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# Self-reported use of novel psychoactive substances among attendees of electronic dance music venues

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## Abstract

**Background—**Novel psychoactive substances (NPSs) continue to emerge in the United States and worldwide. Few epidemiological studies have examined the prevalence and correlates of use.

**Objective—**We examined the extent of NPS use in a high-risk population—attendees of electronic dance music (EDM) parties at nightclubs and festivals.

**Methods—**We surveyed 682 adults (age 18–25) entering EDM events at nightclubs and festivals in New York City (NYC) in 2015. A variation of time–space sampling was used. We examined the prevalence of self-reported use of 196 NPS and correlates of any NPS use.

**Results—**Over a third (35.1%) of participants reported lifetime use of any NPS. Self-reported use of synthetic cannabinoids was most prevalent (16.3%), followed by psychedelic phenethylamines (14.7%; 2C series: 10.3%, 2-(4-iodo-2,5-dimethoxyphenyl)-*N*-[(2-methoxyphenyl)methyl]ethanamine [NBOMe] series: 9.0%, Dox series: 3.5%), synthetic cathinones ("bath salts", 6.9%), other psychedelics (6.6%), tryptamines (5.1%), and dissociatives (4.3%). 2C-I was the most prevalent 2C series drug (5.1%); methylone was the most prevalent synthetic cathinone (3.3%), 2-MeO-ketamine was the most prevalent dissociative (3.7%), and 1P-lysergic acid diethylamide (LSD) (2.9%) was the most prevalent non-phenethylamine psychedelic. Risk factors for NPS use included Ecstasy/MDMA/ Molly, LSD, and ketamine use; identifying as

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**Declaration of interest**

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bisexual (compared to heterosexual), reporting higher frequency of nightclub/festival attendance, and being surveyed outside of a festival (compared to those surveyed outside of nightclubs).

**Discussion—**NPS use is prevalent in the nightclub and festival scenes in NYC. Since individuals in these scenes—especially frequent attendees—are at high risk for use, prevention and harm reduction services need to be geared toward this population.

### Keywords

Novel psychoactive substances; synthetic cannabinoids; synthetic cathinones; young adults; nightclubs

## Introduction

In recent years, the popularity of electronic dance music (EDM) has increased in the US and worldwide (1). While decades ago, EDM parties were generally held as “raves” in places like abandoned warehouses, over the years, parties began to more commonly take place at nightclub venues (2). The popularity of EDM has fluctuated over the years, but in recent years, along with the increasing popularity of EDM, the popularity of nightclub parties—and now large EDM dance festivals—has increased (1,3). Research suggests that EDM nightclub and dance festival attendees tend to be at high risk for drug use (3,4). Party drugs such as ecstasy and ketamine in particular have been shown to be prevalent among nightclub attendees in New York City (NYC) and elsewhere (5,6). However, since EDM nightlife attendees are at high risk for use of party drugs, research is needed to examine the extent to which nightclub and festival attendees are at risk for newly emerging psychoactive drugs.

Novel psychoactive substances (NPSs), also known as new psychoactive substances, have been emerging at an unprecedented rate throughout the world. In 2014 alone, 101 NPSs were discovered by the European Monitoring Centre for Drugs and Addiction (EMCDDA) and they have discovered some 450 NPSs in the last decade (7). The two most common NPS classes are synthetic cannabinoids (which mimic tetrahydrocannabinol [THC] in natural cannabis) and synthetic cathinones (many of which mimic effects of amphetamines and/or ecstasy) (7). In fact, according to the EMCDDA, at least 77 different synthetic cathinones have been discovered (31 in 2014) and at least 134 synthetic cannabinoids have been discovered (30 in 2014) alone (7). The National Forensic Laboratory Information System (NFLIS) identifies confiscated drugs throughout the US and among the 25 most commonly confiscated drugs in 2014, three were synthetic cannabinoids (with over 22,000 reports), and three were synthetic cathinones (a.k.a.: “bath salts;” 5,425 reports involving ethylone, 4,768 involving methylone, and 3,905 involving α-pyrrolidinopentiophenone [alpha-PVP; “Flakka”]) (8). As NPSs are designated as controlled substances, new NPSs tend to take their place in a rapid manner. For example, mephedrone (4-methylmethcathinone [4-MMC]) was once the most commonly confiscated synthetic cathinone (in 2010), but in 2012, methylone became the most commonly confiscated synthetic cathinone, and in 2014, ethylone became the most commonly confiscated synthetic cathinone (8,9).

