Use of new and uncommon synthetic psychoactive drugs among a nationally representative sample in the United States, 2005–2017

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Abstract

Objectives—This study aims to examine patterns and first mentions of reported use of new or uncommon drugs across 13 years, among nationally representative samples in the United States.

Methods—Participants (ages 12) in the National Surveys on Drug Use and Health (2005–2017, $N = 730,418$) were provided opportunities to type in names of new or uncommon drugs they had ever used that were not specifically queried. We examined self-reported use across survey years and determined years of first mentions.

Results—From 2005 to 2017, there were 2,343 type-in responses for use of 79 new or uncommon synthetic drugs, and 54 were first-ever mentions of these drugs. The majority (65.8%) of mentions were phenethylamines (e.g., 2C-x, NBOMe), which were also the plurality of new drug mentions ($n = 22$; 40.7%). Mentions of 2C-x drugs in particular increased from 30 mentions in 2005 to 147 mentions in 2013. We estimate an upward trend in use of new or uncommon drugs between 2005 and 2017 ($p < 0.001$).

Conclusion—Although type-in responses on surveys are limited and underestimate prevalence of use, such responses can help inform researchers when new compounds are used. Continued surveillance of use of new and uncommon drugs is needed to inform adequate public health response.

Keywords

new psychoactive substances; phenethylamines; psychedelics; synthetic cathinones; tryptamines

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1 | INTRODUCTION

New psychoactive substances (NPS) continue to emerge throughout the United States and Europe. In fact, dozens of NPS are detected for the first time in Europe every year, with 51 having been discovered in 2017 and over 100 discovered in 2014 (European Monitoring Centre for Drugs and Drug Addiction, 2018). Likewise, at least 36 NPS were discovered in the United States for the first time via drug seizures in 2016/2017 (U.S. Drug Enforcement Administration, 2017; U.S. Drug Enforcement Administration, 2018). Drug identifications from seizures have been the primary source for determining which new drug compounds are diffusing throughout the drug market, but seizure data are epidemiologically limited as confiscations do not necessarily reflect the wide variety of drugs used by the population. Reports of adverse outcomes to Poison Control Centers are another common method of tracking use of various drugs, but reports are limited by their dependence on users experiencing an adverse outcome and by users or health care professionals reporting the adverse outcome (Palamar, Su, & Hoffman, 2016; Warrick et al., 2013). Hospitalization and mortality data are similarly limited due to underreporting and underdetection of use (European Monitoring Centre for Drugs and Drug Addiction, 2017; Slavova et al., 2017). Therefore, further methods of tracking use of new or uncommon drugs are needed. In addition to drug identification data derived from seizures and adverse drug-related outcomes, we believe that survey data can offer additional insights by providing a more comprehensive picture on use of new or uncommon drugs.

Tracking emergence and prevalence of use of new and uncommon drugs is important for informing prevention and educational efforts. For example, the quick emergence of synthetic cannabinoids and synthetic cathinones ("bath salts") in the United States was associated with tens of thousands of poisonings (American Association of Poison Control Centers, 2016; Cordeiro, Daro, Seung, Klein-Schwartz, & Kim, 2018), suggesting the need for better monitoring of emerging drugs in order to help prevent adverse outcomes associated with use. Surveys are the leading source of gathering data on use of drugs, but they tend to focus heavily on the most common drugs (e.g., cannabis and cocaine) and drugs known to be associated with high rates of dependence (e.g., heroin and methamphetamine; Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2018; Kann et al., 2018; Substance Abuse and Mental Health Services Administration, 2017). Little focus, however, is paid to less common or newly emergent drugs unless there are quick surges in popularity—for example, synthetic cannabinoids and synthetic cathinones (Johnston et al., 2018). This lack of attention represents a problem, given that there are hundreds of potentially dangerous drugs that are new or relatively uncommon. Although some national surveys in the United States have begun including questions about use of some new drug classes (e.g., "synthetic marijuana" and "bath salts"; Johnston et al., 2018), specific drugs within these classes are not queried.

In this paper, we describe patterns and emergence of self-reported use of various new or uncommon drugs, assessed via type-in responses, from 13 consecutive cohorts assessed by a nationally representative survey in the United States. We believe these data can help fill in the gaps with regard to the sparsity of epidemiological data focusing on NPS and other uncommon psychoactive drugs.

2 | METHODS

2.1 | Procedure

Data came from the 13 most recent cohorts (2005–2017) of the National Survey on Drug Use and Health (NSDUH), an ongoing cross-sectional survey of noninstitutionalized individuals ages 12 in the 50 U.S. states and District of Columbia (Substance Abuse and Mental Health Services Administration, 2017). Each year, NSDUH surveys over 55,000 respondents. We included 2005 as the first year to ensure that results are comparable with the annual European Drug Report, which presents the number of new NPS identified throughout Europe each year by the EU Early Warning System (European Monitoring Centre for Drugs and Drug Addiction, 2018). NSDUH is a nationally representative multistage area probability sample. Surveys are administered via computer-assisted interviewing conducted by an interviewer and audio computer-assisted self-interviewing (ACASI). For the computer-assisted interviewing, interviewers administered a computer-based survey to participants. For the ACASI, respondents were provided with a computer and headphones and asked to complete the survey; interviewers were trained to not look at the screens during administration in order to maintain privacy and confidentiality and to increase honest reporting. The ACASI collected variables including the type-in response data. The weighted interview response rates between 2005 and 2017 ranged from 68.4% to 76.0%.

