This pattern of use may be related to the price of the drugs and the financial status of the users. In 2015–2016 in Austin, Texas, a joint of synthetic cannabis was as cheap as $2, and the street outreach workers reported in the summer of 2017 that persons experiencing homelessness were requesting "safe smoke" kits to smoke synthetic cannabinoids, as well as crack cocaine (Maxwell, 2017).

The increased proportion of males documented in the poison center data, as compared to the decreasing ratio of males admitted to treatment, may reflect different outreach strategies by the programs and the need for services targeted to females. Poison centers refer patients to hospitals but not to housing. The options for referral to treatment varied from law enforcement to hospital commitments to screening and referral programs run by local social service agencies. During 2016, the most common sources of referral to treatment for synthetic cannabinoid users were probation (28%), self-referral (27%), family protective service agencies (8%), and family members (7%).

Regardless of source of referral, the increasing proportion of females entering treatment for problems with synthetic cannabinoids is a concern, particularly with the co-occurring problems of homelessness, violence, mental illness, and dependent children. There is a need for programs targeted to females who are experiencing homelessness. These services should include clothing closets, private showers, legal aid to survivors of sexual assault, and safe environments.

Over time, just as the packaging of synthetic cannabinoid products has changed, so too has the population of users changed from young males seeking to obtain a marijuana-like effect without a positive drug test to an older population using a cheap drug that has exacerbated the problems of those who may have preexisting psychiatric and substance use co-morbidity

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References

AAPCC (American Association of Poison Control Centers). 2007. *National Poison Data System (NPDS) reference*

manual part 2 - System information manual. Alexandria, Virginia: American Association of Poison Control Centers.

Barratt, M. J., V. Cakic, and S. Lenton. 2013. Patterns of synthetic cannabinoid use in Australia. *Drug and Alcohol Review* 32:141–46. doi:10.1111/j.1465-3362.2012.00519.x.

Bonar, E. E. 2014. Synthetic cannabinoid use among patients in residential substance use disorder treatment: Prevalence, motives, and correlates. *Drug and Alcohol Dependence* 143:268–71. doi:10.1016/j.drugalcdep.2014.07.009.

Centers for Disease Control and Prevention. 2013a. Acute kidney injury associated with synthetic cannabinoid use - multiple States. *Morbidity and Mortality Weekly Report* 62: 93–98.

Centers for Disease Control and Prevention. 2013b. Notes from the field: Severe illness associated with synthetic cannabinoid use - Brunswick, Georgia. *Morbidity and Mortality Weekly Report* 62: 39.

Drug Enforcement Administration. National Forensic Information System. Accessed https://www.nflis.deadiversion.usdoj.gov/Login.aspx?ReturnUrl=%2fDQS.aspx

Drug Enforcement Administration. 2018. DEA emerging threat report: First quarter. Accessed https://ndews.umd.edu/resources/dea-emerging-threat-reports.

Fantegrossi, W. E., J. S. Moran, A. Radominska-Pandya, and P. L. Prather. 2014. Distinct pharmacology and metabolism of KW synthetic cannabinoids compared to Delta-THC: Mechanism underlying greater toxicity? *Life Sciences* 97:45–54. doi:10.1016/j.lfs.2013.09.017.

Forrester, M. B., K. Kleinschmidt, E. Schwarz, and A. Young. 2011. Synthetic cannabinoid exposures reported to Texas poison centers. *Journal of Addictive Diseases* 30:351–58. doi:10.1080/10550887.2011.609807.

Hall, J. N. National Drug Early Warning System (NDEWS) Southeastern Florida Sentinel Community Site (SCS) Drug Use Patterns and Trends, 2017: SCE Narrative. At https://ndews.umd.edu/sites/ndews.umd.edu/files/florida-scs-drug-use-patterns-and-trends-2017-final.pdf

Hill, S. L., G. A. Cooper, G. Jackson, D. J. Lupton, S. Bradberry, and S. H. Thomas. 2013. What's on the 'Spice' rack? Synthetic cannabinoid receptor agonist toxicity reported to the UK National Poisons information service. *Clinical Toxicology (Phila)* 51:345.

Hoyte, C. O., J. Jacob, A. A. Monte, M. Al-Jumaan, A. C. Bronstein, and K. J. Heard. 2012. A characterization of synthetic cannabinoid exposures reported to the national poison data system in 2010. *Annals of Emergency Medicine* 60:435–38. doi:10.1016/j.annemergmed.2012.03.007.

Iwanicki, JL, and DJ. Cao. 2014. Hoppe j et al. *Novel Synthetic Cannabinoid Outbreak Causing Severe Illness. Clin. Toxicol (Phila.)* 52:402.

Law, R., J. Schier, C. Martin, A. Chang, and A. Wolkin Notes from the field: Increase in reported adverse health effects related to synthetic cannabinoid use - United States, January-May 2015, Morbidity and Mortality Weekly Report, 64 (2015): 618–19.

Manseau, M. W., A. Rajparia, A. Joseph, S. Azarchi, D. Goff, R. Salatodiya, and C. Fuller Lewis. 2017. Clinical characteristics of synthetic cannabinoid use in a large urban psychiatric emergency setting. *Substance Use and Misuse* 52:822–25. doi:10.1080/10826084.2016.1263663.Accessed

Maxwell, J. C. 2017. Substance abuse trends in Texas. University of Texas at Austin Steve Hicks of Social Work. Accessed https://socialwork.utexas.edu/dl/ari/texas-drug-trends-2017.pdf.

Papadopoulos, E. A., K. R. Cummings, J. M. Marraffa, K. M. Aldous, L. Li, and N. Ahmad. 2017. Reports of adverse health effects related to synthetic cannabinoid use in New York State. *American Journal on Addictions* 26:772–75. doi:10.1111/ajad.12636.

Schwartz, M. D., J. Trecki, L. A. Edison, A. R. Steck, J. K. Arnold, and R. R. Gerona. 2015. A common source outbreak of severe delirium associated with exposure to the novel synthetic cannabinoid ADB-PINACA. *Journal of Emergency Medicine* 48:573–80. doi:10.1016/j.jemermed.2014.12.038.

Shanks, K. G., T. Dahn, G. Behonick, and A. Terrell. 2012. Analysis of first and second generation legal highs for synthetic cannabinoids and synthetic stimulants by ultra-performance liquid chromatography and time of flight mass spectrometry. *Journal of Analytic Toxicology* 36:360–71. doi:10.1093/jat/bks047.

Substance Abuse and Mental Health Services. Treatment episode data set (TEDS), 2004-2014, Appendix B, TEDS Data Elements. Accessed https://www.samhsa.gov/data/sites/default/files/2014_Treatment_Episode_Data_Set_State_Admissions_9_15_16.pdf

Trecki, J., R. R. Gerona, and M. D. Schwartz. 2015. Synthetic cannabinoid-related illnesses and deaths. *New England Journal of Medicine* 373:103–07. doi:10.1056/NEJMp1505328.