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Understanding the Toxic and Lethal effects of New Psychoactive Substances from Social Media

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***Abstract*—NPS or Novel Psychoactive Substances (legal highs) are compounds designed to mimic existing recreational drugs. The lethal and toxic effects associated from the use of these compounds on discussion forums, has not yet been explored. A total of 207 threads were analysed from eight discussion forums, which were then exported to NVivo software. The threads were read to categorise themes and sub themes for the study. Six NPS classes that contained six main themes were identified and explored during the study relating to NPS use: Popular derivatives, demography, route of administration, motivation for intake, toxicity and fatalities. This study shows in-depth information from discussion forums about NPS in regard to demography, ROA, MOI, toxicity and fatalities that is not found in literature. The results can provide a guidance to an in-depth education about NPS to possibly help those trying to assist in addiction or treatment.**

***Keywords*—New psychoactive substances, social media, qualitative, thematic content analysis, toxicity**

1 Introduction

Novel psychoactive substances (NPS), known as legal highs, designer drugs, research chemicals and bath salts are a wide and heterogeneous group of substances, often pharmacological analogues of prohibited substances" [1]. It is the speed at which the pharmacology of these substances changes that brings substantial clinical, physical and social issues [2]. As the contents of NPS is constantly changing, it is difficult for emergency healthcare professionals to treat users and thus NPS users are putting themselves at serious risk with these unregulated substances [3].

There are several factors that contributed to the emergence of NPS. The rapid rate and increased marketplace availability of NPS and at which the information is uploaded on the Internet [4-5]. Online user-generated content is increasingly becoming essential to providing an informed and up-to-date portrayal of positive and negative effects regarding NPS consumption [6]. The main classes of novel psychoactive substances consist of phenethylamines, amphetamines, synthetic cathinones, synthetic cannabinoids and tryptamines/hallucinogens [7]. Although the concept of new emerging drugs (NPS) is not new, such compounds have experienced resurgence in many parts of the world, as evidenced by the Drug Enforcement Agency (DEA) and European Union [8-9]. The motivation for developing NPS for recreational use had perceived advantages including avoiding legal liability, an assumption that they are safe, and a relatively low cost compared to other abused street drugs [10-12]. Due to the fact that there are new NPS compounds being introduced on a regular basis some of which may have high potency, has led to reported cases of emergency hospitalization and/or death [13-15].

However, despite the concern over the fatalities from the consumption of NPS, qualitative studies using discussion forum thread content associating death and toxicity from NPS consumption is limited. Most of the information available is quantitative and could require extensive knowledge of the subject area before understanding the data. Furthermore, there is minimal data in literature that associates death from NPS in more than two drug classes. As of December 2023, there are no studies that investigate into compound consumption, demography, ROA, MOI, toxicity and fatalities. Although these substances are now illegal in many countries, research into this area should be conducted, because like other substances of abuse, these compounds could become available through street dealers and even the Internet. It is still important to associate NPS fatalities and there related toxicity's as a result from the consumption of NPS. On the Internet interpersonal communication and connectivity, regardless of physical proximity became the new means to discuss and share knowledge and experiences of certain substances, resulting in an increase in online discussion forums [16]. The anonymous nature enables the sharing of unrestricted material that otherwise could not be shared because of privacy. Therefore, discussion forums and the threads contained within them provide valuable resources that should be utilised in establishing the current issues surrounding NPS, and for this study, associated deaths.

1.1 Aim

The purpose of this study is to investigate into the toxic and lethal effects associated with the use of NPS using content analysis of qualitative data. The study will investigate into the most popular NPS and their derivatives, explore demographic characteristics, review the route of administrations, determine the motives, associate toxicity and review associated fatalities.

2 Materials and Methods

This study involves the qualitative analysis of online discussion forums to explore associated deaths relating to NPS consumption. The topics of drug and deaths are sensitive, so to minimise the ethical considerations, a retrospective desk-based approach was used where no participants names was included.

The growth of the Internet has made discussion forums a popular means to communicate anonymously.