3 | DRUG USE VARIABLES

Participants were asked whether they had ever used a variety of common drugs. However, in the section asking about various common psychedelics (e.g., Lysergic acid diethylamide (LSD)), participants were asked whether they had ever used any other "hallucinogens" besides the compounds that were listed for them. Those who answered affirmatively were asked to type in the name(s) of the other hallucinogens they had ever used. They were instructed that if they were not able to spell the drug, they should make their best guess (Center for Behavioral Health Statistics and Quality, 2015). Participants were able to list up to five drugs and were given a similar opportunity to type in names of drugs used that were not queried when asked about stimulants, inhalants, sedatives, analgesics, and about drugs ever injected. However, as of 2015, open-ended questions about use of "other" stimulants, sedatives, and analgesics were no longer included in the survey.

NSDUH coded these responses and provided variables indicating which drugs were typed in by participants. For example, for relevant variables, response #6171 was coded as "4-acetoxy-*N*,*N*-dimethyltryptamine, 4-AcO-DMT," indicating that the participant typed in the name of this compound. We focused on the 79 synthetic psychoactive compounds not directly queried by NSDUH that were listed between 2005 and 2017. The only exception was that in 2006, NSDUH added a question about use of DMT/AMT/Foxy, which was asked after the type-in option for other psychedelics (and in 2015, the question was moved before the open-ended question). Due to N,N-Dimethyltryptamine (DMT's) popularity as a classic psychedelic and to the survey's change in design, we did not consider DMT in this analysis. We did, however, still consider type-in responses for AMT and Foxy.

We cataloged each new or uncommon synthetic drug reported across all 13 cohorts. Specifically, we first identified the survey year when a specific compound was first ever mentioned on the survey, based on when the drug was assigned its own code for the first time (e.g., #6171 for 4-AcO-DMT). We ensured that neither the drug name nor code number appeared in previous data sets. Specifically, because 2005 was the first cohort in this analysis, we also checked the 2003 and 2004 codebooks (data not formally analyzed) to confirm whether drugs mentioned in 2005 or thereafter were first mentions. After confirming first mentions of specific compounds, we then cataloged all 79 compounds into common classifications guided by previous publications and government reports. Specifically, we ensured that every drug examined had previously been classified into one of the following classes: 2C-x (King, Nutt, & Independent Scientific Committee on Drugs, 2014; Shulgin & Shulgin, 1991; U.S. Drug Enforcement Administration Diversion Control Division, 2017; Yu et al., 2008), DOx (Shulgin & Shulgin, 1991), NBOMe (U.S. Drug Enforcement Administration Diversion Control Division, 2017), other phenethylamines (Greene, 2013; King et al., 2014; Shulgin & Shulgin, 1991), synthetic cathinones (McGraw & McGraw, 2012; Power et al., 2015; Prosser & Nelson, 2012; U.S. Drug Enforcement Administration Diversion Control Division, 2014), tryptamines (Glennon et al., 2000; Shulgin & Shulgin, 1997; U.S. Drug Enforcement Administration Diversion Control Division, 2017; van Hout & Hearne, 2017), synthetic cannabinoids (Deng, Verrico, Kosten, & Nielsen, 2018; U.S. Drug Enforcement Administration Diversion Control Division, 2014), dissociatives (arylcyclohexylamines; Berquist et al., 2018; De Paoli, Brandt, Wallach, Archer, & Pounder, 2013), lysergamides (Brandt et al., 2016; Brandt et al., 2017a; Brandt et al., 2017b; Klinke, Muller, Steffenrud, & Dahl-Sorensen, 2010), and piperazines (U.S. Drug Enforcement Administration Diversion Control Division, 2017). 2C, DOx, NBOMe, and other phenethylamines were further classified into an overall phenethylamine class as per the cited studies. The mention of "synthetic mushrooms" was added to tryptamines as this likely referred to 4-AcO-DMT or a similar tryptamine (Herrmann, Johnson, Johnson, & Vandrey, 2016), and the mention of "synthetic LSD/acid" was added to the lysergamide class (van Hout & Hearne, 2017). After classifying each drug into categories, we then computed counts of mentions for each specific compound and number of counts of all compounds in each class—in total and by survey year. In this report, we (a) describe when specific drugs were mentioned for the first time and (b) present the frequency of individual drugs and drug classes across survey years.

All count statistics described above were computed using unweighted data as we presented frequencies (of these rare drugs) and not percentages. However, we were able to compute prevalence estimates and examine trends over time regarding overall use of new and uncommon drugs examined in this study. This was done using logistic regression by estimating odds of use as a linear function of time as a continuous predictor. In these models, we adjusted for the complex survey design and used sample weights to account for oversampling of young respondents and unit-level and individual-level nonresponse in order to derive nationally representative estimates (Heeringa, West, & Berglund, 2010). This secondary analysis was exempt for review by the New York University Langone Medical Center Institutional Review Board.

4 | RESULTS

Figure 1 presents the number of mentions of new or uncommon drugs from 2005 to 2017. There were fewer than 100 mentions peryearfrom 2005 to 2008, and there was a steady increase in mentions from 2009 onwards, peaking in 2013 before decreasing slightly. Table 1 presents the frequencies of type-in response mentions for each new or uncommon drug from 2005 to 2017. Two thirds of mentions (65.8%) were phenethylamines, which consisted of 37 drugs. 2C-x compounds were the most prevalent subclass of overall mentions and comprised nearly half (48.9%) of all drug mentions. 2C-x mentions increased from 30 in 2005 to 147 in 2013 and then decreased through 2017. This pattern was driven largely by 2C-B, 2C-E, and 2C-I, which comprised over 9/10 (91.0%) of 2C-x series mentions. With regard to other psychedelic phenethylamines, there were 86 mentions of DOx series drugs and 158 NBOMe mentions. NBOMe compounds were not mentioned until 2012, and 72.2% of these mentions were 25I-NBOMe. Other phenethylamines accounted for another 153 mentions.