Of all NPS classes, synthetic cannabinoids and synthetic cathinones also have the highest numbers of reported poisonings. In 2011, there were 6,137 reported poisonings involving

"bath salts" in the US; however the number of reported poisonings decreased substantially—to 520 in 2015 (10). In 2011, there were 6,968 reported poisonings involving synthetic cannabinoids in the US (11). This number was reduced by more than half in 2013, but poisonings have recently increased to 7,779 in 2015 (11,12). However, little information is available on poisonings and confiscations related to less prevalent NPS and NPS classes.

While indicator data derived from confiscations and poisonings are informative regarding the prevalence of various NPSs, there is a dearth of survey data in the US focusing on self-reported NPS use. National surveys in the US, for example, pay little attention to NPS use. Monitoring the Future (MTF), a nationally representative survey of high school students (modal age: 18), asks about "synthetic marijuana" (synthetic cannabinoids) and "bath salt" (synthetic cathinone) use, but not other NPSs (13). The results obtained from MTF suggest that self-reported "bath salt" use is only about 1% among high school seniors, and synthetic cannabinoid use recently fell from 10% in 2010–2012 to 6% in 2014 (13,14,15). European national drug reports generally do not include self-reported prevalence of NPS use, but according to the Crime Survey for England and Wales, in 2014/2015, 1.9% of adults aged 16–24 reported using mephedrone (16). The National Survey on Drug Use and Health (NSDUH) in the US allows participants to type in names of hallucinogens and stimulants not specifically assessed (e.g., NPS) (17); however, we found that the "type-in" method leads to severe under-reporting of NPS use (18).

As hundreds of NPSs have emerged in recent years, little is known about the characteristics of those who use these drugs. However, all NPS classes appear to be associated with various risks (19–23). Many individuals in the general population are at low risk for using any of these drugs; however, attendees of EDM parties at nightclubs and festivals have been found to be at high risk for use (3,4,24–26). Specifically, the Global Drug Survey, an annual international survey on drug use, found that in 2011/2012, compared to respondents reporting no nightclub attendance in the last year, those who reported attending (vs. those not attending) reported higher prevalence of use of mephedrone (30% vs. 10%), 2C-B (12% vs. 4%), 2C-I (6% vs. 2%), methoxetamine (MXE; 6% vs. 3%), N,N-dimethyltryptamine (DMT; 5% vs. 3%), and synthetic cannabinoids (5% vs. 3%) (24). Given that EDM-nightlife attendees are at high risk for NPSs, we piloted an electronic survey to assess the use of various NPSs in those at very high risk for use—nightclub and dance festival attendees.

## Methods

### Participants and procedure

We surveyed 682 individuals about to enter EDM parties at nightclubs and festivals in NYC throughout the summer of 2015 using a variation of time–space sampling. Time–space sampling was used as an efficient approach to reaching the population of interest—attendees of electronic dance music parties at nightclubs and festivals in NYC. Each week, we created a time–venue sample space for random selection including a list of EDM venues and/or specific parties planned to occur that week (usually Thursday through Saturday). We included specific venues that hold EDM parties (consistently every week) and we added parties that were: 1) recommended by key informants and/or 2) listed on a popular EDM ticket website as having at least 15 advanced tickets purchased in advance for that party

(including “secret location” warehouse parties and one-time parties). The state of the current EDM scene did not allow us to first randomly select venues and then randomly select times (due to parties constantly emerging and shifting venues and many one-time parties), which is why we utilized this variation of time–space sampling. Therefore, we randomly selected parties from a sample space combining party and day (e.g., “Party 1, Thursday”, “Party 2, Thursday”. . .“Party 20, Saturday”) rather than randomizing the venue and then the night.

Participants were eligible if they 1) identified to be aged 18–25 and 2) were about to enter the randomly selected event. Trained recruiters approached passersby outside of events (that were alone or in groups) who looked aged 16–27 and asked if they were going to the randomly selected event. The extended age range was to ensure that no one aged 18–25 was skipped. Those who replied affirmatively were asked their age and if they would like to take a survey asking about drug use. After providing informed consent, participants completed the computer-assisted personal interview on a tablet. Those who completed the survey were compensated $10 cash. On average, the response rate of those approached, who were believed to be eligible, was 63%. This study was approved by the authors’ institutional review board.