2.1 Research design

The use of qualitative analysis provides a way to get an in-depth understand of the underlying reasons, attitudes, and motivations behind various human behaviors [17]. The purpose of conducting a desk-based qualitative study was to maximise the data available whilst minimising ethical issues through a non-intrusive approach. The information obtained from the study was through experiments of others and the observation of the researchers through drug discussion content and therefore, is empirical data. This research is regarded as ethnography to which, it involves the observation of individuals, where the researcher has not created the conditions. Ethnography has been used in multiples of studies regarding illicit substances providing valuable data [18].

2.2 Data collection

An Internet search was conducted to discover online forums where synthetic drugs were publically discussed via forums. Key words were used such as 'legal high forums', 'drug discussions' and 'drug forum', to identify threads within forums. The searches returned over 5,000,000 results on the Google search engine and the first ten pages were searched for relevant websites. After inspecting multiple websites, eight total internationally accessible forums that contained threads regarding the usage of NPS: Bluelight.org, Drugs-forums.com, Erowid.com, Legalhighsforum.com, hipforums.com, Partyvibes.com, Reddit.com and UKchemicalresearch.org. The forums were easily accessible and did not require membership to view the content. Internal searches were performed on each of the eight forums regarding deaths associated with NPS. Key words used in the search were "NPS death"' or more specifically "AMT Legal high deaths" and the resulting posts were sorted by date of the last post. All of the posts were first inspected before a complete analysis if relevant to the inclusion or exclusion criteria.

Inclusion criteria included threads that reported any adverse effect from NPS usage with also the route of administration and motivation of intake included. Exclusion criteria were threads reporting information before 2004 and also any naturally occurring substance such as Khat and salvia divinorum. After examination a total of 207 threads were found relevant from the eight forums for the total collection of qualitative data. Data collection took place during September 2023 and users from 2004 to 2023 created the threads retrieved. Threads collected were exported and saved as PDF files to preserve the format of the discussion forum as seen on the webpage.

2.3 Data analysis

In this research 207 threads were collected from the online drug discussion forums, then were imported into the NVivo Pro11 software with the material then being examined for emerging patterns by applying content analysis. The NVivo software contains tools to exploring and analysing patterns in data [19].

Data was analysed over a four-month period, between October 2017 and January 2018. Each thread was read line-by-line to familiarise the researcher with the content of the drug discussion. The text was then searched and analysed for concepts, which could be coded into themes. When a new topic emerged, a category was for the data to be coded into. Threads that had already been coded were read again for the new topics, to see if anything had been missed.

Eventually, saturation was reached where no new themes emerged from the text. This indicated an end point for the study as all discussion topics had been unearthed by the analysis. Five main topics emerged as a result from the content analysis relating to user-associated deaths, Demography, Toxicity, motivation of intake and routes of administration of NPS. The quotes contained in the coded themes were summarized in a table for each of the five coded themes. Any grammatical mistakes were edited to ease the understanding whilst maintaining structure.

2.4 Data validation

The content analysis of adverse effects has been previously documented using discussion forums data [20]. This authenticates that the use for content analysis of reported adverse effects from discussion threads posted online are reliable. Bournemouth University ethics committee approved this research and no data was shared outside the scope of this study.

3 Results and Discussion

3.1 Synthetic cannabinoids

Of the 455 discussion forum respondents, 112 users reported SCB (24.61%). A total of 13 different derivatives and blends were reported with the majority of the users reporting consumption of cannabinoid blends (n=83, 74.1%) with Spice the most frequently reported (n=42, 37.5%). K2 (n=18, 16.07%) was the second most popular blend followed by Black mamba (n=8, 7.14%) and clockwork orange (n=4, 3.57%). JWH was the most popular SCB derivative reported from users (n=15, 13.39%) followed by AM-2201 (n=8, 16.07%), Ab CHIMINCA (n=3, 2.67%) and 5F-AKB-48 (n=3, 2.67%).