There were 94 mentions of synthetic cathinones ("bath salts"), with the first report of methylone occurring in 2009. Unspecified bath salts were almost half (46.8%) of these mentions. Tryptamines accounted for 9.1% of all mentions and contained a wide variety of compounds mentioned ($n = 19$). Synthetic cannabinoids made up 1/10 (10.5%) of mentions, although specific compounds were rarely mentioned. Lysergamides made up 9.3% of all mentions, and new dissociatives comprised 1.1%.

Figure 2 presents the number of first mentions from 2005 to 2017. There were no first mentions of new or uncommon drugs in 2005/2006. Mentions thereafter staggered but increased to eight in 2012 and in 2013 and then decreased in a staggered manner through 2017. Phenethylamines were the plurality of new drug mentions (40.7%, $n = 22$). Table 2 presents a list of the 54 first mentions in ascending order by year of first mention.

Finally, we examined trends in self-reported use of any new or uncommon drug examined in this study. We detected a significant upward trend in use between 2005 and 2017 ($p < 0.001$). More specifically, as shown in Figure 3, 0.12% reported use in 2005, and this steadily increased to 0.25% through 2013 before slightly decreasing in more recent years. Mentions of most drug classes were too rare to permit examining trends over time with confidence, but 2C-x and overall phenethylamine use demonstrated similar trends over time compared with the trend in use of any drug examined (Table SS1). It should be noted that a quarter of those reporting use of a new or uncommon drug reported using more than one. Specifically, 75.7% reported using one, but 16.5% reported using two; 4.7% reporting using three, and 3.1% reported using four-six.

5 | DISCUSSION

From an epidemiological perspective, data based on drug seizures and adverse outcomes resulting from use are largely limited by the fact that they may not capture the wide variety of drugs actually used among the general population. As such, we conducted the first study assessing self-reported use of various new or uncommon drugs based on type-in responses

from multiple cohorts of individuals assessed through nationally representative surveys in the United States.

In general, our survey results show that a large majority of the NSDUH drug mentions were phenethylamines. 2C-x compounds, in particular, comprised the majority of phenethylamine mentions, driven primarily by mentions of 2C-B, 2C-E, and 2C-I. These trends are similar to those reported in several DEA National Forensic Laboratory Information System (NFLIS) reports, showing that the national number of 2C-x seizures sharply increased from 28 reports in 2006 to 1,530 in 2015, with a peak of 2,113 reports in 2013 (U.S. Drug Enforcement Administration Diversion Control Division, 2017; U.S. Drug Enforcement Administration Office of Diversion Control, 2013). The same patterns were reported in studies based on Poison Control Center data, which also noted that 2C-B, 2C-E, and 2C-I were the primary drivers of 2C-x exposures (Forrester, 2013; Forrester, 2014; Srisuma, Bronstein, & Hoyte, 2015). Whereas these three 2C-x subclasses also accounted for 90% of 2C-x NFLIS seizures in 2011, NBOMe compounds accounted for 91% of 2C-x-related seizures by 2015 (U.S. Drug Enforcement Administration Diversion Control Division, 2017). It should be noted that NFLIS categorizes NBOMe with 2C-x compounds, as NBOMe is a derivative of 2C, whereas our NSDUH study presents these as separate subclasses. We did observe that the number of NSDUH mentions of NBOMe, which was first noted in 2012, increased thereafter. The first NBOMe seizures, as per NFLIS, were reported in 2011 (U.S. Drug Enforcement Administration Diversion Control Division, 2017).

With regard to tryptamine use, NSDUH and NFLIS tryptamine trends were somewhat similar for more recent years but differed in years prior to 2010. For example, our findings demonstrate that tryptamine mentions appear to trend downwards between 2005 and 2012 and then remain steady at slightly higher levels between 2013 and 2016. By comparison, NFLIS data show that total tryptamine seizures spiked upwards from 42 reports in 2005 to 4,046 in 2011 but then decreased in 2012 before remaining steady at approximately 1,000 reports between 2013 and 2015. It should be noted that DMT was the most commonly seized tryptamine by a large margin between 2006 and 2010, and the second most seized tryptamine between 2011 and 2015, but we had to exclude DMT in our analyses. Nonetheless, the overall trends are similar.

Synthetic cannabinoids and synthetic cathinones represent two of the more prevalent groups of NPS used in the United States (Miech et al., 2018), and the majority of NPS discovered each year tend to fall into one of these classes (European Monitoring Centre for Drugs and Drug Addiction, 2018). Mentions of drugs in these classes were rare relative to phenethylamine mentions. Specifically, the results showed that the first mentions were in 2010, with a peak in 2013. This trend is comparable with that based on NFLIS reports, which found that the first synthetic cannabinoid seizures occurred in 2009 (15 reports), with numbers spiking upwards thereafter and peaking in 2014 at approximately 33,000 reports before dipping slightly in 2015 to just under 30,000 reports (U.S. Drug Enforcement Administration Diversion Control Division, 2011; U.S. Drug Enforcement Administration Diversion Control Division, 2014). As it pertains to synthetic cathinones, we observed an increase in mentions from 2009 to 2012 and then a decrease. The number of National Poison Control Center cases has similarly trended downwards between 2011 and 2016 (American

Association of Poison Control Centers, 2016), although the number of NFLIS reports during a similar period has trended upwards (from 142 reports in 2010 to 19,490 in 2015; U.S. Drug Enforcement Administration Diversion Control Division, 2011, 2014).