## Measures

**Sociodemographic characteristics and nightlife attendance—**Participants were asked their age, sex, race/ethnicity, level of educational attainment, and sexual orientation. To assess socioeconomic status (SES), we asked participants about parent educational attainment and weekly income (27). Specifically, participants were asked about educational attainment of each parent and we computed a mean-composite score for both parents (or a raw score if only one parent), and categorized responses into tertiles representing low, medium, and high parental educational attainment. Participants were asked how much money they earn (after taxes) per week (on average) from a job or other sources, and we coded responses into tertiles representing <$200, $201–$499, and ≥$500 per week. Religiosity was assessed via two ordinal items—1) “How often do you attend religious services?” (with response options: “never”, “rarely”, “once or twice a month,” and “one a week or more”) and 2) “How important is religion in your life? (with response options: “not important”, “a little important”, “pretty important”, and “very important”). We computed a mean-composite of both answers and divided it into tertiles representing low, moderate, and high religiosity. Parent education, income, and religiosity items were taken from the MTF national survey (13) and recoding was guided by previous studies (4,14,27). Participants were also asked if they live in NYC.

We altered a rave attendance survey item from MTF (4,13), to ask, “How often do you go to rave/nightclub/ festival/dance parties?” and answer options were never, a few times a year, once or twice a month, at least once a week, and almost every day. We recoded this into a trichotomous variable. We also created a variable indicating whether the participant was surveyed outside of a nightclub or a festival.

## Drug use

We asked participants about lifetime use of 196 NPSs, which were listed together in predefined categories. NPS names, street names (when available), and categories were derived from the scientific literature (primarily government reports) and from websites such as Erowid (https://www.erowid.org) and BlueLight (http://www.bluelight.org) where psychonauts (individuals who explore effects of NPSs and document experiences online (28) post drug information/reviews). A Google search was also used to discover and confirm drug names and street names.

After answering the sociodemographic questions, a page informed participants that the next session asks about "use of relatively uncommon synthetic drugs, some of which are called 'legal highs' or research chemicals", and that they will be asked about more traditional drugs such as marijuana and ecstasy afterward. Each NPS category had its own page, which asked "Have you ever (knowingly) used ANY of the following 'new' synthetic drugs?" For example, the first NPS category was psychedelic phenethylamines and we listed all relevant drugs, grouped into the following subcategories listed on the page: NBOMe ([2-(4-iodo-2,5-dimethoxyphenyl)-*N*-[(2-methoxyphenyl)methyl] ethanamine], "pronounced 'N-bomb'"), 2C drugs, 3C drugs, and Dox drugs. Drugs we believed to be most popular (according to the literature and social media) were in bold and red font to help participants recognize them when skimming the lists of (often unfamiliar) drug names. For example, the street name "25i" for 25i-NBOMe was highlighted in this manner with an aim to catch the participant's attention if all drugs listed looked unfamiliar.

The question asking about the lifetime use of any of the drugs in the NPS class served as a gateway question to follow-up questions. On the following page (if "yes" was checked off indicating that the participant had knowingly used any listed drugs), the participant was asked to check off which drug(s) in that class he or she had ever used. They were also given the opportunity to type in names of drugs they believed are in that class that they have used, but we did not ask about. This was repeated for each NPS class. After asking about psychedelic phenethylamines, we asked about 1) "bath salts" (synthetic cathinones) and "other euphoric stimulants" (other phenethylamines "not including ecstasy/ MDMA" [3,4-methylenedioxymethamphetamine]), 2) "other synthetic stimulants", 3) psychedelic tryptamines, 4) dissociatives ("not including ketamine"), 5) synthetic psychedelics "(not including LSD or natural psychedelics like magic mushrooms)", and 6) "synthetic marijuana" (synthetic cannabinoids such as Spice and K2; "not real marijuana"). After asking about NPSs, we then asked about the lifetime use of traditional drugs (e.g., ecstasy, LSD).