3.3.1 Demography

Subs themes found in the study when analysing demography was; age, gender and location. Demographic characteristics were reported from 59 respondents (52.67%) where age, gender and location were only reported from 32 users (28.57%). The remainder only reported one or two characteristics. A total of 63 respondents did not report any demography for SCB

consumption. A total 33 respondents reported age (29.46%) with 30 being between the ages 16 to 39 (90.09%). The mean age of SCB respondents was 24 years old. Only 3 respondents reported their age over 40 and were considered elderly users. Of the 30 respondents who reported their age between 16 and 39, 19 were between the ages 16 to 24 years old (63.33%). The second most reported age ranges were between 25 to 39 years old (n=11, 36.66%). A total of 59 (52.67%) respondents reported gender where males were the most reported (n=43, 72.88%) compared to only 16 females (27.11%). From the 43 male respondents, 27 reported their age (62.79%) ranging from 18 to 33 years of age. A total of 6 (37.5%) females reported age and ranged between 17 to 41 years old. 32 (28.57%) respondents reported their geographical location. The largest portions of users were from the United Kingdom (UK) (n=17, 53.12%) followed by the United stated of America (n=9, 28.12%). Russia (n=4, 12.5%) and Sweden (n=2, 6.25%).

3.1.3 Consumption

From the 112 respondents who reported use of SCB, 17 individuals reported the route of administration (15.17%). Smoking was the most common route of administration for SCB (n=15, 88.23%). Smoking methods included bongs or pipes, or rolling the mixture usually with tobacco into a "joint" or "blunt".Vaping SCB was reported by two users. Vaping SCB involves electronic cigarettes and a liquid, which contain SCB. Dose was reported from 17 respondents (15.17%), where 10 reported dosage and 7 reported "tokes or "hits". 100-150mg was the most common reported dosage (n=3, 17.64%) followed by 1-20mg and 20-30mg (n=2, 11.76%). Seven users reported how many 'tokes' or 'hits' they had when consuming the drug. Users were more likely to consume 1 to 5 tokes or hits, with tokes referring to joint mixtures and hits referring to bong or pipes. A total of 5 individuals (4.46%) reported duration of SCB with 0 to 2 hours the most frequently reported. Fourteen (12.5%) respondents reported their motivation for intake with price and addiction the most common reported (n=4, 28.57%). Accessibility to the drug was the second most common motivation for intake for SCB (n=3, 17.64%).

3.1.3 Toxicity

83 respondents reported toxicity associated from consuming SCB (74.10%) and includes cardiovascular, Gastrointestinal, neurological, renal and respiratory adverse effects. Cardiovascular toxicity was reported from 13 (11.6%) individuals, where tachycardia was the most frequently experienced (n=6, 46.15%). Two individuals reported cardiac arrest. Arrhythmia, cardiac irregularities, poor circulation, hypertension and palpitations were all reported once each (7.69%) as cardiovascular toxicity associated from SCB.

Fourteen (12.5%) individuals suffered gastrointestinal toxicity from SCB use. Vomiting was the most commonly associated gastrointestinal toxicity (n=10, 71.42%) followed by diarrhoea (n=2, 14.28%), abdominal pain and gastrointestinal disturbances which each has one user report.

Fifty-one (45.53%) individuals reported neurological toxicity from SCB use and 15 respondents reporting cognitive neurological toxicity, of which affected thought process (n=7, 13.72%) and confusion (n=4, 7.84%) were the most commonly associated adverse effects. Speech difficulties were the third most reported cognitive effect from individuals (n=3, 5.88%) and only one respondent reported decrease intelligence. General and mental neurological effects were the second most reported neurological toxicity after cognitive effects, experienced by 10 individuals each. Of the 10 respondents who reported general effects, anxiety (n=4, 7.84%%) and paranoia (n=3, 5.88%%) were the most common reported adverse effects. One user reported both anxiety and paranoia. Sweating was the third most reported general effect, experienced from two respondents. Insomnia was the only other reported general effect and was experienced from one individual. Mental illness effects were reported from 10 respondents, which addiction and psychosis were the most commonly experienced mental illness. One user reported self-inflicted injuries as a result of withdraw. Less experienced mental illness were delusions with two users reporting symptoms. Four individuals reported altered personality neurological toxicity and of these, two reported aggression. Damaged personality and irritability were reported each once. One user reported that small a small dosage could change your personality. Hallucinations were the only experienced altered perception reported from SCB consumption (n=4). Altered vision (n=2, 3.92%) and visual effect (n=1, 1.96%) were also reported. Muscular effects reported by 4 individuals include seizures (n=3, 5.88%) and shaking (n=1, 1.96%) and were violent in nature. Auditory adverse effects were a less reported experience with 2 individuals reporting effects. One respondent reported time dilation and auditory distortion. Renal toxicity was only reported from 1 respondent (0.89%) with reduced urination associated.

