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ORIGINAL ARTICLE

Synthetic cannabinoid use in an acute psychiatric inpatient unit

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ABSTRACT: *In the present study, we explored the prevalence of new psychoactive substance use by people admitted into an Australian acute public mental health facility specializing in comorbid mental health and substance use. These substances have since been banned from retail outlets, but the pattern of uptake and reasons people use them is informative in terms of motivations and the management of substance use more generally. A cross-sectional study to explore the use of synthetic cannabis by people admitted to an acute adult mental health unit was undertaken. Associations with diagnostic, service use, and demographic profiles were explored. Fifty-six percent of people reported having used at least one type of new psychoactive substance, including 53.5% who reported using synthetic cannabis alone, and 18.8% who reported using both synthetic cannabis and other new psychoactive substances. Synthetic cannabis use was not associated with any demographic or diagnostic groups. Legality and availability (43% combined) were common reasons for use, along with the feeling of intoxication (20%). The high prevalence of new psychoactive substance use adds weight to the recommendation that clinicians should routinely screen for substances from the time of admission. Accurate information about these substances is required in order to provide accurate guidance and appropriate interventions to people in their care.*

KEY WORDS: *cannabinoids, new psychoactive substance, prevalence, psychiatric, substance use disorder.*

INTRODUCTION

People with mental health issues are known to experience high rates of substance use disorders and associated morbidities. The management of these comorbid conditions requires specific approaches to treatment (Stewart *et al.* 2015), which are predicated on accurate assessment. The availability of new psychoactive substances (NPS), including synthetic cannabis, has complicated the assessment process. Not all standardized substance assessment forms include questions relating to new and emerging substances.

Background

Synthetic cannabis is generally sold in the form of green leafy inert plant material of inconsequential origin, which is then sprayed with a solution containing one or more synthetic cannabinoids. Synthetic cannabinoids are structurally-diverse compounds that bind to CB1 cannabinoid receptors in the brain and act as

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agonists in much the same way as delta-9-tetrahydracannabinol (THC), which is the major psychoactive chemical in cannabis. Synthetic cannabis does not contain a cannabidiol (CBD) mimetic; CBD is another cannabinoid found in cannabis that does not appear to contribute to the intoxicating effects of cannabis, but instead is thought to modulate some of the effects of THC, and could also possess some mild antipsychotic properties (Leweke *et al.* 2016). Synthetic cannabinoids have been available for purchase in Australia since 2010 (Barratt 2012). These products have been sold under a variety of brand names and are often labelled as 'incense', 'not for human consumption' (Brakoulias 2012). Tobacconists, specialist adult shops, 'head shops' (specializing in smoking paraphernalia and/or herbal products), and a number of other retail outlets in Australia began selling synthetic cannabinoids in approximately 2009 (Brakoulias 2012). In the past few years, the number of synthetic cannabinoids marketed around the world has grown exponentially, and most of them are now banned in many countries (Dargan *et al.* 2011).

There are limited data available on the prevalence and pattern of synthetic cannabinoid use. A recent Australian National Household Survey (Australian Institute of Health and Welfare, 2014) collected this information for the first time, reporting that among Australians over 14 years of age, 1.2% had identified as having used synthetic cannabinoids in the previous year, and 0.4% had used other NPS.

The health impacts of synthetic cannabinoid and NPS use remains unclear. The situation is complicated by the diverse chemical structures of these products (Hudson & Ramsey 2011), a number of which have consistently demonstrated greater binding affinity for CB1 and CB2 receptors than THC (Fantegrossi *et al.* 2014). Nelson and colleagues summarized the literature relating to complications from the use of synthetic cannabis (Nelson *et al.* 2014). Mental health issues related to their use included agitation, anxiety, irritability, sedation, confusion, paranoia and psychosis, tolerance, dependence, and withdrawal. Physical complications included seizures, hyperthermia, tachycardia, dysrhythmia, chest pain, myocardial infarction, hypertension, vomiting, acute kidney injury, hypokalaemia, and hyperglycaemia.