## Analyses

We created indicator variables for self-reported lifetime use of each NPS and we also collapsed self-reported use of NPSs into the corresponding classes. For example, lifetime 25i-NBOMe use was coded into its own indicator, and it was also coded into a variable indicating psychedelic phenethylamine use and into a variable indicating any NBOMe series use. We thus determined the self-reported prevalence (along with 95% confidence intervals) for 1) use of any NPS, 2) use of NPSs within a specific category (and subcategory if

applicable), and 3) use of the specific NPSs. We created and utilized sample weights to estimate the prevalence. Specifically, since we utilized a variation of time–space sampling, our analyses took into account clustering of participants by event and differential probability of selection; Taylor series estimation methods were used to obtain accurate standard errors (29). The complex sampling design specified event as the primary sampling unit and probability weights for participants. Probability weights incorporated frequency of self-reported attendance at nightclubs and festivals and the proportion of potentially eligible participants approached outside the event the participant attended.

After examining the prevalence and conducting descriptive analyses for sociodemographic variables, we then examined whether the prevalence of any NPS use was associated with each covariate of interest. We first examined potential differences in a bivariable manner using logistic regression to determine the unadjusted odds ratio (OR) for each covariate. However, since sample weights were a function of the level of attendance, we examined attendance separately using unweighted data. We then fit all covariates (other than attendance) into a single model, simultaneously, to examine unique associations with adjusted ORs (AORs). We ensured that multicollinearity was not an issue—even though lifetime self-reported prevalence drug use covariates were mild to moderately correlated (phi = 0.06–0.46), there was very little variance inflation resulting from their inclusion in the multivariable model (e.g., the variance inflation factor for drug use covariates ranged from 1.08 to 1.52). We examined attendance as a covariate in a separate unweighted model, controlling for all other variables. All analyses were computed using Stata SE 13 (StataCorp, 2009).

## Results

About a third (35.1%) of the sample reported lifetime use of any NPS. Table 1 presents prevalence estimates for use of each NPS category and NPSs that were reportedly used by at least 1% of the sample. Synthetic cannabinoid use was most prevalent with 16.3% of the sample reporting use. Psychedelic phenethylamine use was reported by 14.7% of the sample, with the 2C series the most prevalent in this class (10.3%), followed by NBOMe series (9.0%), and Dox series (3.5%). Non-psychedelic phenethylamines were reportedly used by 7.8% of the sample and use primarily consisted of “bath salts” (6.9%). A small percentage of participants also reported use of non-phenethylamine psychedelics (e.g., 1P-LSD; 6.6%), tryptamines (e.g., DMT; 5.1%), dissociatives (e.g., 2-MeO-ketamine; 4.3%), narcotics/benzodiazepines/depressants (4.1%), or other stimulants (1.8%). NBOMe “unknown” was the most commonly reported NBOMe series drug (5.4%) and 2C-I was the most commonly reported 2C series drug (5.1%). Methylone was the most prevalent “bath salt” (3.3%), 2-MeO-ketamine was the most prevalent dissociative (3.7%), and 1P-LSD (2.9%) and LSZ (2.5%) were the most prevalent non-phenethylamine psychedelics.

As shown in Table 2, compared to those reporting low levels of parental education, those reporting moderate or high parental education were at about half the odds of reporting lifetime NPS use, and this association strengthened after controlling for all other covariates. Compared to those who identified as heterosexual, those identifying as bisexual were at over four times the odds of reporting NPS use and after controlling for all other variables they

were at seven times increased odds for reporting use. Those surveyed outside of festivals (compared to nightclubs) were not at increased odds for use in the bivariable model; however, when controlling for all other variables, festival attendees were at over twice the odds (AOR = 2.12, $p = 0.013$) for reporting NPS use. While all five drugs were significant risk factors in the bivariable models, in the multivariable model LSD (AOR = 4.64, $p = 0.004$), ecstasy (AOR = 4.54, $p < 0.001$), and ketamine (AOR = 2.51, $p = 0.041$) remained significant. Unknown powders only approached significance while controlling for all other variables (AOR = 8.03, $p = 0.082$). Finally, with regard to nightclub attendance, compared to those who reported never attending or attending once or twice a year, those reporting attending once or twice a month were at double the odds for reporting NPS use, even when controlling for all other variables. Those who reported attending at least once a week were at increased odds for reporting NPS use in the bivariable model (OR = 1.76, $p = 0.007$), but this association only approached significance when controlling for all other variables (AOR = 1.56, $p = 0.078$).

