Paradoxical increase in synthetic cannabinoid emergency–related presentations after a citywide ban: Lessons from Houston, Texas

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Synthetic cannabinoids (SCs) have become a major drug of abuse associated with severe hospital presentations. There have been a variety of legislative efforts to regulate these drugs: The authors focus on trends in SC-related hospitalizations at Ben Taub General Hospital before and after a ban enacted by the city of Houston. Data from all consults seen by Ben Taub’s Licensed Chemical Dependency Counselor were examined for changes in SC-related presentations before and after the ban. The findings were compared alongside other reports of current SC use. A significant increase was found in the prevalence of SC-related presentations at Ben Taub Hospital following Houston’s citywide ban. These findings are consistent with other state and national data. Houston’s ordinance was expected to decrease harmful effects of SC in the community; however, the data suggest an increase in presentations since the legislation was passed. While further study is needed, it initially appears that the threat of SCs is still considerable despite policy efforts. These results suggest the need for further monitoring of SC use and continued collaboration toward effective public health measures. (Bulletin of the Menninger Clinic, 80[4], 357–370)
Cannabis homologs were originally developed in the 1970s and 1980s as laboratory tools to study the human endocannabinoid receptor system (Howlett, Johnson, Melvin, & Milne, 1988; Johnson & Melvin, 1986). Recreational synthetic cannabinoid (SC) use likely emerged in Europe in the early 2000s, where these products were first marketed as legal alternatives to cannabis (Deluca et al., 2009). Initial reports of SC trafficking in the United States date to December 2008, and SCs have become major drugs of abuse since then (Office of National Drug Control Policy, n.d.). SCs mimic delta-9-tetrahydrocannabinol (THC), the primary psychoactive ingredient in cannabis; then, combined with herbal substrates, they are packaged under names such as “Kush,” “Spice,” and “K2.” These products are chemically distinct from cannabis in many ways, and increasing data have linked SCs to mental phenomena including but not limited to frank psychosis and physical findings such as cardiovascular and neurological dysfunction (Castaneto et al., 2014). Growing acknowledgment of these harmful effects has prompted international attention and closer study of SC abuse as a public health “crisis.”

Epidemiological studies have suggested that SC users are primarily young cannabis and polydrug users across groups: U.S. high school student use is affected by the perception of SCs as a “safer” alternative to other drugs of abuse, and use among military personnel and athletes is influenced by the lack of detectability of SCs in routine drug urine tests (Castaneto et al., 2014). The popularity of these drugs has also been attributed to their intense psychoactive effects and legal status in many jurisdictions (Gunderson, Haughey, Ait-Daoud, Joshi, & Hart, 2012; Vandrey, Dunn, Fry, & Girling, 2012; Winstock & Barratt, 2013).

The legal status of SCs has persisted, largely, because manufacturers have managed to circumvent regulations by synthesizing new, structurally variant compounds for distribution in classic “designer drug” fashion. Agencies such as the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) have carefully followed SC trends in concordance with the Early Warning System (EWS) on new psychoactive substances, and
reports have unfortunately demonstrated a continued pattern of growth: 9 novel SCs in 2009, 11 in 2010, 23 in 2011, 30 in 2012, 29 in 2013, and 30 in 2014, with a total of 137 different SCs noted as of February 2015 (EMCDDA, 2015). Chemical classification of these compounds is complex and includes cyclohexylphenols, naphthoylindoles, naphthylmethylindoles, naphthylmethylindenes, benzoylindoles, phenyl acetylindoles, adamantoylindoles, tetramethylcyclopropylindoles, and other miscellaneous groups; subsequently, a number of different analytical techniques have been applied in the detection and quantification of SCs and SC metabolites in packaged herbal products, hair specimens, and body fluids (Bretteville-Jensen, Tuv, Bilgrei, Fjeld, & Bachs, 2013; Presley, Janse-Carnum, & Logan, 2013). These methods include gas chromatography mass spectrometry (GC-MS; Bretteville-Jensen et al., 2013; Emerson, Durham, Giddens, & Lay, 2013; Gottardo et al., 2012), liquid chromatography tandem mass spectrometry (LC-MS/MS; Bretteville-Jensen et al., 2013; Presley et al., 2013; Teske et al., 2010; Wohlfarth, Scheidweiler, Chen, Liu, & Huestis, 2013), high mass resolution techniques like matrix-assisted laser desorption/ionization time of flight mass (MALDI-TOF) spectroscopy (Bretteville-Jensen et al., 2013; Gottardo et al., 2012; Presley et al., 2013), direct analysis in real time mass spectrometry (DART-MS; Musah, Domin, Walling, & Shepard, 2012), nuclear magnetic resonance (NMR; Rollins, Spuhler, Clemens, Predecki, & Richardson, 2013), gas chromatography/mass spectrometry (GC/MS; Sobolevskii, Prasolov, & Rodchenkov, 2011), and immunoassays (Arntson et al., 2013).