It should be noted that there were no reports of use of novel opioids via the type-in response option on this survey. There were some type-in reports of fentanyl use over the years, but these responses were listed as "Actiq, Fentanyl, Duragesic, Sublimaze", so we could not determine whether use was of synthetic, illicitly manufactured fentanyl, or misuse of prescriptions. NSDUH has also started specifically querying fentanyl use in recent years. No other novel opioids or fentanyl analogs were typed-in by participants. There have been tens of thousands of deaths related to exposure to these compounds in the United States in recent years (Jones, Einstein, & Compton, 2018), so we believe use was underreported. Underreporting may be due, in part, to the fact that exposure to or misuse of fentanyl, its analogs, and/or other opioid NPS is often unknown, given that they are common adulterants in drugs such as heroin.

The apparent underreporting of use of NPS such as synthetic cannabinoids, synthetic cathinones, and novel opioids demonstrates that type-in responses must be considered with caution (Kroutil, Vorburger, Aldworth, & Colliver, 2010; Palamar, Martins, Su, & Ompad, 2015). It is unknown why drugs such as 2C are more commonly typed in when compared with more prevalent new or uncommon drugs, though one potential explanation is that many such drugs were still legal at the time of survey administration. Consequently, these drugs may not have instinctively come to mind while participants were completing the survey. In similar fashion, when prompted to type in names of other hallucinogens, stimulants, or inhalants, and about drugs ever injected, synthetic cannabinoids, in particular, may not have been considered because they lack salient characteristics that fit in any of these categories. Inclusion of questions about "other" drugs smoked might have led to increased reporting of use of synthetic cannabinoids. Also, drug class names were more commonly typed in for these two classes as opposed to specific compound names. There are now hundreds of synthetic cannabinoid compounds in circulation (European Monitoring Centre for Drugs and Drug Addiction, 2018; U.S. Drug Enforcement Administration, 2018), and mixtures of these compounds, which are often mislabelled (Zamengo, Frison, Bettin, & Sciarrone, 2014), are most often sold in the United States in packages under names such as Spice and K2. Thus, the popularization of these drugs, coupled with ever-shifting mixtures of components, makes it difficult for users to become aware of the specific compounds they are using. Instead, these drugs are often simply grouped together as "synthetic marijuana" or "Spice" drugs. A somewhat similar situation occurred regarding "bath salts," but it appears more common for users to be aware of which compound(s) they are using.

Despite biases with regard to type-in responses on surveys, we believe such information can assist epidemiologists in detecting emergence and patterns of use of new and uncommon drugs. We also believe reporting on Poison Control and other adverse-event-based data could be improved as it relates to exposure to new or uncommon drugs. Annual national Poison Control Center reports, for example, do not list many specific compounds and simply classify numerous stimulants as "hallucinogenic amphetamines" (Gummin et al., 2017). Similarly, stimulant drug-related deaths reported by the Centers for Disease Control and

Prevention are collapsed into a "psychostimulant" category (Seth, Scholl, Rudd, & Bacon, 2018). Collection and/or reporting of data on adverse effects of specific new or uncommon drugs in such systems could improve public health response.

In the grander scheme, there is also a need for the collection and analysis of data on use of new and uncommon drugs that are not dependent on an adverse outcomes or confiscation. Social media platforms and websites where "psychonauts" report on effects of use of various NPS have been put forth as important sources of information (Deluca et al., 2012), but purposive targeting of psychonauts may not yield data generalizable to the overall population. Surveys administered systematically to the overall population would provide more generalizable information, although as reported in this study, use of most new or uncommon drugs would be rare. An alternative scheme potentially worth consideration could be the systematic administration of surveys to "at-risk" populations. For example, electronic dance music nightclub/party attendees have consistently been shown to report high prevalence of use of new and/or uncommon drugs (Palamar, Acosta, Sherman, Ompad, & Cleland, 2016; Palamar, Barratt, Ferris, & Winstock, 2016). Understanding prevalence obtained through such surveys may help us better understand diffusion of such drugs throughout the general population.

6 | LIMITATIONS

NSDUH only surveyed individuals living in households, noninstitutionalized group quarters (e.g., dormitories and shelters), and civilians residing at military bases. Homeless individuals (who do not use shelters), military personnel on active duty, and residents of institutional group quarters, such as hospitals and jails, were not surveyed by NSDUH, which can limit generalizability. The change in survey design in 2015, which dropped open-ended questions about use of "other" stimulants, sedatives, or analgesics, could have also affected responses; however, almost all (99.2%; 1651 of 1664) responses in previous years were typed into the categories that remained, giving us confidence that the change in questions did not likely have a large impact on reporting. The lack of a question querying use of "any type of drug not asked about" is another limitation. In addition, these open-ended questions queried ever use, so recency of use cannot be determined.

Type-in responses are limited because not providing questions about specific drugs tends to lead to severe underreporting (Kroutil et al., 2010; Palamar, Martins, et al., 2015). We believe substantial underreporting occurred not only because respondents were not specifically asked about these dozens of drugs but also because many individuals are simply unaware what drugs they have used. Use of "mystery" (unknown) pills and powders, for example, is common (Palamar, Acosta, et al., 2016), and moreover, consumption of adulterants present in common drugs is prevalent. For example, various studies suggest drugs like ecstasy commonly contain synthetic cathinones (bath salts), whereas drugs said to be LSD have been found to be NBOMe (Brunt et al., 2016; Martins et al., 2017; Palamar, Salomone, Vincenti, & Cleland, 2016). Many respondents also reported use of drug classes but not specific compounds within the class. For example, it is unknown which synthetic cathinone or synthetic cannabinoid users of bath salts or Spice drugs actually used. However,

we also classified specific drugs into categories so lack if specific drug compound name was not a major limitation in most cases.