Four respondents reported respiratory toxicity. The most common respiratory toxicity reported was chest pains experienced by two of the four respondents. Dyspnoea and respiratory damage were each reported once. Accidental death was the most common reported synthetic cannabinoid death (n=14, 93.33%). One respondent reported intentional death associated with SCB consumption.

3.2 Synthetic Cathinones

A total of 103 respondents reported the name of the cathinone taken. Six cathinone derivatives were reported from individuals with mephedrone (n=46, 44.66%) the most commonly reported. MDPV was the also most commonly associated with 46 users reporting, followed by Benzo fury (n=5, 4.85%), NRG-1 (n=3, 2.91%) and Space-E (n=3, 2.91%). One respondent reported suicide after consuming cathinone derivatives. Of the 103 respondents who reported SCTH consumption, 33 (32.03%) reported demographic characteristics.

3.2.1 Demography

Twenty-nine respondents who reported SCTH demographic characteristics reported age with a mean age of 21 years old. The most common reported age range of 16 to 24 years old (n=17, 58.62%) and followed by 25 to 39 years old (n=6, 20.68%). Ages 12 to 15 were considered young adults (n=4, 13.79%) and over 40 (n=2, 6.89%) years old elderly were less reported. A total of 33 respondents reported gender from consuming SCTH with 24 individuals stating they were male (72.72%) and 9 females (27.27%). 22 of the 24 males (91.66%) reported age, ranging between 17 to 49 years. Age was reported from 7 female respondents with a range between 14 to 28 years old. Geographical location was reported by 21.35% of SCTH users (n=22). The most frequently reported geographical location was from the UK (n=13, 59.09%), followed by the United States of America (n=4, 18.18%), Sweden (n=3, 13.63%) and Australia (n=2, 9.09%).

3.2.2 Consumption

Of the 103, 8 reported route of administration (7.76%) Nasal insufflation was reported from 4 (50%) individuals and was the most common route of administration. Oral ingestion was reported from 3 (37.5%) respondents with respondents reporting 'pills' or 'capsules'. Smoking of SCTH was less favourable with only one user reporting the route of administration. Of the 103 SCTH respondents, 8 reported dosages. Two individuals each reported dosages of 20-30mg, 100-150mg and 250-400mg. There were reported dosages of 600-100mg and 2-4 grams but less frequent. Two respondents reported duration of SCTH with one user reporting effects for 12-24 hours and the other reporting above 24-hour effects and usually after repeated dosing. Of the 103 respondents who reported SCTH, 20 reported motivations for intake (19.41%). The most common motivation for intake was 'clubbing' (n=5, 25%) followed by accessibility (n=4, 20.00%) and addiction (n=4, 20.00%). Sexual desire often referred to, as "chem sex" was the third most common reported motivation for intake associated with SCB use (n=3, 15.00%). Experimentation was reported two times (10.00%) from individuals. The least reported motivation was legislation and price, which only one respondent reported each.

3.2.3 Toxicity

Of the 103, 28 respondents reported adverse effects from consumption of SCTH (27.18%). Reported adverse effects included cardiovascular, gastrointestinal, neurological toxicity and respiratory toxicity. Seven users that consumed SCTH reported cardiovascular toxicity, with cardiac irregularities the most frequently experienced. Cardiac arrest was associated commonly associated with two users reporting. Less experienced adverse effects reported were palpitations and tachycardia with only one user reporting the symptoms. Abdominal cramps were reported from 1 respondent from SCTH consumption. The user reported that MDPV caused the adverse effect.

From the 14 (13.59%) respondents that reported neurological toxicity, four reported cognitive neurological toxicity, of which affected thought process (n=3, 21.42%) was the most common. Confusion was reported from one respondent. One user reported anxiety affecting their thought process. General and mental neurological toxicity were the second most reported form of neurological toxicity after cognitive effects, being experienced by three individuals each. Paranoia was the most reported general toxicity associated (n=2, 14.28%) and anxiety was only experienced from one user. Addiction was the most experienced mental illness reported from individuals (n=2, 14.28%) and one respondent reported psychosis. Less reported neurological effects included altered perception and motor function. Hallucinations (n=2) effects were the only reported altered perception experience from individuals. Motor function only affect two individuals with them both experiencing lack of motor control. One respondent reported Six individuals (5.82%) reported respiratory toxicity. The most common respiratory adverse effect was dyspnoea, reported by five of the six users. Chest pains were less common with one user suffering from the respiratory adverse effect. From 52 reported deaths, a total of 15 respondents reported SCTH associated deaths. Accidental death was the most commonly associated death with a total 12 reported. Only 3 intentional SCTH associated deaths were reported.