## Discussion

There is a lack of research on self-reported NPS use in the US. Since the previous research suggests that attendees of EDM parties at nightclubs and festivals are a high-risk population, we surveyed young adults entering nightclubs and festivals hosting EDM parties in NYC to assess prevalence and correlates of NPS use. Over a third of the sample reported lifetime use of any NPS and the most prevalent NPS reportedly used was synthetic cannabinoids (16.3%). Psychedelic phenethylamines (e.g., 2C and NBOMe series) was the next most-prevalent NPS class (14.7%), followed by synthetic cathinones (6.9%). We thus found that use of these new and relatively unstudied drugs appears to be prevalent among this population, underscoring the need for prevention and harm reduction services targeted to people who use NPSs.

While synthetic cannabinoids are generally marketed as such (e.g., under brands such as K2 and Spice), we did not ask about the names of specific compounds. However, importantly, we asked about 35 different synthetic cathinones, including a “bath salts unknown” category, and we asked about many specific NPSs in each class because they are marketed as such. Including lists of specific drugs in NPS categories (along with street names) is important as individuals may not know the class of the drug they have used. Similar to how an individual taking a survey may not know that Xanax is a benzodiazepine or that Vicodin is an opioid, many users appear to be unaware that methylone (“M1”), for example, is a synthetic cathinone (“bath salt”). Unlike many other surveys that have assessed NPS use, we included numerous names of drugs (and street names when available) and we categorized responses into classes in order to prevent underestimation.

While the main aim of this analysis was to determine self-reported prevalence, we also examined potential correlates of self-reported NPS use. We found that higher levels of parent education were associated with decreased odds of reporting any NPS use. Parent educational attainment (and personal income) is a common proxy for SES (27), so this may suggest that those of higher SES were at low risk for use. Examining national MTF data, we have found similar findings with regard to powder cocaine use, heroin use, and frequent (used >6 or

more times) synthetic cannabinoid use (14,30,31). A recent national study on self-report NPS use also found that “some college” was a risk factor for NPS use—especially for psychedelic phenethylamines and tryptamines (18). Personal income, another indicator of SES (27), was not a significant correlate of use in this study, so further research is needed to examine the extent to which SES is associated with risk of the overall NPS use, as well as specific NPS and NPS classes.

We found that those identifying as bisexual were at increased odds for reporting NPS use. Previous studies of nightclub attendees have found that females identifying as bisexual/lesbian report higher rates of use of ecstasy, ketamine, cocaine, methamphetamine, and LSD compared to those who identify as heterosexual (5,32). The same studies found that while the prevalence of cocaine and methamphetamine use is higher among males who identify as gay/bisexual, the prevalence of LSD use was found to be higher among heterosexual males (5,32). The results obtained from national studies in the US are similar, although these studies have generally found individuals identifying as bisexual as being at higher risk for use of drugs such as marijuana, cocaine, ecstasy, amphetamine, and cocaine—with even greater risk than those identifying as gay or lesbian (33–35). A recent investigation of a national sample in Australia also found males and females identifying as gay/lesbian/bisexual as being at higher odds for use of ecstasy, methamphetamine, cocaine, ketamine, gamma-hydroxybutyrate (GHB), and hallucinogens compared to their heterosexual counterparts (36). However, similar to the studies focusing on nightclub attendees, one national study also found that heterosexual males are at higher risk for LSD use than gay/bisexual males (34).

We also found that ecstasy, LSD, and ketamine use were consistent risk factors for reporting NPS use. This was not surprising as NPSs are often used as replacements for traditional drugs, particularly ecstasy and LSD, and in some cases are “legal” (37). A previous study of self-reported NPS use in a US nationally representative sample found that 79.4% of NPS users reported lifetime ecstasy/3,4-methylenedioxymetham-phetamine (MDMA) use and 73.7% reported LSD use, with even higher prevalence among those reporting use of tryptamines or psychedelic phenethylamines (18). A recent European study found that ecstasy users were more likely to report use of phenethylamines and that LSD users were more likely to report use of phenethylamines and tryptamines (38), and an online survey of mephedrone users found that 87% had used ecstasy and 11% typically co-used mephedrone with ecstasy (39). While drugs such as “bath salts” may have similar effects to drugs such as ecstasy, ecstasy is also commonly adulterated with such NPSs (40–42). Similarly, psychedelic phenethylamines (e.g., 2C, NBOMe, and Dox series) and tryptamines have been sold as LSD (40).