There are limited data on the pattern of synthetic cannabinoid use among individuals with mental health issues (Castellanos & Thornton 2012; Every-Palmer 2011), even though this group is potentially more vulnerable to adverse health impacts as a result of use (Pierre 2011). Routine screening for commonly-known substances of abuse is recommended and conducted in mental health services across Australia (Safety and Quality Partnership Standing Committee, 2013), including New South Wales (NSW) (NSW Health, 2001). At the time the study was conducted, questions regarding the use of NPS, including synthetic cannabinoids, were not included in standard self-report screens, and the majority of these drugs cannot be detected in standard urine drug screens. Toxicological assessment requires sophisticated and expensive testing that not readily available to clinical staff (Salomone *et al.* 2012). Data reported in the present study were collected prior to the major legislative changes, which have been implemented in most Western countries since the emergence of new psychoactive substances, including synthetic cannabis (Munro & Wilkins 2014). Australian and state legislation has since been modified, banning the importation and sale of synthetic cannabinoids and other new psychoactive substances, although there are indications that the use of NPS continues in some parts of the community (Sutherland *et al.* 2016).

Clinicians from a specialist mental health and substance use service (MHSUS) unit in NSW, Australia, noted that several people admitted to the unit had asked staff for information about these new substances. At the time, very little was known about the pharmacology of the substances or appropriate management. In view of these concerns, it was felt that further information was required regarding the psychoactive properties of these substances. Clinicians were also uncertain about the patterns of use of these substances by people admitted to the acute mental health unit involved. The MHSUS developed and implemented a routine screening/assessment tool based on self-report, focussing on new psychoactive substances. This assessment was incorporated into the routine substance use assessments conducted on each person admitted to the unit as per state protocols (NSW Health, 2001).

The present study reports the patterns of use of NPS by people admitted to an acute public mental health facility in NSW, which specializes in the comorbid mental health and substance use disorders. To our knowledge, this represents the first standardized screening for new and emerging psychoactive substances in an acute psychiatric population that has been published. This paper expands on a study described in conference proceedings from the 40th International Mental Health Nursing Conference (Clancy *et al.* 2014).

The aim of the present study was to explore the prevalence of NPS use among people admitted to an acute mental health unit specializing in the comorbidity of mental health and substance use, and explored associations between synthetic cannabis use, demographic factors, service utilization, and diagnoses.

METHOD

Design and setting

An exploratory, cross-sectional study was conducted within a 22-bed acute MHSUS unit situated within a large (100-bed) regional acute mental health facility in NSW, Australia. Admission to the MHSUS unit is determined by assessment conducted by a psychiatric emergency care centre, which manages admission processes for each unit in the 100-bed facility. Individuals who meet criteria for admission to the acute psychiatric facility, and who are also identified as having used illicit substances within the month prior to admission, or who have a serious alcohol-use disorder, are eligible for admission to the MHSUS inpatient unit. The mean length of stay for the MHSUS unit is 14.5 days.

A sample-size calculation determined that 100 admissions would provide 80% power to detect a point prevalence estimate with a confidence interval of 15% using a two-tailed test, with an alpha of 0.05.

Data collection

The present study involved the collection of data from consecutive admissions to the MHSUS unit between October 2012 and January 2013. Routine substance use assessments incorporating NPS assessment were conducted by MHSUS clinicians for each person who was admitted to the unit as soon after admission as practicable.

Instrument

A search of the literature conducted prior to the commencement of screening failed to identify any instrument that had been validated for screening or assessment of NPS use. The absence of specific diagnostic criteria for NPS-use disorders, and the lack of readily-available pathology tests for recent NPS use, led the team to develop a simple screening tool for clinical use based on the format of the standardized assessment items from the Mental Health Outcomes And Assessment Tools (NSW Department of Health, 2004), which was already being used in the unit.