3.3 Synthetic hallucinogens

Of the 455 respondents who reported NPS consumption, 79 (17.36%) users reported hallucinogen derivatives with the compound name. A total of six hallucinogen derivatives were reported with NBOM-e being the most frequently reported (n=44, 55.69%). AMT was the second most reported hallucinogen derivative (n=21, 26.58%), followed by 5 Meo DMT (n=5, 6.32%), 1P LSD (n=4, 5.06%), 4 Aco DMT (n=3, 3.79%) and 4-HO-MiPT (n=2, 2.53%).

3.3.1 Demography

Of the 79 respondents who reported SH consumption, 26 (32.91%) reported demographic characteristics. A total of 17 respondents reported their age (21.51%), with 15 (88.23%) being adults aged between 16 and 39 years old. The mean age of respondents for SH consumption was 19 years old. Only two users (11.77%) were aged between 12 and 15 and no users were aged over 40. Of the 15 adults, 14 (93.33%) were between 16 to 24 years old. One user reported their age between 25 to 39 years old. A total of 26 users reported their gender with most SH users identifying as male (n=20, 76.92%) and only 6 users identified as female (n=6, 23.07%). A total of 13 male respondents report their age, ranging between 14 to 24years old. Four female respondents reported age and ranged between 16 to 35 years old. Seventeen respondents reported their geographical location with the UK the most prominent (n=11, 61.11%). Six individuals reported their location in the United States (33.33%) and only one individual reported their location in Australia (5.55%).

3.3.2 Consumption

Of the 79 respondents who reported synthetic hallucinogen use, 14 individuals reported their route of administration (17.72%%). Oral ingestion was the most common route of administration reported from 7 users (50%) followed by Nasal insufflation (n=4, 28.57%%). Sublingual, inhalation and eyeballing were all reported once each (7.14%). A total of 15 (18.98%) respondents reported SH dose and included milligram and blotter dosage. Milligram dosages were reported from 10 respondents, where 20-30mg was the most frequently reported (n=3, 20%). A total of 5 respondents reported consumption of SH in the form of blotters. Blotter dose was most frequent for 1-500mcg and 500-1000mcg with 2 individuals reporting consumption for each. Blotter dosages over 1000mcg were less frequent with 1 user reporting. Five respondents reported duration of SH 'high' (6.32%) where 0-2 hours and 12-24 hour were the most commonly reported (n=2, 40%). One user reported effects lasting over 24 hours after 1 blotter of NBOMe. From the 79-hallucinogen respondents, 3 (3.79%) reported motivation for intake. Access to the drug, addiction and clubbing were all reported once from 3 different individuals (33.33%).

3.3.3 Toxicity

Of the 79, 38 reported toxic effects when consuming SH (48.1%). Reported adverse effects included cardiovascular, gastrointestinal, neurological toxicity, renal and respiratory toxicity. Five users reported cardiovascular toxicity (6.32%), where tachycardia and arrhythmia were the most frequently experienced (n=2, 40%). One user reported prolonged duration of cardiovascular adverse effects. Less frequently experienced cardiovascular effects experienced were hypertension (n=1, 20%). Only three user's reported gastrointestinal adverse effects (6.32%), where all respondents reported only vomiting (n=3, 100%). One user reported blood contained within the vomit.