In the absence of rapid laboratory tests to confirm SC exposure or intoxication, detection becomes a time-consuming process. Newly introduced products that circulate in drug markets must first be identified after being obtained from police seizure or from clinical sampling of intoxicated individuals, and only then may an analytical standard be established to confirm SC detection in repeat analyses (Trecki, Gerona, & Schwartz, 2015). Possibly months may elapse before these methods are validated and confirmatory testing for new compounds becomes widely available. Because manufacturers move on to newer compounds
quickly, SC data are likely underreported. With analytical capacity as a limiting factor in SC identification, forensic testing laboratories may be poorly equipped to evaluate trends of drug abuse, and health care providers may be restricted in their ability to evaluate the clinical effects of SC use and to develop specific treatment plans for those who present with intoxication or abuse (Moran, 2011).
Some efforts have been made across levels of government to regulate the availability and use of SCs (Figure 1). Since 2011, the U.S. Drug Enforcement Administration (DEA) has assigned Schedule 1 classification to 15 total SCs through temporary scheduling actions on four different occasions (Sacco & Finklea, 2013). The Synthetic Drug Abuse Prevention Act of 2012 was a federal initiative that added to these efforts and permanently placed 26 SCs on the Controlled Substances Act, while increasing the Attorney General’s temporary scheduling authority. On a state level, all 50 states have some type of SC ban in place, the majority of which involve legislation, and 34 states also have analogue laws to ban drugs that are not officially designated as controlled substances though similar in structure or effect (National Conference of State Legislatures, 2015).

It is particularly relevant to examine efforts that have been passed in the state of Texas, because our investigation takes place within that context. Senate Bill 331 and House Bill 2118, initial actions toward the threat of SCs, were passed in the 82nd Texas Legislature and became effective in September 2011. The laws prohibited any synthetic chemical compound that could be identified as a cannabinoid receptor agonist or found to mimic the pharmacological effect of naturally occurring cannabinoids and outlined SC categories and specific compounds within those categories to be penalized under the Texas Controlled Substance Act. SC manufacturers responded by altering the chemical composition of their products to escape the reach of the bills (Houston Investigative Support Center [HISC], 2015). In turn, cities within Texas countered with local ordinances intended to close loopholes in state law that were being exploited. The city of Houston, Texas, enacted its own local ordinance in 2015, employing language that broadened the definition of an illicit synthetic drug, while additionally targeting deceptive packaging or labeling. Since then, more laws have been passed as a product of the 84th Texas Legislative Session. Senate Bill 173, Senate Bill 461, and House Bill 1212 took effect in September 2015 with the purpose of strengthening state law from 2011.

Various federal, state, and local education and prevention efforts have also been made regarding SC use. The online Syn-
thetic Drug Prevention Information Toolkit by the federal Office of National Drug Control Policy was built as a resource for parents and other influencers trying to learn about the SC phenomenon and address usage within families. Efforts in Houston have included “Synthetic Awareness for Emily” (SAFE), an awareness campaign run through web address www.safe4emily.org by the family of a teenager who suffered severe medical disability resulting from SC use. Multiple local organizations, including The Council on Recovery in Houston, the Houston High-Intensity Drug Trafficking Area (HIDTA) Initiative, the DEA, and the University of Texas Health Science Center hosted a nonvirtual Summit on Synthetic Marijuana in July 2015, where Houston area professionals met to discuss and exchange expertise regarding SCs (HISC, 2015).