A 17-item NPS assessment instrument was drafted by a clinical nurse consultant in mental health and substance use and a psychologist from the MHSUS unit, both with experience in comorbid mental health and substance use and in questionnaire development. Input was provided by consumers, and the draft version of the tool was reviewed and refined by a multidisciplinary panel of nine experts in comorbidity, comprising nurses, psychiatrists, psychologists, and a social worker. Reviewers were asked to consider comprehensiveness, clinical utility, ease of use, and time taken to administer the tool.

The first item in the instrument was a screening item to identify whether respondents had ever used NPS. Respondents who answered 'no' to this question were asked no further questions. The other 16 items related to past and recent use of NPS, including class of substances (synthetic cannabis, stimulant/hallucinogen, both) and brands used (e.g. Kronic, Spice, K2, Smokin' Slurries, White Revolver, Shaman's Dust).

Six additional items were added to the tool, based on elements of a newly-published Australian survey of synthetic cannabis use reported in the literature (Barratt *et al.* 2013). These items related to place of purchase, mode of use (bong (waterpipe used for smoking cannabis), joint, or other), and questions relating to mixing synthetic cannabis with tobacco (spin) for smoking. The panel of experts involved in the review of the original version of the instrument was asked to review the additional items.

For people who have ever used synthetic cannabis, the following questions were used: amount used (in dollars, cones, grams, or other), date of first use, date of last use, and the number of days that synthetic cannabis was used in the month prior to admission. One item related to subjective rating of the experience of intoxication with synthetic cannabis (positive/negative).

Demographic information and discharge diagnoses were retrieved from electronic medical records to complete the audit.

Permission was sought and granted by the Hunter New England Area Human Research Ethics Committee (Newcastle, NSW, Australia) to conduct this prevalence audit (A copy of the instrument used in this paper can be obtained by contacting the corresponding author).

Analysis

Data were analysed using SPSS version 22 (IBM, Armonk, NY, USA). For the purpose of planned

comparison within an analysis of variance (ANOVA) model, patients were categorized into three groups (Fig. 1). Group 1 comprised people who reported they had never used synthetic cannabinoids, but had used other substances; group 2 comprised people who reported having tried synthetic cannabinoids in the past, but not in the month prior to admission; and group 3 comprised people who reported using synthetic cannabinoids within the month prior to admission.

ANOVA was used to compare these groups for association with continuous variables (length of stay, age, number of previous admissions), and χ^2 comparisons were used to analyse associations with categorical variables (discharge diagnoses, sex, employment status, and self-reported experience of using synthetic cannabis).

RESULTS

A total of 88% of admissions (101/115) to the unit completed the assessment. Most patients were Caucasian and male, with mean age of 33 years (standard deviation: 10.9). Characteristics of the sample are described in Table 1.

One individual in the sample had a second admission during the period of data collection. Interestingly, on the first brief admission, this person reported a negative experience from the use of synthetic cannabis, whereas on the second, longer admission, this person reported a positive experience from the use of synthetic cannabis. Data could not be collected from 14 patients for a variety of reasons, including patients' refusal and discharge before data were able to be collected. There was no significant difference in demographics between those who did or did not complete the assessment.

Of the 101 admissions assessed, 57 (56%) reported having used NPS, 54 (53.5%) reported using synthetic cannabinoids, and 19 (18.8%) reported using both NPS and synthetic cannabinoids (Table 2).