27 respondents reported neurological adverse effects (34.17%) with 7 respondents reporting cognitive neurological effects (25.92%) of which, affected thought process was the most common adverse effect (n=3, 11.11%). Inability to focus was the second most reported cognitive adverse effect reported (n=2, 7.4%) followed by confusion and memory loss with only one user reporting each (3.7%). Altered perception was the second most reported neurological adverse effect and affected 6 individuals (22.22%). 3 respondents reported hallucinations (11.11%) followed by tachyphasia (n=2, 7.4%). Less reported altered perceptive adverse effects were dissociation (n=1, 3.7%). Muscular effects, reported by 5 (18.51%) individuals and included seizures (n=3, 11.11%), shaking (n=1, 3.7%) and tingling (n=1, 3.7%) with one user reporting multiple of seizures. Four of the 27 individuals reported general neurological effects (14.81%) including anxiety (n=3, 11.11%), headache, nausea and sweating (n=1, 3.7%). One user reported both anxiety and nausea symptoms. Mental illness affected 4 individuals (14.81%), where delusions were the most common adverse effect (n=3, 11.11%). Other mental illnesses reported from synthetic hallucinogens were psychosis (n=2, 7.4%) and addiction (n=1, 3.7%). One respondent reported a severe psychotic episode. Altered personality adverse effects were reported from 3 respondents (11.11%), with aggression being the only reported symptom (n=3, 100.00%). Less reported neurological effects were motor (n=2, 7.4%) and visual functions (n=1, 3.7%) and included lack of motor coordination and visual effects. Three respondents reported renal toxicity from consumption of SH (3.79%). Of the 3, 2 reported increased urination followed by kidney damage (n=1). Of the 79 respondents, five (6.32%) reported toxicity of the respiratory system. Dyspnoea was the most common respiratory effect, reported by four users (80%) and one user suffered with chest pain (20%). Of the 79 respondents, 13 reported (16.45%) SH associated death. The 13 associated deaths reported more commonly were accidental (n=11, 84.61%) and two intentional (15.38%).

3.4 Synthetic opioids

Of the 455 respondents, 38 (8.35%) reported opioid derivatives with named compounds. A total of 4 opioid derivatives were reported from respondents where kratom was the most frequently reported. Reports from users explained that legal derivatives were desirable. U-47700 was the second most reported opioid derivative (n=14, 36.84%), followed by fentanyl (n=5, 13.15%) and AH-7921 (n=2, 5.26%). One user reported AH-7921 was sold as 'legal heroin'.

3.4.1 Demography

Of the 38 respondents who reported consumption of SO, 15 reported demographic characteristics (39.47%). A total of 9 (23.68%) individuals reported their age with all adults between 16 to 39 years old. Of the 9 adults, 8 (88.88%) were between 25 to 39 years old and only one user reported their age between 16 to 24 years old (11.11%). The mean age of SO respondents was 31 years old. From 38 respondents, 14 (36.84%) individuals stated their gender with most identifying as male (n=11, 78.57%) compared to 3 females (21.42%). Seven male respondents reported their age and all reported range between 25 to 39 years old. Two female respondents reported their age with one respondent between 16 to 24 and one other respondent between 25 to 39 years old. Geographical location was reported from 15 individuals from two separate locations. The largest portion of users reported their location as the United States of America (n=12, 80%) followed by the UK (n=3, 20%).

3.4.2 Consumption

Eight respondents reported route of administration from the 38 opioid respondents (21.05%). 5 different routes of administration were reported with oral the most common route of administration (n=4, 50%). Nasal insufflation, intravenous injection, sublingual and a fentanyl patch were all reported once. A total of 7 individuals reported SO dosage (18.42%). Most frequently reported dose was 2-4 grams (n=5, 71.42%) and was only associated with the consumption of kratom extract. Lower dosages were reported for fentanyl and U-47700 opioid analogues but were less frequent (n=2, 28.57%). Of the

38, three reported SO duration (7.89%). The respondents all reported duration between 0-2 hours describing a very 'euphoric' initial 5-15 minutes after consumption and desired effects never lasting over 2 hours. Four individuals reported motivation for intake (10.52%). Most commonly reported in opioid motivation for intake was accessibility of the drug. Addiction and experimentation followed after accessibility in motivation for intake with 1 individual each (25.00%).

