Title:

Patterns of synthetic cannabinoid use in Australia

Short title:

Synthetic cannabinoids in Australia

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Abstract

Introduction and Aims To assess the demographic profile, use patterns, market characteristics, reasons for first use, and self-reported harms associated with use of synthetic cannabinoids in Australia. **Design and Methods** An online questionnaire was administered to a purposive sample of 316 Australian synthetic cannabinoid users (96% cannabis users, 77% male, median age 27yrs, IQR 23–34) who self-reported demographic and drug use characteristics. **Results** The median duration of synthetic cannabinoid use was 6 months (IQR 2–10), 35% reported use weekly or more often, and 7% reported daily use. Reasons for first use included curiosity (50%), legality (39%), availability (23%), recreational effects (20%), medicinal effects (9%), nondetection in standard drug screening assays (8%), and to aid the reduction or cessation of cannabis use (5%). Users reported buying a median of 3g (IQR 3–6) and paying a median of 60AUD (IQR 37–90). Most (68%) reported at least one side effect during their last session of use, including decreased motor coordination (39%), fast or irregular heartbeat (33%), dissociation (22%), dizziness (20%), paranoia (18%) and psychosis (4%). Only 4 respondents reported seeking help. A greater number of side effects were reported by males, those aged 18–25yrs, waterpipe ('bong') users, and concurrent alcohol drinkers. **Discussion and Conclusions** The sample reported first using synthetic cannabinoids due to curiosity, legality, availability, effects, nondetection in drug testing, and to reduce their cannabis use. Harms were widely reported yet help-seeking was minimal. Inclusion of questions regarding synthetic cannabinoids in household surveys is warranted.

MeSH Keywords Cannabis, Cannabinoids, Demography, Prevalence, Questionnaires

Introduction

Synthetic cannabinoid receptor agonists (hereon 'synthetic cannabinoids') produce subjective effects similar to cannabis in humans. Although they are structurally dissimilar from Δ-9-tetrahydrocannabinol (THC), the chief psychoactive compound found in cannabis, synthetic cannabinoids also act upon the endocannabinoid system in the brain [1-3]. There are a large number of structurally different synthetic cannabinoids, which have been classified by Hudson and Ramsey [2] into 8 groups: dibenzopyrans or classical cannabinoids (e.g., Nabilone), cyclohexylphenols or non-classical cannabinoids (e.g., CP 47,497), benzoylindoles (e.g., AM-694), phenylacetylindoles (e.g., JWH-250), naphthoylindoles (e.g., JWH-018), naphthylmethylindoles (e.g., JWH-185), naphthoylpyrroles (e.g., JWH-369), and naphthylmethylindenes (e.g., JWH-176). Individual synthetic cannabinoids from these diverse categories may act as full agonists, partial agonists, neutral antagonists or inverse agonists at the CB1 receptors, and some also show affinity to the CB2 receptors [4].

With the exception of the classical cannabinoids Dronabinol (oral THC) and Nabilone (synthetic THC) [5, 6], synthetic cannabinoids have not been approved for therapeutic use. Their use as recreational drugs was first reported in 2004, with increased use reported in 2008 in Europe [7] and in 2010–11 in the US [8], Australia [9] and New Zealand [10]. Synthetic cannabinoid products are typically manufactured by applying synthetic cannabinoids onto relatively inert plant matter that can be smoked [1-3]. They have been sold under several commercial brands, with Spice the most common in Europe, K2 in the US, and Kronic in Australia. Due to their structural dissimilarity to cannabis, synthetic cannabinoid products were legal when they first became

popular. Their use was also difficult to monitor because assays had not yet been developed to detect their metabolites in urine and blood tests. In response to increased reports of use and a growing harm profile, prohibitions of synthetic cannabinoids have now been enacted in a number of countries including, but not limited to, the US [11], UK [12], New Zealand [13] and Australia [14]. Between June and August 2011, some Australian jurisdictions prohibited a range of synthetic cannabinoids, and in July 2011, the Australian federal Therapeutic Goods Administration (TGA) added them to the federal Poisons Standard [15]. In May 2012, the TGA prohibited the 8 aforementioned categories of synthetic cannabinoids as well as any synthetic cannabinomimetics not otherwise scheduled [14].

To date there are only two published surveys of synthetic cannabinoid users [16, 17], with only one providing detailed epidemiological data [17] and none separately describing Australian users. Unfortunately, data from representative survey samples are not currently available.