Importantly, these findings corroborate a recent study of a nationally representative sample of American high school seniors that found that “rave” attendance was positively associated with the use of a variety of different drugs including synthetic cathinones and synthetic cannabinoids (4). The national study not only found that any rave attendance was linked to increased likelihood of use, but it also found that more frequent attendance was associated with higher odds for reporting use, while controlling for other sociodemographic variables. Our study adds to these findings as we focused solely on young adult attendees of EDM

parties at nightclub and festivals. Higher levels of attendance generally placed individuals at higher risk for use of NPSs, so not only is any attendance associated with increased risk of using NPSs, but the results also suggest that attending more frequently is associated with higher risk for using these substances. Other studies have also found a relationship between higher frequency of EDM event attendance and ecstasy use (43,44). Frequent attendance may reflect more involvement in the EDM scene, and as has been shown with ecstasy (44–47), attendance may be related to higher levels of exposure to individuals who use, offer, or sell these substances.

## Limitations

Participants had to be aged 18–25 to participate, so older individuals were excluded and this might have led to lower lifetime prevalence in the sample. Participants were surveyed outside of nightclubs and festivals, so the results may not be generalizable to those outside of these party scenes. The survey compensation may also have led to a bias as underprivileged individuals may have been more likely to respond, and this might also have affected our findings regarding reporting income. We did not select events specifically catered to gay/lesbian patrons, so those who only attend such parties may be underrepresented. We did not have enough power to adequately examine potential associations between sexual orientation or sexual partner preference and use of specific NPSs or NPS classes, and our sample size was modest for exploring relatively rare substance use-taking behaviors. We did not utilize a true random sample, which is not feasible to recruit nightlife attendees, but we did use time–space sampling, which is a probability-based approach (48,49).

Another limitation is that for each NPS category, there were participants who answered affirmatively to the gateway question, but then did not check off the use of any drugs in that category. In these cases, the participant likely either accidentally checked off “yes” to the gateway question; they simply did not check off which specific drug(s) were used in that category; or they did not know which drug they used. We report conservative estimates based only on which specific drugs were checked off (rather than affirmative answers to the NPS category gateway questions). The absolute difference in prevalence between gateway questions and our prevalence variables ranged between 0.9% and 3.6%. The only significant difference in the prevalence by the NPS category was for the non-psychedelic phenethylamine category (which included the “bath salt” category) in which the prevalence would have been 3.6% higher if they had checked off at least one drug within that category ($p = 0.036$). Lists of (unfamiliar) drugs might have been overwhelming for some participants, especially those who were not familiar with many NPSs listed, but we listed as many street names as possible and also presented the most popular NPSs in a different color font to ensure that these stood out on the lists. More research is also needed to determine whether highlighting more prevalent drugs on lists of NPSs leads to biased responses. While the survey was short for those reporting the use of no NPS (as checking “no” did not lead to follow-up questions about the use of specific NPSs in that category), the survey was longer for those who did report the use of multiple NPS categories and this may have affected their responses. It is also possible that there was an order effect in which some participants underreported NPS use later on in the survey, so future studies should randomize the order

of NPS categories and test for such effects. Finally, we only assessed known use. It is possible that a portion of participants unknowingly used NPS thinking that it was another drug. For example, we recently found that 4 out of 10 nightclub/festival attendees who reported using ecstasy/MDMA/Molly, but not synthetic cathinones, had their hair detect positive for synthetic cathinones such as methylone as well as other NPS (50). Future studies should also ask about more recent use and the frequency of use.

## Conclusions

NPS use is prevalent in the nightclub and festival scenes in NYC and attendees are at particularly high risk for use of synthetic cannabinoids, synthetic phenethylamines (e.g., NBOMe), and synthetic cathinones ("bath salts" such as methylone). Since individuals in these scenes—especially frequent attendees—are at high risk for use, prevention and harm reduction services need to be geared toward this population. Specifically, potential users need to be educated about the risks associated with the use of these new drugs, and since much use is actually unintentional, users of drugs such as ecstasy and LSD can purchase test kits online to test whether their product actually contains MDMA or LSD, or a potentially more dangerous NPS such as synthetic cathinones or NBOMe. Likewise, as NPSs continue to emerge at a rapid rate and the prevalence appears to be increasing, researchers need to stay up-to-date with NPSs as they emerge and assess prevalence and correlates of use in order to help prevent NPS-related drug epidemics and associated adverse outcomes.