7 | CONCLUSION

Given the limitations of seizure data and data on adverse events related to drug use, we believe surveys can add to our understanding of emergence and patterns of use of new and uncommon drugs. Indeed, type-in responses on surveys tend to lead to biased estimates of use, but data on use that did not necessarily result in adverse outcomes are needed nonetheless. Monitoring the extent of use of new or emerging drugs can guide public health efforts, particularly those targeting synthetic cannabinoids and synthetic cathinones—two of the most commonly used classes of NPS associated with tens of thousands of poisonings in the United States as evidenced by survey, Poison Control, and emergency department data. Even though prevalence of use of synthetic cannabinoids and synthetic cathinones has decreased in recent years (Kann et al., 2018; Miech et al., 2018; Oliver et al., 2018), these compounds continue to emerge at an alarming rate (European Monitoring Centre for Drugs and Drug Addiction, 2018). Moreover, some of these compounds are highly potent and dangerous (Dalton, Wang, & Zavitsanou, 2009; Watterson & Olive, 2017), leaving users at risk for dependence or other serious adverse outcomes.

It is important to note that synthetic cannabinoids and synthetic cathinones were less commonly mentioned in our study than 2C-x. We believe we are the first to examine 2C-x use on a repeated national survey and have determined that use of these compounds has increased in popularity despite having remained relatively unrecognized by epidemiologists. More research is needed to determine the extent to which use of 2C-x and related compounds leads to adverse effects and need for treatment in order to gauge potential impact on public health. We also detected increasing use of NBOMe, a class that includes compounds known to be particularly dangerous, especially when ingested unknowingly (e.g., in purported LSD). Finally, we detected use of other drug classes that carry less capacity for harm, such as tryptamines and lysergamides (Gable, 2004; Nutt, King, & Phillips, 2010). Despite a lower public health impact, health care professionals may still benefit from knowing that these drugs are used at an appreciable rate in the event of adverse outcomes arising from use.

Ultimately, different drug classes (or compounds within specific classes) are associated with differing degrees of danger and may each require a different degree of public health attention. Nevertheless, continued research is needed on all drug classes examined in this paper. Although the epidemiology of NPS use is only in its infancy, there is an abundance of literature (e.g., case studies) regarding adverse effects (and their treatment) of many of the compounds examined here. Although small case studies do have value, any preventative or harm reduction measures targeting such compounds require more systematic research and surveillance.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENT

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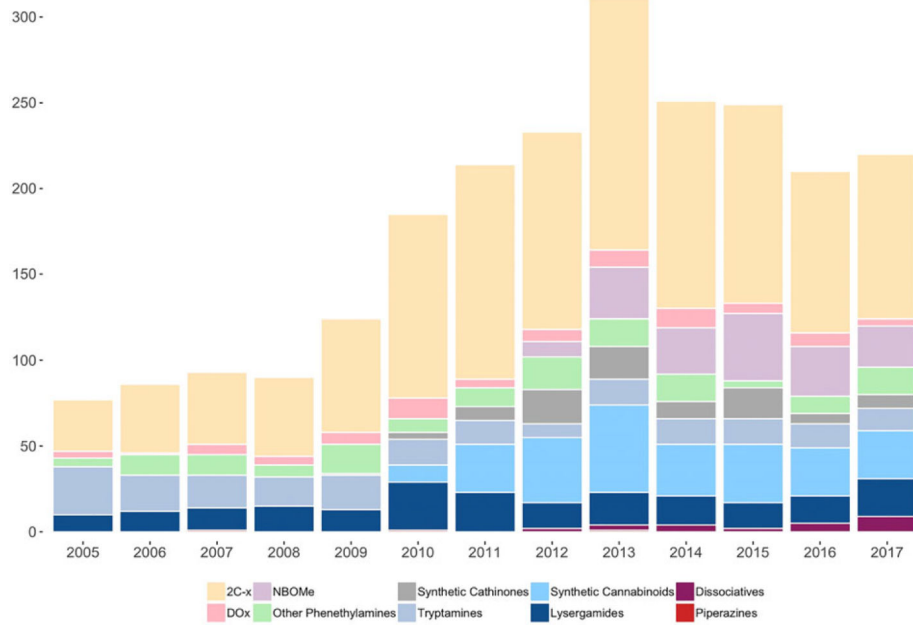**FIGURE 1.**
Number of new or uncommon drugs reported each year, 2005–2017
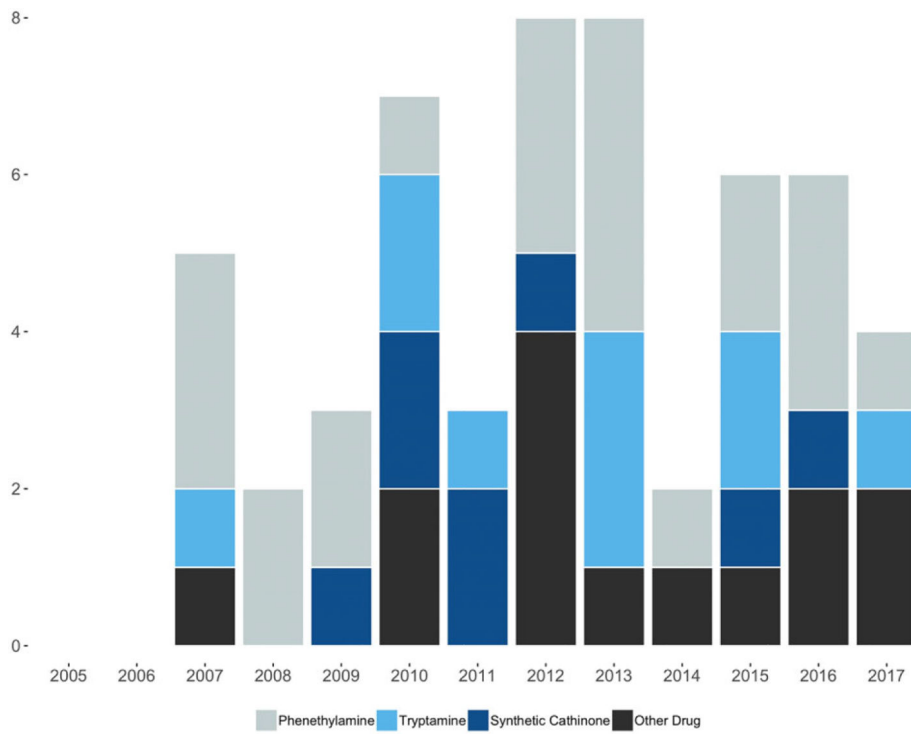
FIGURE 2.
Number of first mentions of new or uncommon drugs reported each year, 2005–2017
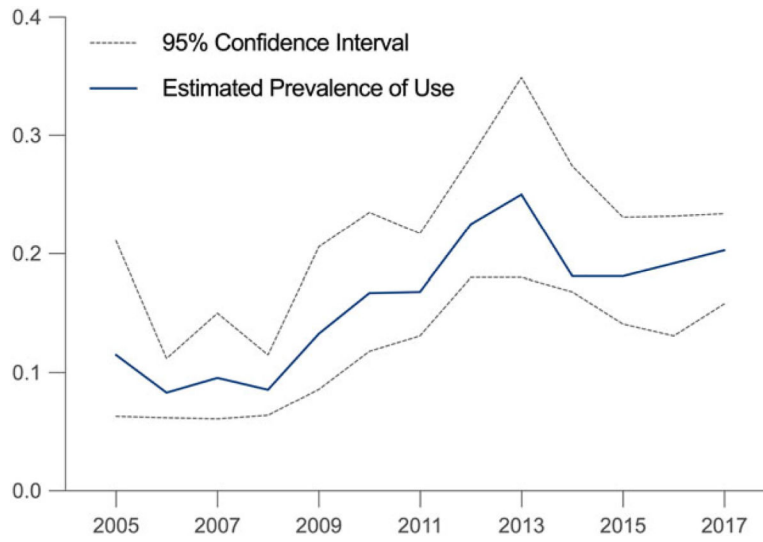
FIGURE 3.
Estimated prevalence of use of any new or uncommon drug, 2005–2017