Aim

To assess the demographic profile, use patterns, market characteristics, reasons for first use, and self-reported harms of synthetic cannabinoid use in Australia through an online questionnaire.

Method

Survey design and sample recruitment

Respondents completed an online questionnaire of approximately 15 minutes duration from December 2011 to January 2012 and comprised Australian residents aged

≥18yrs who reported use of synthetic cannabinoids on one or more prior occasions ($N = 316$). The full questionnaire can be accessed by contacting the first author. The research was approved by the ethics committee at Curtin University.

Our knowledge of the target population led to use of a variety of strategies aimed at accessing a broad range of Australian synthetic cannabinoid users in the community (i.e., not through treatment or correction services). Purposive sampling [18] strategies included engaging in online forums where synthetic cannabinoids were discussed, social media (e.g., posting to synthetic cannabinoid groups, asking well-connected people to 'share' the survey with their networks), e-mail lists, distribution of business cards to drug paraphernalia and adult shops who distributed the cards to customers, announcements at a conference about the spiritual use of plants ('entheogens'), and print media. Over one third (37%) of the sample reported finding out about the study through social media (Facebook 35%, Twitter 1%, e-mail 1%), under one third (30%) found out about the study through online drug discussion forums (Bluelight.ru 16%, Shaman-australis.com.au 11%, OzStoners.com 4%), and the remainder found out about the study through drug paraphernalia shops (12%), the entheogen conference and e-newsletter (Entheo.net 6%), word of mouth (6%), adult shops (4%), mX newspaper (2%), and other online sources (2%). Recruitment through social media and online forums involved engaging participants in conversations and responding promptly to questions about the study and the researchers, following procedures previously outlined by the authors [19].

No reimbursements or other incentives were offered to survey participants. Offering reimbursement or prizes provides motivation for multiple responding or vote stacking

[20] and also involves taking identifying information from participants. Instead, we emphasised the anonymous nature of participation in our study, which did not collect Internet Protocol (IP) addresses or email addresses which could potentially be used to identify individuals. The disadvantage of not collecting IP addresses is that we cannot identify respondents who may have taken the survey more than once from the same computer [20]; however, the lack of financial incentive and the 15-minute time commitment reduced the motivation for respondents to deliberately respond more than once. Although we did not collect IP addresses within the dataset, we did use Google Analytics to conduct traffic analysis on the URL used to promote the survey, kronicstudy.net. These data indicate that 94% of the 1,042 visits to kronicstudy.net over the study period were unique visitors. While in no way exact, the Google Analytics data indicate that multiple responding from the same computer could not have grossly affected the data.

Analysis

The analysis primarily involved descriptive statistics. Medians with interquartile range (IQR) were reported as these statistics are less biased descriptors for count variables which were positively skewed. Mann-Whitney *U*, Kruskal-Wallis, and Pearson's chi-square tests were used to test differences between groups, using an alpha level of significance of .05. Unless otherwise specified, the sample size was 316. Open-ended responses to the question 'why did you first consume synthetic cannabinoids' and free text 'other' responses were coded for themes, then transformed into count data. Analyses were conducted using Stata 11 (College Station, TX) and SPSS 19 (IBM, New York, NY).

Results

Demographics

The median age of respondents was 27yrs (IQR 23–34), and most were male (77%). Almost all (86%) reported completing secondary school and the majority reported completion of a tertiary qualification (65%), including technical college (20%), diploma (15%), or university degree (30%). Most (78%) were currently employed, some (19%) were students, and 6% reported being unemployed and looking for work (multiple response). Most of the sample (73%) had never participated in tobacco, alcohol or other drug treatment programs, but 14% reported having sought help to reduce or cease tobacco consumption, 10% reported help-seeking for illicit drug problems and 3% for alcohol-related problems.

Drug use

Synthetic cannabinoids. All respondents reported prior lifetime use of synthetic cannabinoids, almost the entire sample (94%) reported use within the past 12 months, and less than half (45%) reported use within the last month. Over one third (35%) reported use weekly or more often and 7% reported daily use. Males (36%) were no more likely than females (33%) to report use weekly or more often ($\chi^2(1) = .21$, $p = .65$), but weekly-plus users did report an older median age (30 vs 26, Mann-Whitney $U = 9030$, $p < .01$). The majority (70%) reported having used synthetic cannabinoids on ≥10 occasions, with 32% reporting use on ≥100 occasions in their lifetime (valid $n = 300$). Males reported a higher median number of lifetime use occasions than females (30 vs 15, Mann-Whitney $U = 6790$, $p = .03$). Younger users aged 18–25yrs reported significantly less lifetime use occasions than 26–35yrs and ≥36yrs (median 10 vs 45 vs 50, $\chi^2_{kw}(2) = 10.87$, $p < .01$). This finding is unlikely to

be explained by less exposure to synthetic cannabinoids by virtue of age (right censoring), as the median length of synthetic cannabinoid use was 6 months (IQR 2–10) and 19% reported using it for ≤1 month (valid n = 170).

