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Clinical and financial implications of emergency department visits for synthetic marijuana

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ABSTRACT

Background: Many users believe that synthetic cannabinoids offer a safe and legal means of getting high. However, spikes in emergency department visits have been associated with use of synthetic cannabinoids. The purpose of the current study was to document emergency department visits from three large hospitals in one metropolitan area over a two month period.

Method: This was a retrospective chart review examining 218 patients presenting to three inner city emergency departments between March and April 2014. Data collected included demographic information, information regarding ED diagnosis and treatment, signs and symptoms, ancillary testing, ED disposition, and cost of the medical treatment.

Results: The majority of patients (75.7%) were discharged after ED workup, but 12.4% were admitted for medical treatment and 11.5% were admitted for psychiatric treatment. Ten patients (4.6%) were admitted to the ICU. Symptoms experienced most frequently include: hypertension, tachycardia, agitation, drowsiness, nausea, and confusion. Cluster analysis revealed four symptom clusters of individuals presenting after using synthetic cannabinoids: 1) confusion, hostility, agitation, 2) nausea, vomiting, abdominal pain, 3) drowsiness, and 4) the absence of these symptoms.

Conclusion: This study has three important findings. First, significant ED resources are being used to treat individuals presenting due to effects of synthetic cannabis. Second, synthetic cannabis is not a benign substance. Third, while the hostile and agitated user is generally presented in the media, this study finds significant heterogeneity in presentation. Further research is needed to fully understand the implications of synthetic cannabinoid use.

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1. Introduction

Synthetic cannabinoids are manmade chemicals that bind to cannabinoid type 1 (CB1) and type 2 (CB2) receptors. Synthetic cannabinoids were initially developed in the 1960's in order to investigate potential therapeutic use without the psychotropic effects [1]. Recreational use of these drugs began in Europe around 2004 [2] and was identified in the United States in 2008 [3]. Synthetic cannabinoids are typically dissolved in chemicals such as acetone and sprayed onto plant material [3,4]. While the natural cannabinoid found in marijuana, Δ^9 -tetrahydrocannabinol (THC), is a partial CB1R and CB2R agonist, many synthetic

cannabinoids are full agonists [5] with varying affinities for the cannabinoid receptors [6]. In addition, synthetic cannabinoids lack cannabidiol, which is found in natural marijuana and has antipsychotic properties [7]. Numerous adverse effects of synthetic cannabinoids on cognition (e.g., confusion, delusions, psychosis), behavior (e.g., nightmares, agitation, restlessness), mood (e.g., anxiety, euphoria), sensation/perception (e.g., hallucinations) as well as physiological effects (tachycardia, nausea, vomiting, hypertension, seizures) have been noted [8] [9].

Many users believe that synthetic cannabinoids offer a legal and “harmless” high, and may be motivated to use synthetic cannabinoids to avoid detection [2]. Individuals who have used both natural and synthetic cannabis report fewer negative effects and more positive effects from natural cannabis [10]. Information provided on the AAPCC website [11] indicates large volumes in calls in 2011, the beginning of 2012, and a significant spike between March and May 2015. In 2016, 2695 calls related to synthetic cannabis were logged [11]. Outbreaks of synthetic

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cannabinoid use and subsequent spikes in emergency department visits and adverse events have been reported across the United States [3, 12–14].

There is still a paucity of literature regarding emergency department presentations and dispositions of large samples of patients reporting adverse effects of synthetic cannabinoids. The purpose of the current retrospective study was to document emergency department visits from three large hospitals in one metropolitan area over a two month period, after physicians anecdotally noted an increased in synthetic marijuana use. Emergency department cost, presentation, laboratory results, physical findings, and disposition were documented.

2. Method

This was a retrospective chart review involving a cohort of patients presenting to three inner city emergency departments. Charts were reviewed from March to April 2014, after a spike in synthetic marijuana presentations was anecdotally noted by ED physicians. Because there are no ICD-9 codes for synthetic marijuana, charts for the following ICD-9 codes were identified: acute alcohol intoxication (262.89), abuse, drug or alcohol (305.90), chronic drug abuse (304.90), drug abuse, marijuana (305.20), episodic drug abuse (305.92), mixed drug abuse (305.93), occasional drug abuser (305.92), polysubstance abuse (305.90), polysubstance dependence (304.80), polysubstance overdose (977.9), drug overdose (977.9), accidental marijuana overdose (969.6), marijuana intoxication (292.89), marijuana use (305.20; 305.21), and uses marijuana (305.20). Investigators then manually reviewed the charts in order to identify ED presentations related to synthetic marijuana and extract the data, using data collection forms. Diagnosis of synthetic cannabis intoxication was made by investigators if the patient or a close contact reported the patient used synthetic cannabis within 24 h of the emergency department visit. Delayed effects of synthetic cannabis use were defined as emergency department presentation for sequelae of synthetic cannabis ingested between 24 h and one week prior to the ED visit. This study was approved by the school of medicine's institutional review board as well as a hospital institutional review board with oversight of two of the hospital's personnel.