In acknowledgment of the need for increased public health awareness and surveillance of SCs, we explore temporal trends in SC use at Houston’s Ben Taub Hospital, a level I trauma center, in context of the citywide local ban that was proposed in September 2014 and unanimously passed on October 8, 2014, as an addition to prior federal and state legislation.

Methods

Data from all consults seen by Ben Taub’s Licensed Chemical Dependency Counselor (LCDC) were compiled, encompassing the Ben Taub Hospital Emergency Center & Psychiatric Adult Inpatient unit. Patients meeting criteria for consultation were identified by either history of addiction/substance use or urine drug screen consistent with substance use. Data were examined for changes in prevalence of SC-related presentations before and after the city-enacted ban. Statistical analysis of hospitalization patterns before and after the ban was done using a two-tailed Mann–Whitney U test with a significance level set at .05. We also compared against other Texas reports of substance abuse (e.g., poison control center calls, residential treatment center trends).
Data

There was a significant ($U = 4; p \leq .05$) increase in the prevalence of SC-related presentations at Ben Taub Hospital after Houston’s citywide ban. Additionally, the percentage of total drug consults attributed to SCs nearly doubled from 9.4% to 18.5% (Figures 2 and 3). These results might be explained by an increase in toxic SC variants that have been engineered to bypass legislation or produced by less experienced chemists, an increase in popularity due to status as a newly illicit drug, increases in media attention and reporting by health entities, or other changes in substance use patterns that are independent of the Houston ban. Even though SCs caused a larger percentage of drug-related hospitalizations after the 2014 legislation (Figure 3), we must consider other shifting drug trends in Texas that may be an indirect influence. For instance, cocaine indicators are thought to be generally decreasing as a result changes in the international market, with fewer coca bushes being grown in the Andes and more product diverted to Europe (Maxwell, 2015). Data from Ben Taub are consistent with such a shift, with cocaine presentations decreasing from 51.3% to 40.8% of drug consults in the pre- and postban periods, respectively.

The pre- and postban shift observed during our period of study is consistent with other national and state data. A comparison of January through May of 2014 with the same period in 2015 revealed a 225% increase in SC-related exposure calls.
at poison centers nationwide, during which the total number of cases rose from 1,115 to 3,621 (American Association of Poison Control Centers [AAPCC], 2016). In Texas, the first five months of 2015 alone saw a 46% increase in exposure calls to the Texas Poison Center Network, with the highest number of calls from Houston’s own Harris County (AAPCC, 2016). Data from state treatment programs funded by the Texas Department of State Health Services (DSHS) indicate that 491 persons with a primary SC problem entered treatment programs in 2014 compared to 156 in 2012 (Maxwell, 2015). Despite that increase in SC-directed treatment, SCs still comprised only 0.7% of all Texas admissions in 2014, seemingly at odds with the prevalence of SC use that has been seen at Ben Traub General Hospital. Other factors may explain this discrepancy, such as more acute versus chronic SC use patterns in hospitals and differences in city and state trends. Areas for intervention include better defining SC use as a significant public health problem, adequately detecting and monitoring SC use, and appropriately allocating resources to work with those who may benefit from treatment.

Recently, Houston law enforcement has participated in a number of actions to extend legislation and combat the threat of SCs (HISC, 2015). In Operation Log Jam of 2012, Houston
DEA agents confiscated 250,000 packets of synthetic drugs and thousands of pounds of other drug-related materials. A November 2013 raid in Southwest Houston resulted in the seizure of more than 70,000 packets of SCs worth $700,000. In January 2015, $2.2 million worth of SCs was seized from two storage units in Houston. A May 2015 raid produced more than 1,000 pounds of untreated plant material and 3,000 packets of SCs, and another large raid in June 2015 came up with 661 pounds of SCs in the Houston area. In spite of impressive police work, the threat of SCs in Houston looms large.