Other drugs. Almost the entire sample (96%) reported lifetime use of cannabis, and most (81%) reported use on ≥100 occasions. Most (94%) reported cannabis use within the last 12 months and over half (61%) reported use within the last month. Daily cannabis use was reported by 15%. Including alcohol and tobacco, the sample reported using a median of 9 discrete drugs in their lifetime (IQR 6–14; range 2–28), 5 in the previous 12 months (IQR 4–8; range 1–25), and 3 in the previous month (IQR 2–4; range 0–14). Despite this extensive drug history, most only reported use of alcohol (77%), cannabis (61%) and tobacco (58%) in the last month.

Patterns of use

Respondents who reported use of synthetic cannabinoids in the last 12 months in Australia described their most recent occasion of use (valid n = 291). A total of 27 different brands of synthetic cannabinoid products had been consumed. Brand names were mostly derived from slang references to cannabis or the names of cannabis strains, the most commonly mentioned brands being Kronic (39%), Northern Lights (15%), K2 (9%), Zeus (5%), Puff (4%), Spice (3%) and Tai High (3%) (valid n = 269). Additionally, 6% reported use of non-branded ‘raw’ or ‘pure’ synthetic cannabinoids; that is, not applied onto a smokable substance, and 2% described use of a homemade preparation.

The majority of the sample reported that the effects of synthetic cannabinoids lasted either ≤1 hour (30%) or 2 hours (35%), with the remainder reporting effects lasting 3

hours (21%), 4 hours (9%) or ≥5 hours (5%) (valid $n = 286$). The most commonly reported route of administration during the last occasion of use was a waterpipe ('bong', 54%), while approximately one quarter smoked synthetic cannabinoid products in a 'joint' (27%) or 'pipe' (23%). Only a few respondents ate synthetic cannabinoid products (4%) or inhaled them using a vaporiser, a device that vaporises active ingredients from plant material for inhalation without combustion (2%, multiple response). Males (59%) were more likely than females (36%) to report using a bong ($\chi^2(1) = 10.21$, $p < .01$), and bong users were significantly younger than the remainder of the sample (median age 26.5 vs 29, Mann-Whitney $U = 9094$, $p = .04$).

Almost two thirds (64%) reported concomitant use of other drugs with synthetic cannabinoids. Tobacco (40%), alcohol (33%) and cannabis (13%) were the only other drugs used by more than two per cent of the sample concurrently with synthetic cannabinoids.

Market characteristics

Bricks-and-mortar drug paraphernalia stores or 'head shops' were the most commonly reported method of purchase (31%), followed by the internet (22%), friends (19%), adult shops (14%), tobacconists (9%), family (2%), drug dealer (1%) and other (1%). Users reported buying a median of 3g (IQR 3–6) and paying a median of 60AUD (IQR 37–90). The median price paid per gram was 18AUD (IQR 13–23).

Reasons for first use

Half the sample (50%) reported that they first tried synthetic cannabinoids because they were curious to compare the effects of synthetic cannabinoids with cannabis (see

Figure 1). Other commonly reported reasons were that synthetic cannabinoids were legal (39%), easier to get than cannabis (23%), produced desirable recreational effects (20%), were 'something different' to cannabis (11%), or were offered by friends (10%). Therapeutic effects of synthetic cannabinoids, such as relief from pain, nausea, anxiety and insomnia, were mentioned by 9% of the sample. A few respondents (5%) reported that they had used synthetic cannabinoids to reduce or cease cannabis use.

(Insert Figure 1 about here)

Only 8% of the sample reported that they first tried synthetic cannabinoids to evade workplace or drug driver testing. Over double this amount (20%) reported being currently subject to drug testing, including 12% for drug driving and 11% for workplace testing. Most believed synthetic cannabinoids were less likely to be detected by workplace drug testing (76%) and drug detection dogs (79%) than cannabis.