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## Table 1

NPS classes and individual NPS with at least 1% prevalence (weighted $N = 682$).

| | Weighted % (95% CI) |
|---|---|
| Any NPS | 35.1 (29.8, 40.3) |
| Synthetic cannabinoids | 16.3 (11.3, 21.4) |
| Psychedelic phenethylamines | 14.7 (9.5, 19.9) |
| NBOMe series | 9.0 (5.5, 12.5) |
| 25b-NBOMe | 3.4 (1.7, 5.1) |
| 25i-NBOMe | 3.2 (1.0, 5.4) |
| NBOMe (unknown) | 5.4 (2.6, 8.2) |
| 2C series | 10.3 (5.4, 15.3) |
| 2C-I | 5.1 (1.9, 8.4) |
| 3C series | 2.6 (1.0, 4.3) |
| Dox series | 3.5 (1.7, 5.2) |
| Phenethylamines (non-psychedelic) | 7.8 (3.8, 11.8) |
| Synthetic cathinones (“bath salts”) | 6.9 (2.9, 10.8) |
| Non-synthetic cathinone phenethylamines | 4.4 (1.5, 7.2) |
| Tryptamines | 5.1 (1.9, 8.3) |
| Arylcyclohexylamines (dissociatives) | 4.3 (1.0, 7.7) |
| Psychedelics (non-phenylethylamine) | 6.6 (3.1, 10.1) |
| 1P-LSD | 2.9 (1.2, 4.7) |
| Narcotic, benzodiazepine, and depressant NPS | 4.1 (1.9, 6.4) |

*Note*. NPS: novel psychoactive substance, CI: confidence interval.

**Table 2**

Sample characteristics and binary logistic models delineating correlates of lifetime NPS use.

| | Raw percentages | | | Unadjusted estimates | | Adjusted estimates | |
|---|---|---|---|---|---|---|---|
| | **Full sample (%)** | **No NPS use (%)** | **NPS use (%)** | **OR** | **95% CI** | **AOR** | **95% CI** |
| Age | | | | | | | |
| 18–20 | 26.1 | 22.9 | 32.1 | 1.00 | | 1.00 | |
| 21–22 | 33.3 | 37.1 | 26.4 | 0.51 | (0.14, 1.85) | 0.36 | (0.09, 1.48) |
| 23–25 | 40.5 | 40.0 | 41.5 | 0.74 | (0.21, 2.58) | 0.28 | (0.07, 1.04) |
| Sex | | | | | | | |
| Male | 54.7 | 52.8 | 58.2 | 1.00 | | 1.00 | |
| Female | 45.3 | 47.2 | 41.8 | 0.80 | (0.36, 1.78) | 0.53 | (0.21, 1.33) |
| Race/ethnicity | | | | | | | |
| White | 57.4 | 55.1 | 61.5 | 1.00 | | 1.00 | |
| Black | 5.8 | 5.8 | 5.8 | 0.90 | (0.22, 3.62) | 1.97 | (0.49, 7.84) |
| Hispanic | 20.4 | 21.2 | 19.0 | 0.80 | (0.31, 2.06) | 1.27 | (0.42, 3.90) |
| Asian | 9.7 | 11.2 | 6.9 | 0.56 | (0.23, 1.37) | 0.99 | (0.36, 2.69) |
| Other | 6.7 | 6.8 | 6.7 | 0.88 | (0.23, 3.32) | 0.78 | (0.16, 3.88) |
| Educational attainment | | | | | | | |
| High school/GED or less | 23.3 | 20.9 | 27.6 | 1.00 | | 1.00 | |
| Some college | 32.3 | 32.0 | 32.9 | 0.78 | (0.36, 1.70) | 0.92 | (0.40, 2.15) |
| Bachelor's degree | 37.4 | 40.0 | 32.6 | 0.62 | (0.30, 1.29) | 1.17 | (0.43, 3.16) |
| Graduate school | 7.1 | 7.2 | 6.9 | 0.73 | (0.14, 3.90) | 0.93 | (0.13, 6.53) |
| Parent educational attainment | | | | | | | |
| Low | 32.0 | 26.7 | 41.8 | 1.00 | | 1.00 | |
| Moderate | 43.1 | 45.8 | 38.0 | 0.53* | (0.33, 0.85) | 0.41** | (0.21, 0.78) |
| High | 24.9 | 27.5 | 20.2 | 0.47* | (0.25, 0.88) | 0.42* | (0.18, 0.98) |
| Weekly income | | | | | | | |
| ≤$200 | 30.0 | 28.1 | 33.3 | 1.00 | | 1.00 | |
| $201–$499 | 37.6 | 37.5 | 37.7 | 0.85 | (0.41, 1.75) | 0.86 | (0.36, 2.01) |
| ≥$500 | 32.4 | 34.3 | 29.0 | 0.72 | (0.27, 1.87) | 0.91 | (0.28, 2.89) |
| Religiosity | | | | | | | |