When comparing the three groups (Fig. 1), no significant difference was found in demographic variables, namely age on admission, employment status, sex, or relationship status. Similarly, no significant difference was found between the three groups on clinical variables, namely number of previous admissions, length of

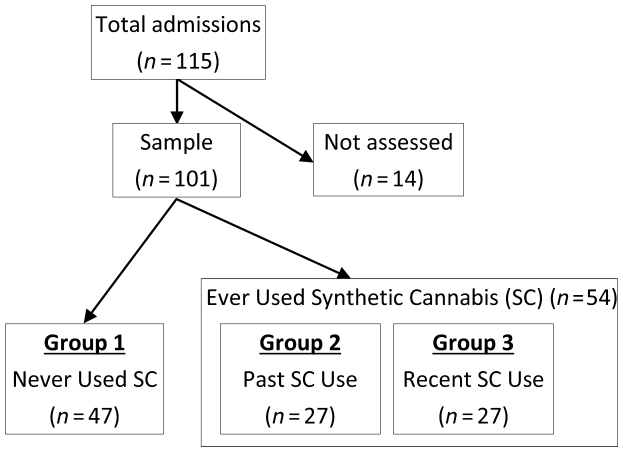

FIG. 1: *Categorisation of the sample for comparison using an ANOVA model.*

TABLE 1: *Sample characteristics*

Sample (n = 101)	% (n)
Male	81 (82)
English spoken at home	99 (100)
Aboriginal & Torres Strait Islander	
Aboriginal	9 (9)
Marital status	
Never married	80 (81)
Married	14 (14)
Divorced, widowed, or separated	5 (5)
Unknown	1 (1)
Currently unemployed	78 (79)
Discharge diagnoses[†]	
Psychotic disorder	68 (67)
Mood disorder	31 (30)
Anxiety disorder	20 (20)
Suicidal ideation	40 (39)
Substance-induced disorder	30 (29)
Cannabis-related disorder	50 (49)
Other substance use disorder	75 (73)
Tobacco-related disorder	80 (78)
Legal status on admission	
Mentally ill[‡]	41 (40)
Mentally disordered[‡]	19 (18)
Voluntary[‡]	40 (43)

[†]Multiple diagnoses recorded for each patient; [‡]Legal status as defined by the NSW Mental Health Act.

TABLE 2: *Self-reported use of NPS*

Lifetime NPS use	% (n)	95% CI
Neither	43.6 (44)	34–54
Any NPS	56 (57)	46–66
Synthetic cannabinoids only	34.7[†] (35)	25–45
'Legal high' only	3.0 (3)	0–8
Both	18.8[†] (19)	12–28
Total	100 (101)	

[†]Synthetic cannabinoids used by 53.5% (n = 54) of the total sample (95% CI: 43–63). CI, confidence interval; NPS, new psychoactive substances.

admission, legal status on admission, or diagnoses (mood disorder, suicidal ideation, substance-induced disorder, or psychotic disorder). A trend was seen between recent synthetic cannabinoid use and a higher incidence of cannabis-related disorder and anxiety disorders (cannabis related disorder $\chi^2(2, n = 98) = 5.683$, $P = 0.058$; anxiety disorders $\chi^2(2, n = 98) = 5.87$, $P = 0.053$).

Patients who reported using synthetic cannabinoids were asked reasons for their use of synthetic cannabinoids. These are outlined in Table 3.

In the course of assessment, patients were also asked to rate their experience with using synthetic cannabinoids. More than half of the respondents (59%) rated their experience as negative. A negative experience was associated with a higher chance of discontinuing the use of synthetic cannabinoids ($\chi^2(1, n = 50) = 4.778$, $P = 0.029$), although almost half (46%) of those who rated their experience as negative continued to use these substances.

Of the recent synthetic cannabinoids users, 21 (21/27) reported using regularly in the month prior to admission (current regular use was defined as using $\geq$4 days in the month prior to admission). In this group, the mean number of days per month in which synthetic cannabinoids were consumed was 17 (range: 1–30). Thirty-eight percent ($n = 8$) reported daily use, while 33% ($n = 7$) used between 4 and 8 days per month, which equates to weekend use.

The self-reported number of 'cones' per day by synthetic cannabinoid users varied between two to 90 per day. The mean reported consumption was approximately nine cones per day, with a median of four cones per day. Eleven patients reported using 'spin' with their synthetic cannabinoids (mixing tobacco or other plant material with cannabis is referred to as 'spin'). Thirteen patients reported using a bong to smoke synthetic cannabinoids, while one respondent reported using a pipe, and another reported preferring to smoke 'joints'.