Discussion

With evidence of increasing incidence of severe illness and even death related to SC use (Trecki et al., 2015), it is important to evaluate the efforts to combat SC abuse and also their effectiveness. The annual U.S. Monitoring the Future survey suggests a downward trend in SC use among high school students. Comprehensive data polled 44,892 students from 382 public and private schools in 2015 and indicated declining use of SCs in 12th graders, with a prevalence of 5.2% in 2015, down from 5.8% in 2014, 7.9% in 2013, and 11.3% in 2012 (EMCDDA, 2015; Johnston, Miech, O’Malley, Bachman, & Schulenberg, 2015). However, these findings are limited by self-report and one particular age demographic. We propose that the demographic and patterns of SC use are changing rather than the cumulative burden of abuse. The Internet and online retailers are an additional barrier to effectively banning SC sale and abuse. In 2013, the FBI shut down Silk Road, an anonymous online market that facilitated illicit drug sales. Unfortunately, complex online systems have replaced it, together conducting $300,000–$500,000 in average daily sales (Soska & Christin, 2015).

An understanding of SC abuse influences future policy recommendations moving forward. Some evidence suggests a more hands-off legal approach. In an anonymous online survey of a large global sample (N = 14,966), 93% of users who had tried both synthetic and natural cannabis preferred natural cannabis (Winstock & Barratt, 2013). There may be a relationship
between the illegality of cannabis and legally available SC use. However, in Portugal, where widespread decriminalization of drugs has been observed since 2001, there remains an expanding threat of SC abuse. The country passed a law in April 2013 to regulate commercialization of 159 psychoactive substances, including SCs, after they were linked to increasing reports of intoxication and death (Simões, Silva, Ajenjo, & Dias, 2014). That same year, New Zealand passed the Psychoactive Substance Bill that legalized certain synthetic drugs if they met low-risk criteria after an approval process, while other drugs like cannabis remained illegal. Consistent with realizations in Portugal, New Zealand’s bill was revised in 2014 to ban the sale and possession of all synthetic drugs in response to widespread opposition to the legislation and evidence that even approved products were causing harm (Associated Press in Wellington, 2014). The bill maintains a stipulation for drug distributors to establish safety before legal sales, and this type of quality-control process may indeed be a promising area for further investigation. Ultimately, it appears that the attitude favoring widespread legalization of cannabis or cannabis homologs has not played out as imagined in other countries in terms of SC abuse.

It is difficult to predict what an effective drug policy would look like. The current U.S. approach of banning individual substances as they are detected has culminated in an “arms race” and explosion of novel, perhaps increasingly toxic SC compounds on the market. More general bans—for instance, implicating chemicals with cannabinoid receptor action—would likely be difficult to prosecute in practice. Consider the UK’s broad-sweeping effort to combat “legal highs”: the Psychoactive Substances Bill, which went into effect in April 2016. This legislation makes it an offense to produce, supply, or offer to supply any psychoactive substance if it is likely to be used for its psychoactive effects and regardless of its potential for harm. While the new law is still in its infancy, it has received various forms of pushback, including criticism from The British Advisory Council on the Misuse of Drugs (ACMD) for being difficult
to enforce and predisposed to bringing about unintended negative consequences (Travis, 2015). The more we learn about SC abuse, the more likely it seems that an effective solution in areas where SCs are prevalent will require a multifaceted approach to what is a complex problem.

It is necessary to consider what clinicians and other health providers can do to improve the response to SCs. With increased identification and reporting of SC use and associated adverse health effects to local poison centers or public health departments, health care practitioners can aid regulatory efforts already under way across multiple levels of government. Other areas for improvement include better defining SC use as a significant public health problem where it is not recognized as one, adaptation of validated “screening, brief intervention, and referral to treatment” (SBIRT) type tools for detecting and monitoring SC use, and appropriately allocating resources to work with those who may benefit from treatment.

Conclusions

Houston’s citywide ordinance was expected to close loopholes that were being exploited in previous legislation and decrease harmful effects of SC in the community. Our data suggest a paradoxical increase in SC-related presentations since the legislation was passed. Although further study is needed, it initially appears that current public health efforts in Houston have been inadequate in terms of decreasing adverse sequelae as measured by treatment and hospitalizations attributed to SCs. Our results suggest the need for further monitoring of SC use and perhaps even the need for further policy modification. It is important to recognize that SC abuse represents an unprecedented threat that will likely require multifaceted, data-driven solutions. Furthermore, because SCs are not detected by routinely available drug tests, clinician awareness of associated clinical features and repercussions of SC use is critical to medical management of these patients.
References


Synthetic cannabinoids in Houston, Texas