TABLE 1

Type -in mentions of new and uncommon drugs, 2005–2017

2C-x	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
2C-B (Bromo mescaline, Nexus)	9	11	19	13	20	34	50	35	33	48	40	33	34	379
2C-I (2,5-Dimethoxy-4-iodophenethylamine)	13	17	10	18	30	36	42	41	51	41	40	37	34	410
2C-E (2–5-Dimethoxy-4-ethyl-phenethylamine)	4	5	6	12	10	28	29	31	49	22	24	14	19	253
2C-T-2	2	2	4	1	1	4	3	3	1	2	1	1	2	27
2C-T-7 (T7, Blue Mystic)	2	4	2	1	2	3	0	1	1	1	2	1	1	21
2C-D (2,5-Dimethoxy-4-methylphenethylamine)	0	1	0	0	0	0	1	0	0	1	0	0	0	3
2C-T (2,5-Dimethoxy-4-methylthiophenethylamine)	0	0	1	0	0	1	0	0	0	2	0	1	0	5
2C-T-21 (2,5-dimethoxy-4-(2-fluoroethylthio)phenethylamine)	0	0	0	1	2	0	0	0	1	0	0	0	0	4
2C-C (2–5-Dimethoxy-4-chlorophenethylamine)	0	0	0	0	1	0	0	1	1	0	0	0	0	5
2C-BCB (TCB-2)	0	0	0	0	0	1	0	1	0	1	0	0	1	4
2C-P (4-propyl-2,5-dimethoxyphenethylamine)	0	0	0	0	0	0	0	1	9	2	7	6	4	29
2C-F (2,5-dimethoxy-4-fluorobenzaldehyde)	0	0	0	0	0	0	0	1	0	0	0	0	0	1
2C-C (4-chloro-2,5-dimethoxyphenethylamine)	0	0	0	0	0	0	0	0	1	1	2	0	1	5
2C-B-Fly (2C-Bromo-Fly)	0	0	0	0	0	0	0	0	0	0	0	1	0	1
2C-x total	30	40	42	46	66	107	125	115	147	121	116	94	96	1145
DOx	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
DOM (STP)	4	1	5	1	1	3	1	2	3	6	1	4	1	33
DOI (2,5-Dimethoxy-4-iodoamphetamine)	0	0	1	0	1	1	1	1	0	1	0	2	0	8
DOC (2,5-dimethoxy-4-chloroamphetamine)	0	0	0	4	0	5	2	2	4	1	3	2	2	25
DOB (2,5-dimethoxy-4-bromoamphetamine)	0	0	0	0	5	3	1	2	3	3	2	0	1	20
DOx Total	4	1	6	5	7	12	5	7	10	11	6	8	4	86
NBOMe	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
25I-NBOMe (2C-I-NBOMe, BOM-CI, Cimbi-5)	0	0	0	0	0	0	0	8	23	22	26	20	15	114
25C-NBOMe (2C-C-NBOMe, NBOMe-2C-C)	0	0	0	0	0	0	0	1	6	3	8	3	3	24
25B-NBOMe (NBOMe-2C-B)	0	0	0	0	0	0	0	0	1	2	2	2	3	10
NBOMe, otherwise unspecified	0	0	0	0	0	0	0	0	0	0	3	4	2	9
25D-NBOMe	0	0	0	0	0	0	0	0	0	0	0	0	1	1
NBOMe Total	0	0	0	0	0	0	0	9	30	27	39	29	24	158
Other Phenethylamines	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
MDA (Methylenedioxyamphetamine)	3	10	11	7	14	8	10	19	10	11	2	5	7	117
PMA (Paramethoxyamphetamine)	1	1	0	0	0	0	0	0	0	0	0	0	0	2
DMA (2, 5-Dimethoxyamphetamine)	1	0	0	0	0	0	1	0	2	2	0	0	0	6
TMA (Trimethoxyamphetamine)	0	1	0	0	1	0	0	0	0	0	0	0	0	2
PMMA (Paramethoxymethamphetamine)	0	0	1	0	0	0	0	0	0	0	0	0	0	1
3C-Bromo-Dragonfly (DOB-Dragonfly)	0	0	0	0	2	0	0	0	2	1	1	2	0	8
MDE (MDEA, 3,4-Methylenedioxy-N-Ethylamphetamine)	0	0	0	0	0	0	0	0	1	0	0	0	4	5
4-FMA (4-Fluoromethamphetamine)	0	0	0	0	0	0	0	0	1	1	0	0	0	2
6-APB, Benzo Fury	0	0	0	0	0	0	0	0	0	1	0	1	1	3
5-MAPB	0	0	0	0	0	0	0	0	0	0	1	1	0	2
6-MAPB	0	0	0	0	0	0	0	0	0	0	0	1	0	1
4-FA (4-Fluoroamphetamine)	0	0	0	0	0	0	0	0	0	0	0	0	2	2
5-APB	0	0	0	0	0	0	0	0	0	0	0	0	1	1
3,4-Ethylenedioxy-N-methylamphetamine (EDMA, MDMC)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Other Phenethylamine Total	5	12	12	7	17	8	11	19	16	16	4	10	16	153
Phenethylamine Total	39	53	60	58	90	127	141	150	203	175	165	141	140	1542
Synthetic Cathinones	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
bk-MDMA (Methylone)	0	0	0	0	1	1	1	1	4	1	3	2	2	16
MCAT (Mephedrone)	0	0	0	0	0	2	3	5	2	2	1	0	2	17
Methedrone	0	0	0	0	0	1	0	0	1	0	0	0	0	2
MDPV (Methylenedioxypyrovalerone)	0	0	0	0	0	0	3	2	2	1	2	1	0	11
Bath salts, otherwise unspecified	0	0	0	0	0	0	1	11	10	6	11	1	4	44
Cloud 10 Ultra	0	0	0	0	0	0	0	1	0	0	0	0	0	1
alpha-PVP (alpha-Pyrrolidinopentiophenone)	0	0	0	0	0	0	0	0	0	0	1	1	0	2
Beta-keto 2C-B (Bk-2C-B)	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Synthetic Cathinones Total	0	0	0	0	1	4	8	20	19	10	18	6	8	94
Tryptamines	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
AMT (Alpha-methyltryptamine, IT-290, 3-IT)	15	7	5	8	6	1	5	2	0	7	1	1	0	58
Foxy	3	3	3	1	2	3	2	2	2	0	0	1	0	22
5-MeO-DiPT (Foxy methoxy)	3	2	1	4	0	3	1	0	0	2	0	1	0	17
5-MeO-AMT	3	1	4	1	4	2	0	1	1	1	1	0	1	20
DiPT (Di-isopropyl-tryptamine)	2	1	1	0	1	0	1	0	0	0	0	0	0	6