| | Raw percentages | | | Unadjusted estimates | | Adjusted estimates | |
|---|---|---|---|---|---|---|---|
| | **Full sample (%)** | **No NPS use (%)** | **NPS use (%)** | **OR** | **95% CI** | **AOR** | **95% CI** |
| Low | 34.1 | 32.5 | 37.4 | 1.00 | | 1.00 | |
| Moderate | 39.0 | 37.3 | 42.3 | 0.98 | (0.54, 1.79) | 0.91 | (0.44, 1.86) |
| High | 26.9 | 30.4 | 20.3 | 0.58 | (0.29, 1.14) | 0.88 | (0.51, 1.52) |
| Sexual orientation | | | | | | | |
| Heterosexual | 83.2 | 88.9 | 72.2 | 1.00 | | 1.00 | |
| Gay/lesbian | 5.1 | 4.8 | 5.6 | 1.45 | (0.28, 7.48) | 1.41 | (0.33, 6.10) |
| Bisexual | 11.8 | 6.4 | 22.2 | 4.30* | (1.45, 12.68) | 6.95** | (2.19, 22.10) |
| Residence | | | | | | | |
| Outside of NYC | 55.3 | 54.8 | 56.4 | 1.00 | | 1.00 | |
| NYC | 44.7 | 45.2 | 43.6 | 0.94 | (0.42, 2.09) | 1.10 | (0.40, 3.06) |
| Recruitment venue | | | | | | | |
| Nightclub | 52.3 | 52.6 | 51.6 | 1.00 | | 1.00 | |
| Festival | 47.7 | 47.4 | 48.4 | 1.04 | (0.66, 1.65) | 2.12* | (1.19, 3.79) |
| Lifetime drug use | | | | | | | |
| LSD | 19.7 | 10.8 | 36.2 | 4.68*** | (2.27, 9.61) | 4.64** | (1.75, 12.27) |
| Ecstasy/MDMA/Molly | 42.8 | 32.3 | 62.4 | 3.48** | (1.60, 7.56) | 4.54*** | (2.41, 8.58) |
| Ketamine | 17.6 | 10.1 | 31.5 | 4.09** | (1.97, 8.46) | 2.51* | (1.04, 6.05) |
| Methamphetamine | 8.0 | 5.0 | 13.6 | 3.01* | (1.29, 7.02) | 0.61 | (0.18, 2.14) |
| Unknown powders | 2.5 | 0.8 | 5.7 | 7.80** | (2.72, 22.35) | 8.03 | (0.75, 86.13) |
| Nightclub attendance (unweighted) | | | | | | | |
| Never or once or twice a year | 29.6 | 35.7 | 21.9 | 1.00 | | 1.00 | |
| Once or twice a month | 42.7 | 37.5 | 49.2 | 2.13*** | (1.47, 3.10) | 2.01** | (1.29, 3.13) |
| At least once a week/every day | 27.7 | 26.8 | 28.9 | 1.76** | (1.17, 2.65) | 1.56 | (0.95, 2.56) |

*Note*. OR = (unadjusted) odds ratio, AOR = adjusted OR, CI = confidence interval. The lifetime prevalence of NPS (the outcome variable) was 35.1%. Unweighted nightclub attendance was not included in the full multivariable model, but the AORs for attendance reflect us controlling for all other unweighted covariates.

* $p < 0.05$;

** $p < 0.01$;

*** $p < 0.001$.