Data collected included demographic information, information regarding ED diagnosis and treatment, signs and symptoms, ancillary testing, ED disposition, and cost of the medical treatment. Data were collected using ED data collection forms. Investigators familiar with the hospitals' medical records completed the data collection forms. Financial data was provided by each hospitals' financial services.

3. Results

There were 218 people identified as presenting to the ED due to adverse effects of synthetic cannabis. Of these, 114 reported using synthetic marijuana but did not specify the type. Ninety-nine reported using MOJO, specifically, and 5 individuals reported using other brand names (i.e., Bad Kitty, Happy, Spice, White Diamond, and White Widow, respectively). Ages ranged from 13 to 68. The mean age of individuals was 29.35 and median was 27. Thirty-six were female and 182 (83.5%) were male. The majority of individuals (63.8%) presented to the ED within 24 h of using synthetic cannabis. However, 2.3% of individuals presented to the ED reporting side effects of synthetic cannabis and stated it had been one week since they had used it. Toxicology screening results can be found in Table 1. Only four patients tested positive for alcohol; however, 32% of patients tested positive for marijuana.

Overall, 48 patients were transported to the hospital by Emergency Medical Services. Of these, 17 required sedation by EMS and 3 individuals were intubated by EMS (Table 2). A majority (60.1%) of patients received IV fluids in the ED. Approximately 27% were given sedation and 22% received antiemetic medications in the ED. Less frequently, patients received supplemental oxygen (8.3%) or required physical restraints (5.0%). Ten patients required intubation. The majority of patients

Table 1

Alcohol and drug screen results for patients presenting to the emergency department after using synthetic cannabis.

	Number positive	Percent
Marijuana	70	32.1
Benzodiazepines	33	15.1
Opiates	23	10.6
Cocaine	13	6
Amphetamine	11	5
Alcohol	4	1.8

Note: Percentages do not add up to 100 as patients can test positive for multiple substances.

(75.7%) were discharged after ED workup, but 12.4% were admitted for medical treatment and 11.5% were admitted for psychiatric treatment. Mean time spent in the ED was 5.2 h (SD 4.8). Ten patients (4.6%) were admitted to the ICU. On average, ED and hospital related charges of visits related to synthetic cannabis use were \$4494.07, with a range from \$228.05 to \$155,555.10.

Symptoms experienced most frequently include: hypertension, tachycardia, agitation, drowsiness, nausea, and confusion (Table 3). More than 10% of patients experienced vomiting, hallucinations, hostility, and chest pain. One patient was treated for cerebral vascular accident. Another patient received treatment for falling off a horse after smoking synthetic marijuana. CPK levels were requested in 91 of the 218 patients. Of those requested, 60 (66%) were elevated and 19(21%) were five times the normal limit, suggesting rhabdomyolysis. Approximately 24% of individuals presented with hypokalemia, 10% had low levels of bicarbonate, 12% had elevated creatinine, and 53% were hyperglycemia (Table 4). Sixty-seven individuals received X-rays and forty-two received CT scans, with only four positive results.

In order to determine whether there are distinct clinical presentations associated with use of synthetic marijuana, a cluster analysis was performed. As the data are dichotomous symptoms, two-step clustering with outlier detection was performed using SPSS version 22. To reduce the number of outliers, only symptoms experienced by 5% or more patients were included. Despite this, eleven cases (5%) were classified as outliers and not included in the solution. Four clusters emerged. Cluster 1 (n = 34) was composed of patients experiencing confusion, agitation, and hostility. Cluster 3 (n = 50) was defined by nausea, vomiting, and abdominal pain. Cluster 4 (n = 41) was notable for drowsiness. Cluster 2 (n = 82) was comprised of individuals who did not score high on any particular symptom. That is, the absence of drowsiness, nausea, agitation, etc. differentiated them from the other clusters, though members of this cluster appear to have a more heterogeneous clinical presentation. Chi-square analyses revealed the clusters differed in the timing of their presentation to the ED. Clusters 1 (agitation, confusion, hostility) and 4 (drowsiness) tended to be seen more acutely, while more members of Clusters 2 (no particular symptoms) and 3 (nausea, vomiting, abdominal pain) were seen more than 24 h after use. The clusters also differed on rates of testing positive for marijuana only, any other substances, no substances, or not having a drug screen ordered. The vast majority (91.2%) of members of Cluster 1 had drug screens ordered,

Table 2

Medical treatment received by patients presenting to the emergency department after using synthetic cannabis.

	EMS (%)	ED (%)
IV Fluids	1 (0.5)	131 (60.1)
Sedation	17 (7.8)	58 (26.6)
Antiemetic	1 (0.5)	48 (22)
Supplemental oxygen	2 (0.9)	18 (8.3)
Restraints	3 (1.4)	11 (5)
Intubation	3 (1.4)	10 (4.6)
Admitted to hospital		52 (23.9)

Note: EMS: Emergency Medical Services; ED: Emergency Department.

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