Side effects

Two thirds (68%) reported at least one side effect during their last session of synthetic cannabinoid use (valid $n = 291$). The median number of side effects reported was 1 (IQR 0–4). Side effects reported were: decreased motor coordination (38%), fast or irregular heartbeat (33%), dissociation (22%), dizziness (20%), paranoia (18%), confusion (18%), headache (18%), panic (14%), slurred speech (14%), sweating (14%), nausea or vomiting (9%), depression (4%), and psychosis (4%). Only six

respondents reported that these side effects were serious enough for them to consider seeking help. Help received included being monitored by friends (n = 2), ambulance called but later cancelled (n = 1) and taken by ambulance to hospital (n = 1). The remainder received no help or treatment (n = 2).

The number of side effects reported during the last session of use were compared by sex, age group, bong use, and concurrent use of alcohol and cannabis (valid n = 291). Males reported significantly more side effects than females (median 2 vs 1, Mann-Whitney $U = 5722$, $p < .01$). Younger users aged 18–25yrs reported significantly more side effects than 26–35yrs and ≥36yrs (median 2 vs 1 vs 1, χ^2_{kw} (2) = 9.28, $p = .01$). Users of bongs reported significantly more side effects than users who reported other routes of administration (median 2 vs 1, Mann-Whitney $U = 8670$, $p < .01$). Participants who reported use of alcohol concurrently with synthetic cannabinoids reported significantly more side effects than those who did not report concurrent alcohol use (median 2 vs 1, Mann-Whitney $U = 7873$, $p = .02$). Use of both synthetic cannabinoids and cannabis concurrently was not associated with increased reporting of side effects (median 1 vs 1, Mann-Whitney $U = 4782$, $p = .78$).

Discussion

Findings

Almost all (96%) of the synthetic cannabinoid users who participated in this study also reported cannabis use. The only other published survey of synthetic cannabinoid users recruited from the general population found that 16% had never used cannabis [17]. Further study is required to determine whether our result reflects a low level of

appeal of synthetic cannabinoids to non-cannabis users or was a result of sampling bias.

The use of emerging psychoactive substances by middle-aged adults is rarely described in the literature. The median age in our sample was 27yrs and one quarter reported an age of ≥35yrs. Vandrey et al.'s survey of synthetic cannabinoid users recruited from the general population reports first use at a mean of 26yrs [age at survey was not reported, 17], and calls to US poisons centres report a median age of 20yrs (IQR 17–25) across 1,353 single-agent exposures in 2010 [21]. The lack of middle-aged users reported in clinical samples may indicate that young people are more likely to need medical assistance after consuming synthetic cannabinoids compared with older users or are more visible in the clinical surveillance system than older users. This interpretation is supported by our finding that participants aged 18–25yrs reported a greater number of side effects than older users.

The sample reported first using synthetic cannabinoids due to curiosity, legality, availability, effects, nondetection in drug testing, and to reduce their cannabis use. Studies of psychiatric in-patient populations [22, 23] and community samples [17, 24] also report that use of synthetic cannabinoids was motivated by nondetection in drug tests [17, 22-24], legality [22], availability [22, 24], desirable effects [17, 23, 24] and curiosity [17]. The use of synthetic cannabinoids for therapeutic purposes, including relief from pain, nausea, anxiety and insomnia, and in order to reduce or cease cannabis use, was also reported in this survey. The price of synthetic cannabinoid products (18AUD/g) was not a primary reason for use in this study. In other studies,

the price of synthetic cannabinoids [24] and their shorter duration of action [22, 24] were reported as reasons for use.

Harms were widely reported yet help-seeking was minimal. A greater number of side effects was reported by males, those aged 18–25yrs, bong users, and people who drank alcohol while concurrently consuming synthetic cannabinoids. Concurrent use of cannabis did not predict increased side effects from synthetic cannabinoids.

Limitations

This study was conducted with a self-selected sample recruited mainly from online sources. These results should not be interpreted as representative of any wider populations of synthetic cannabinoid users, as through our recruitment strategy, we were likely to overrepresent people with an extensive drug use history and people more heavily engaged in online discussion groups. Respondents may have 'faked good' by under-reporting side effects to make synthetic cannabinoids appear less harmful; however, organised multiple responding was unlikely because almost all visits to the survey website were unique. While this study provides new and original information about the epidemiology of synthetic cannabinoid use, it is set in a context where new synthetic drugs are rapidly appearing. This necessitates caution in interpreting these findings and limits generalisability into other contexts where different synthetic cannabinoids may be used.