Patients reported nearly 30 variants (brands and labels) of NPS, with Kronic being the most frequently reported. No chemical analysis was undertaken of samples to determine the specific chemical content.

TABLE 3: *Reasons for using synthetic cannabinoids*

Reasons for NPS use	% (*n*)
Legality	24.1 (13)
Feeling state (in intoxication)	20.4 (11)
Availability	18.5 (10)
Curiosity	11.1 (6)
Being 'shouted'	9.3 (5)
Work	3.7 (2)
Cost	3.7 (2)
Other	9.3 (5)

DISCUSSION

The present cross-sectional exploratory study took place in a large regional acute mental health inpatient facility specializing in comorbid substance use. At the time of data collection, NPS, including synthetic cannabinoids, were being sold in Australia with little restriction online and in tobacconists, specialist adult shops, and other outlets. Clinicians had little information to guide their practice in relation to NPS, and were unaware of the frequency of NPS use by people accessing services.

The only other known study into NPS use by people accessing mental health services ($n = 15$) was conducted in a New Zealand forensic unit (Every-Palmer 2011) reporting a higher prevalence of use (86% vs 56% in our case).

Our sample population was predominantly male, with the average age being 33 years. The mean age of synthetic cannabis users in community surveys (Barratt *et al.* 2013; Winstock & Barratt 2013) is reported to be approximately 25 years. The mean age in the inpatient study (Every-Palmer 2011) is comparable (34 years). The higher mean age in the mental health populations is likely to be attributable to sampling methods used, although it could be possible that older synthetic cannabinoid users could have severe mental health problems requiring inpatient treatment. In the present study, the demographic and clinical variables were similar between synthetic cannabinoid users and other acute inpatients. It could be that the mental health impact associated with synthetic cannabinoids is similar to other illicit substances used by this client group. It is also possible that the use of synthetic cannabis could be associated with their mental health conditions, as a number of mental health symptoms are reported to be associated with synthetic cannabinoid use (Alverio *et al.* 2012; Benford & Caplan 2011; Brakoulias 2012; Castellanos *et al.* 2011; Every-Palmer 2011; Hurst *et al.* 2011; Johnson *et al.* 2011; Muller *et al.* 2010; Oluwabusi *et al.* 2012; Peglow *et al.* 2012; Rodgman *et al.* 2011; Tung *et al.* 2012; Van Der Veer & Friday 2011). However, mental health issues are often multifactorial in aetiology, and thus any direct associations are difficult to quantify. The issue of quantifying the risk is unlikely to be answered in the foreseeable future due to the changing chemical structure and variable concentration of synthetic cannabinoids sold to and used by the public.

Cannabis use is reported to be associated with synthetic cannabinoid use (Barratt *et al.* 2013; Every-Palmer 2011; Winstock & Barratt 2013). This association between cannabis-use disorder and synthetic cannabis use approached statistical significance in our study. Our patients reported that legality and availability were high in their reasons for using synthetic cannabis. The legal availability of synthetic cannabis might have led consumers to perceive that synthetic cannabis was safer than herbal cannabis. These individuals might also have avoided herbal cannabis due to previous adverse experiences. The reasons given by patients for choosing to use synthetic cannabinoids (legality, availability, and non-detectability) were similar to the findings of other studies (Barratt *et al.* 2013; Winstock & Barratt 2013). The pattern of use in this population could change, as these substances are no longer legal. A significant number of patients in our study and the Every-Palmer (2011) study reported negative experiences with synthetic cannabinoid use, but continued to use the substance, which indicates the addictive property of these substances.

Synthetic cannabis smokers used synthetic cannabis an average of 17 days in the month prior to admission to hospital, consuming a mean of nine cones of synthetic cannabis on each smoking day. Quantifying the extent of intoxication this level of consumption produces is virtually impossible; however, it does appear that some individuals are spending significant portions of time in an intoxicated state.