3.4.3 Toxicity

From the 38 respondents who reported about the use of synthetic opioids, 13 (34.21%) reported toxicity. Reported adverse effects included cardiovascular, gastrointestinal, neurological toxicity, renal and respiratory toxicity. Arrhythmia was the only reported cardiovascular toxicity associated with the use of synthetic opioids (n=1, 2.63%). Gastrointestinal adverse effects were reported from 5 individuals who consumed SO (13.15%) with abdominal cramps the most frequently reported (n=2, 40%). Constipation, stomach cramps and vomiting were all reported once each (20%). A total of 5 respondents reported neurological toxicity associated with SO (13.15%). General toxicity was the most frequently reported (n=4, 80%) neurological adverse effect with nausea was the most commonly reported (n=3, 60%) followed by sweating (n=1, 20%). Cognitive and muscular effects were also reported (n=2, 20%). One user reported combined symptoms of 'shaking' and 'sweating' from consumption of U-47700.

Of the 38 opioid respondents, 3 (7.89%) reported renal toxicity associated with the use of synthetic opioids. Urine colour was the most commonly reported renal toxicity (n=2, 66.66%) followed by kidney pain (n=1, 33.33%). Two respondents reported very dark urine colour from consumption of kratom. From the relevant 38 users in the study, two respondents (5.26%) mentioned associated deaths. Accidental death from the use of synthetic opioids (n=2, 100%) was the only reported death.

3.5 Synthetic phencyclidines

A total of 46 (10.10%) respondents reported phencyclidine derivative consumption with the named compound, with 4 Phencyclidine derivatives. MXE was the most frequently reported derivative (n=34, 73.91%). One user reported 'Lotus' as MXE. 3 Meo PCP was the second most frequently reported derivative of PCP (n=8, 17.39%), followed by 5-iT (n=2, 4.34%) and Diphenidine (n=2, 4.34%).

3.5.3 Demography

From the 46 respondents who reported SPCP consumption, 20 (43.47%) individuals stated demographic characteristics. Eleven users reported their age (23.91%), where 10 individuals (90.90%) reported their age between16 to 39. Of the 10, 6 respondents age ranged between 24 to 39 years old and 4 between 16 to 24 years old. Only one respondent reported their age over 40 years old. The mean age of SPCP respondents was 27 years old. 43.47% of individuals stated gender (n=20) with most identifying as male (n=16, 80%) compared to four females (20%). A total of 8 males reported their age with 4 individuals between 25 to 39 years old. Again four male users reported that they were between 16 to 24 years old. Three female respondents reported their age and ranged between 25 to 59 years old. Only two geographical locations were reported from 14 respondents and included the UK and USA. Both locations were reported from 7 individuals.

3.5.3 Consumption

From the 46 respondents who reported SPCP use, 10 reported route of administration (21.73%). Both oral and sublingual administrations were most frequently reported (n=3, 30%) followed by nasal insufflation (n=2, 20%). Rectal administration was reported once from one user who dosed 3 chemicals. Eyeballing was also reported once for SPCP route of administration. Of the 46, 10 reported dosages when consuming SPCP (21.73%). Dosages between 30 and 100 mg were most frequently reported (n=4, 40%) when consuming SPCP followed by 20 to 30 mg (n=2, 20%). Smaller dosages of 1-20mg and larger dosages of 200-250, 250-400 and 400-600mg were all reported once each (10%). User reports of SPCP duration of effects were reported from 5 individuals (10.89%), where 0-2 hours and 4-12 hours were most frequently reported (n=2, 40%). Reported duration of effects between 2-4 hours was reported once (20%). Motivation for consuming SPCP was reported from 5 individuals (10.89%) with sexual desire the most frequently reported. Sexual desire often referred to as 'chem sex' was reported when using 3-MeO-PCP. Access to the drug (n=1, 20%) and addiction (n=1, 20%) were also reported. Users were motivated to consume methoxetamine (MXE) because it was a legal alternative to ketamine.

3.5.3 Toxicity

Of the 46 respondents who reported SPCP consumption, 10 (21.79%) reported adverse effects. Adverse effects included cardiovascular, gastrointestinal and neurological toxicity. Cardiovascular adverse effects were reported from 3 respondents (6.52%) with all 3 associated with tachycardia. Users would generally report that consuming a certain dosage would cause the adverse effect. Only 1 user reported gastrointestinal toxicity associated from SPCP consumption (2.17%). A total of 6 respondents reported neurological adverse effects associated with SPCP consumption (13.04%). Altered thought process affected 2 individuals with mild visual hallucinations as reported. Cognitive neurological effects were also reported with affected thought process (n=2, 33.33%) with users experiencing 'mind shifts' or 'zoning out'. General effects including anxiety (n=1, 16.66%) and nausea (n=1, 16.66%) were also reported from SPCP consumption. Of those who reported synthetic phencyclidine use, 1 respondent (20.0%) reported death. The 1 respondent reported accidental death.