Future research

Questions regarding synthetic cannabinoids should be included in future household surveys to provide more robust epidemiological data on this emerging class of drugs.

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Contributors

MB led the writing, analysis and structure of this paper. VC provided substantial input into the survey construction and analysis. All authors provided substantial input into the design, content, interpretations and conclusions.

Conflict of interest

None

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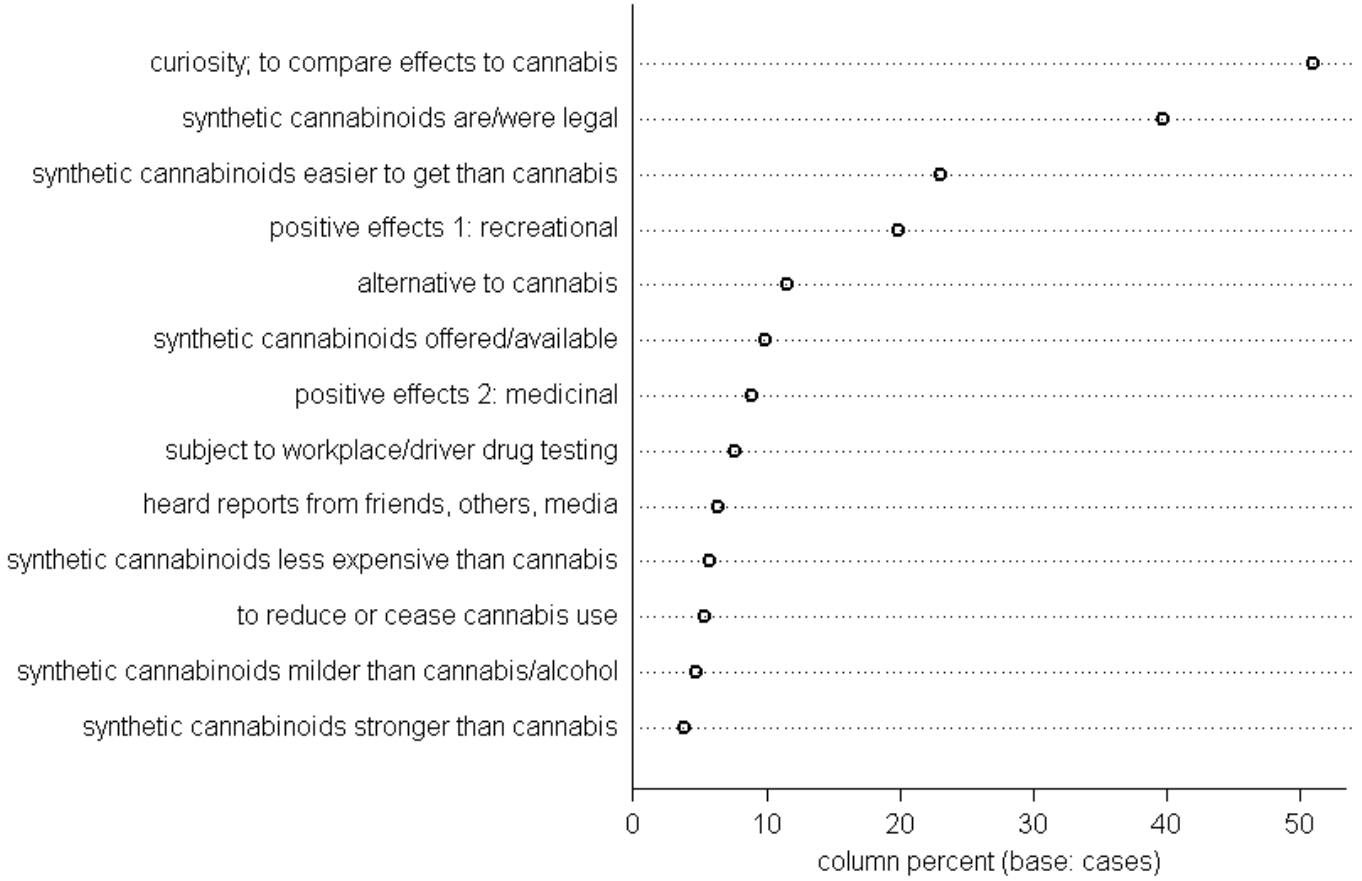

Figure 1. Reasons for first using synthetic cannabinoids ($N = 316$)

Note. Only reasons with counts of 10 or more are included.