Limitations

The present study was reliant on self-report, thus had the limitations therein. The screening tool was conducted as part of routine clinical assessments on all consecutive admissions, which might have reduced the sampling bias commonly associated with self-reports (Winstock & Barratt 2013). The present study was limited to acute mental health inpatients in one Australian facility with comorbid substance use issues, so the results might not be representative of the general Australian or international population. The tool that was developed for this population has not been tested for concurrent validity, nor has it been piloted in other populations.

Further research

The present study further contributes to existing literature regarding adverse mental health consequences associated with synthetic cannabis use. Further studies are needed to comprehensively assess the impact. The present study was conducted prior to the introduction of bans restricting the sale of NPS, including synthetic cannabis. Changes in the pattern of use in different populations with legal changes could also be explored in future studies.

CONCLUSION

As a baseline measure of the prevalence of use of NPS in an acute psychiatric facility for people with comorbid substance use issues, the data reported here will contribute to the understanding of the impact of the introduction of legislation, such as the changes to the NSW Drug Misuse and Trafficking Act and amendments to Australian therapeutic goods legislation schedules in 2013 on substance use patterns among a complex subgroup of the community. Given that the purchasing methods of this subgroup differ from other samples reported in the literature (Barratt *et al.* 2013), it is possible that legislation changes will have different impacts on different populations. Ongoing routine assessment for the use of these substances is clearly indicated due to the prevalence and potential health consequences. The rate at which the uptake of these emerging substances has spread serves as a reminder to clinicians to be vigilant for the introduction of new substances and their associated health impacts in the future.

Relevance for clinical practice

Cannabis intoxication impacts individuals' concentration, memory, executive function, and other cognitive abilities. It is likely that synthetic cannabinoids will similarly impact cognitive function. Bearing in mind that impaired cognition is likely to impact on psychosocial interventions, clinicians in inpatient and community settings are advised to assess all people accessing treatment for NPS use when they assess for other substance use. Clinicians should be aware that many NPS substances are not detected in routine urine drug screens. Our study demonstrates that among acute mental health inpatients who use substances, there are no diagnostic or demographic markers to help identify likely users of NPS. Accurate assessment of all substances used will assist clinicians to determine any contribution to impairment attributable to new and emerging substances, and will provide a first step in identifying symptoms related to withdrawal from these

substances and developing withdrawal-management treatments.

Where the use of NPS is identified, as with any other substance use, clinicians are recommended to employ motivational strategies to engage and encourage people to consider the impact that substance use is having on their life, and consider ways to reduce any current and potential harms associated with their substance use. It is helpful to ask the person to refrain from using substances immediately prior to future home visits or centre-based appointments in order to reduce the impact of acute intoxication on cognitive function. Scheduling appointments early in the day might also reduce the likelihood of intoxication. If a person is intoxicated at the time of a scheduled visit, it is helpful for clinicians to provide necessary interventions, but consider delaying delivery of complex interventions to a later time if it is likely that a more suitable (less-intoxicated) time is likely to be found in the near future. For many people receiving treatment for mental health issues, abstinence is not a goal to which they currently aspire. In this situation, clinicians can continue to provide mental health interventions, despite ongoing substance use, along with motivational interventions to help the person consider changing their substance use.

It is also important that clinicians are able to provide consumers with accurate information about substances they are using. Due to the evolving nature of NPS, clinicians will need to constantly update their information on the psychoactive profiles of these substances.

As a result of the findings of this study, MHSUS clinicians developed a short educational video and a pamphlet for consumers about synthetic cannabis. Education outlining the major issues relating to synthetic cannabis was delivered to clinicians in the MHSUS.

Continued monitoring of NPS use is indicated in this population at the individual clinical level, and prevalence monitoring from a broader public health perspective.

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