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
5-MeO-DMT	1	5	4	2	4	2	3	1	3	2	1	1	3	32
DPT (Dipropyltryptamine)	1	1	0	0	1	1	0	1	0	0	0	1	0	6
5-MeO-T (5-methoxytryptamine)	0	1	0	0	0	0	0	0	0	0	0	0	0	1
4-AcO-DMT (4-HO-DMT, 4-acetoxy-N,N-dimethyltryptamine)	0	0	1	1	1	0	1	1	3	2	9	5	3	27
5-MeO, otherwise unspecified	0	0	0	0	1	1	0	0	2	1	0	1	2	8
4-HO-DiP (4-HO-DiPT, 4-Hydroxy-N,N-diisopropyltryptamine)	0	0	0	0	0	1	0	0	0	0	0	0	1	2
4-Hydroxy-MIPT (4-HO-MiPT)	0	0	0	0	0	1	0	0	0	0	1	0	0	2
4-HO-MET (N-Ethyl-4-hydroxy-N-methyltryptamine)	0	0	0	0	0	0	1	0	0	0	0	2	1	4
5-MeO-MiPT	0	0	0	0	0	0	0	0	2	0	0	1	1	4
4-MeO-DMT	0	0	0	0	0	0	0	0	1	0	0	0	0	1
5-MeO-DALT (N,N-diallyl-5-methoxytryptamine)	0	0	0	0	0	0	0	0	1	0	0	0	0	1
4-HO-DET (CZ-74, Ethocin)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
4-AcO-MET (4-Acetoxy-MET, Metacetin)	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Synthetic mushrooms (unspecified)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Tryptamine Total	28	21	19	17	20	15	14	8	15	15	15	14	13	214
Synthetic Cannabinoids	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
Synthetic cannabinoids (e.g., K2, Spice, JWH-018)	0	0	0	0	13	9	28	33	49	29	33	25	26	232
CP 55,940	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Synthetic cannabis, otherwise unspecified	0	0	0	0	0	0	0	3	2	1	1	3	2	12
AM-2201	0	0	0	0	0	0	0	2	0	0	0	0	0	2
Synthetic Cannabinoids Total	0	0	0	0	13	10	28	38	51	30	34	28	28	247
Lysergamides	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
LSA	10	12	13	15	13	27	23	14	18	16	12	14	20	207
ALD-52	0	0	0	0	0	1	0	1	0	0	0	0	0	2
LSZ (Lysergic acid 2,4-dimethylazetidide)	0	0	0	0	0	0	0	0	1	0	1	1	0	3
LAH (LSH, Lysergic acid hydroxyethylamide)	0	0	0	0	0	0	0	0	0	1	0	0	0	1
AL-LAD (6-allyl-6-nor-LSD)	0	0	0	0	0	0	0	0	0	0	2	0	0	2
IP-LSD	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Synthetic LSD/acid (unspecified)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Lysergamides Total	10	12	13	15	13	28	23	15	19	17	15	16	22	218
Dissociatives	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
3-MeO-2-Oxo-PCE (MXE, Methoxetamine)	0	0	0	0	0	0	0	1	3	4	2	4	9	23

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Cl-400 (Eticyclidine, PCE)	0	0	0	0	0	0	0	1	0	0	0	0	0	1
3-MeO-PCP (3-Methoxyphencyclidine)	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Dissociative Total	0	0	0	0	0	0	0	2	3	4	2	5	9	25
Piperazines														
BZP (Benzylpiperazine)	0	0	1	0	0	1	0	0	1	0	0	0	0	3
Piperazines Total	0	0	1	0	0	1	0	0	1	0	0	0	0	3
Total	**77**	**86**	**93**	**90**	**124**	**185**	**214**	**233**	**311**	**251**	**249**	**210**	**220**	**2343**

Note. NSDUH staff classified typed-in responses into precoded response options for previously reported drugs and coded new responses for first reported drugs. The drug names listed above represent NSDUH classification–some of which contain full chemical names or street names and others do not. We did not make major edits to response options for transparency.

TABLE 2

First mentions of new and uncommon drugs by Year ($n = 54$)

Year	New or uncommon drug	Drug class
2007	2C-T	Phenethylamine
2007	4-AcO-DMT; 4-HO-DMT	Tryptamine
2007	BZP	Piperazine
2007	DOI	Phenethylamine
2007	PMMA	Phenethylamine
2008	2C-T-21	Phenethylamine
2008	DOC	Phenethylamine
2009	3C-Bromo-Dragonfly	Phenethylamine
2009	bk-MDMA (Methylone)	Synthetic cathinone
2009	DOB	Phenethylamine
2010	2C-BCB	Phenethylamine
2010	4-HO-DiPT	Tryptamine
2010	4-HO-MiPT	Tryptamine
2010	CP 55,940	Synthetic cannabinoid
2010	MCAT (Mephedrone)	Synthetic cathinone
2010	Methedrone	Synthetic cathinone
2010	Synthetic cannabinoids	Synthetic cannabinoid
2011	4-HO-MET	Tryptamine
2011	Bath salts, otherwise unspecified	Synthetic cathinone
2011	MDPV	Synthetic cathinone
2012	25C-NBOMe	Phenethylamine
2012	25I-NBOMe	Phenethylamine
2012	2C-F	Phenethylamine
2012	3-MeO-2-Oxo-PCE (MXE)	Dissociative
2012	AM-2201	Synthetic cannabinoid
2012	CI-400	Dissociative
2012	Cloud 10 Ultra	Synthetic cathinone
2012	Synthetic cannabis, otherwise unspecified	Synthetic cannabinoid
2013	25B-NBOMe	Phenethylamine
2013	2C-C	Phenethylamine
2013	2C-P	Phenethylamine
2013	4-FMA	Phenethylamine
2013	4-MeO-DMT	Tryptamine
2013	5-MeO-DALT	Tryptamine
2013	5-MeO-MiPT	Tryptamine
2013	LSZ	Lysergamide
2014	LAH	Lysergamide
2014	4-FA	Phenethylamine
2015	4-AcO-MET	Tryptamine

Year	New or uncommon drug	Drug class
2015	4-HO-DET	Tryptamine
2015	5-MAPB	Phenethylamine
2015	AL-LAD	Lysergamide
2015	alpha-PVP	Synthetic cathinone
2015	NBOMe, otherwise unspecified	Phenethylamine
2016	1P-LSD	Lysergamide
2016	2C-B-Fly	Phenethylamine
2016	3-MeO-PCP	Dissociative
2016	6-MAPB	Phenethylamine
2016	6-APB, Benzo Fury	Phenethylamine
2016	Bk-2C-B	Synthetic cathinone
2017	25D-NBOMe	Phenethylamine
2017	5-APB	Phenethylamine
2017	Synthetic LSD/acid (unspecified)	Lysergamide
2017	Synthetic mushrooms (unspecified)	Tryptamine