3.6 Synthetic phenethylamines

Of the 455 respondents who reported NPS consumption, 31 (6.81%) reported phenethylamine derivatives with the name. A

total of 3 phenethylamine derivatives were reported, where 2CB-dragon fly and MDAI were the most frequently reported (n=12, 38.7%). One user reported a bad trip from as little as '8 mg'. The derivative 2CE was reported from 7 respondents and was even consumed in chocolate from one user.

3.6.3 Demography

38.7% of STHY respondents reported demographic characteristics (n=12). A total of 9 respondents reported their age and all ranged between 16 to 39 years old. Of the 9, 7 (77.77%) reported their age between 16 to 24 years old followed by 2 (22.22) respondents reporting ages between 25 to 39 years old. The mean age of STHY respondents was 20 years old. 12 individuals stated their gender (38.7%) with 8 identifying as male. Four respondents identified as female (33.33%). From 8 male individuals, 5 reported their age, with 4 aged between 16 to 24 and 1 between 25 to 39 years old. Of the 38, 7 users (18.42%) reported their geographical location. The largest portion of the users reported their location in the UK (n=5, 71.42%) compared to 2 respondents from Australia (28.57%).

3.6.3 Consumption

Of the 31, 3 respondents reported route of administration associated with consumption of STHY (9.67%). Oral ingestion was the most common route of administration (n=2, 66.66%) followed by eyeballing (n=1, 33.33%). A total of 5 STHY users reported dosage (16.12%) where 1-20mg was most frequently reported dose (n=2, 40%). Duration of STHY high was reported from 2 respondents (6.45%). Effects reported were between 4 and 12 hours (n=2, 100%) with one user reporting that 10 hours after consumption effects were still present. Motivation for intake was reported from 3 individuals associated with synthetic phenethylamine consumption (9.67%). Accessibility to the drug was the most common reported motivation for intake for synthetic phenethylamines (n=2, 66.67%) followed by experimentation (33.33%).

3.6.3 Toxicity

Of the 31, 12 (31.7%) respondents reported toxicity from consumption of STHY. The adverse effects included cardiovascular, neurological and respiratory toxicity. A total of 3 respondents reported cardiovascular toxicity (9.67%) associated with the use of STHY. Arrhythmia, cardiac arrest and circulatory problems were reported from individuals each once (n=1, 33.33%). Of the 31 individuals, 7 reported neurological toxicity (22.58%). General neurological adverse effects were highest reported (n=3, 42.86%), which anxiety, headaches and sweating were reported (n=1, 14.29%). Cognitive effects were the second most reported form of neurological toxicity after general effects being experienced by two individuals. Of the 2, Affected thought process and decreased intelligence were reported each (n=1, 14.29%). Auditory and muscular adverse effects were the lowest reported form of neurological toxicity and from the same user (14.29%). Auditory distortion was reported for auditory neurological adverse effects and convulsions for muscular neurological toxicity. Associated respiratory toxicity was reported from 2 respondents (6.45%), with chest pains and dyspnoea each being reported once (50.00%). Respiratory effects were also associated with cardiovascular toxicity. All five reported deaths associated with the consumption of synthetic phenethylamines were accidental. There were no reported intentional deaths associated with synthetic phenethylamines.

4 Conclusions

The results in this study are difficult to evaluate whether they represent NPS as a whole or just from the individuals who responded on the forums analysed. Although that there are gaps in literature, this paper gives information that is more in depth about the effects of NPS from individuals who have actually experienced them.

Online discussion forums provide a very useful tool for in depth user analysis but should be further researched. Respondents from the forums provide a useful insight to their experience, however, by further interviewing those who have consumed the drugs of choice what their experiences and perceptions are. Since the enforcement of the Psychoactive Substances Act (2016) in the United Kingdom NPS have been banned. However, further research into NPS before and after the legislation was enforced in the United Kingdom would provide a better view to whether the law has really worked.

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