



Published in final edited form as:

Drug Alcohol Depend. 2020 April 01; 209: 107889. doi:10.1016/j.drugalcdep.2020.107889.

Trends in Drug Use among Electronic Dance Music Party Attendees in New York City, 2016-2019

Joseph J. Palamar¹, Katherine M. Keyes²

¹New York University School of Medicine, Department of Population Health, New York, NY

²Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY

Abstract

Objective: Electronic dance music (EDM) party attendees are a high-risk population for drug use and associated adverse effects. We examined trends in past-year drug use within this population to better inform prevention and harm reduction efforts.

Methods: Each summer from 2016 through 2019, we used time-space sampling to survey a cross-section of adults entering EDM parties at randomly selected nightclubs and at dance festivals in New York City. Ns ranged from 504 (2019) to 1,087 (2016). We estimated log-linear trends in past-year use of 16 different synthetic drugs or drug classes.

Results: Between 2016 and 2019, estimated past-year prevalence of use of ketamine increased from 5.9% to 15.3% (a 157.6% relative increase; $P=.007$), LSD use increased from 9.9% to 16.6% (a 67.7% relative increase, $P<.001$), powder cocaine use increased from 17.3% to 35.2% (a 103.5% relative increase, $P<.001$), and GHB use increased from 1.0% to 4.2% (a 311.8% relative increase; $P=.002$). Past-year use of 3 drugs increased from 12.7% to 20.5% (a 61.4% relative increase; $P=.013$); however, estimated past-year use of unknown powders decreased from 2.0% to 1.1% (a relative 44.7% decrease; $P=.038$) and ecstasy/MDMA/Molly use was stable across years (at 25.0-28.5%; $P=.687$).

Conclusions: Reports of powder cocaine, LSD, ketamine, and GHB are becoming more prevalent among EDM party attendees. Prevention and harm reduction efforts are needed to address increasing use. Research is also needed to examine whether increasing media coverage of medical use of ketamine and other psychedelics affects prevalence of recreational use.

Address correspondence to: Joseph J. Palamar, Department of Population Health, 180 Madison Avenue, Room 1752, New York, NY 10016, joseph.palamar@nyulangone.org, T: 646-501-3555.

Contributors

All authors are responsible for this reported research. J. Palamar conceptualized and designed the study, and conducted the statistical analyses. K. Keyes advised regarding statistical analysis conducted in this study. J. Palamar and K. Keyes drafted the initial manuscript, and both authors interpreted results, and critically reviewed and revised the manuscript. Both authors approved the final manuscript as submitted.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Declaration of Interest: The authors declare no conflict of interest.

Keywords

cocaine; ketamine; ecstasy; electronic dance music

1. Introduction

Electronic dance music (EDM) party attendees are a high-risk population for drug use and associated adverse effects (Palamar et al., 2019). Use of illegal party drugs such as ecstasy/MDMA/Molly is common at EDM parties at nightclubs and warehouses, and at large dance festivals, and use is common among people who attend such parties (Hughes et al., 2017; Krotulski et al., 2018; Kurtz et al., 2017; Palamar et al., 2015; Palamar, Acosta et al., 2019; Palamar, Le et al., 2019; Ramo et al., 2011). For example, high school seniors in the United States (US) surveyed in 2011-2013 who attended “rave” parties (underground EDM parties) had higher estimated prevalence and frequency of use of 18 different drugs compared to non-attendees (Palamar et al., 2015). While extensive research suggests that EDM party attendees use a variety of non-medical drugs, according to music industry reports, popularity of this scene appears to have increased in recent years (Watson, 2018, 2019), especially the popularity of large dance festivals, many of which have >10,000 attendees per day. Thus, whether the drug-use burden in this community will increase if attendance expands remains unknown.

We believe focusing on at-risk populations such as EDM party attendees is particularly necessary as death rates related to drug use have been increasing in the US. For example, death rates associated with cocaine (a common party drug) and psychostimulants (e.g., methamphetamine) have risen between 2015 and 2016, with increases of 52.4% and 33.3%, respectively (Kariisa et al., 2019). The drug landscape also continues to change, particularly with an increasing number of new psychoactive substances (NPS) such as synthetic cathinones (commonly referred to as “bath salts” in the US) and fentanyl analogs emerging (U.S. Drug Enforcement Administration, 2019). Media coverage and public discourse about the use of ketamine and psychedelics to treat medical conditions such as depression is also increasing, particularly in the US, which may in turn influence recreational use of these substances. In light of increasing popularity of the EDM scene and the changing drug landscape in the US, we aimed to examine whether estimated prevalence of use of various drugs in this population has shifted in recent years.

2. Methods

2.1. Procedure and Participants

Each summer, from 2016-2019, participants were surveyed near the entrance of EDM parties in New York City (NYC). Time-space sampling (MacKellar et al., 2007) was used, and each week, parties (primarily at nightclubs) were randomly selected. Each week the party selection sample space contained a list of nightclubs that consistently hold EDM parties each week and a list of other parties advertised on EDM party ticket websites listed as having >15 tickets purchased by mid-week. We used R 3.1 software (R Core Team) to randomly select parties from the list each week. Recruitment typically occurred on 1-2 nights per week on

Thursday through Sunday. While most participants were surveyed entering nightclubs and warehouses, participants were also surveyed outside of 1-2 large daytime EDM dance festivals each year.

Individuals were eligible if they were between 18-40 years old, and were about to enter the randomly selected party. We attempted to approach all individuals who appeared eligible rather than approach every n th person as previous venue-based studies in NYC have found that eliminating this level of random selection was not associated with significantly different participant characteristics (Parsons et al., 2008). Surveys were taken on tablets after informed consent was provided, and those completing the survey were compensated \$10 USD. Surveys were administered outside of 125 parties (37 in 2016, 39 in 2017, 24 in 2018, and 25 in 2019). Parties at nightclubs and warehouses ($n=109$) were randomly selected and festivals (with recruitment occurring on 16 separate days) were not randomly selected. The survey response rate was 72% (77% in 2016, 74% in 2017, and 73% in 2018, 64% in 2019). The total sample size was 3,558 (1,087 in 2016, 962 in 2017, 1,029 in 2018, and 504 in 2019). All methods were approved by the New York University Langone Medical Center institutional review board.

2.2. Measures

Participants were asked about demographic characteristics and about their frequency of past-year EDM party attendance. Participants were then asked about past-year use of various drugs (16 drugs or drug classes). While most drugs were queried as single items (i.e., ecstasy/MDMA/Molly, powder cocaine), NPS categories were queried via lists of compounds within each group. Specifically, each year we asked about 13-26 synthetic cathinones (“bath salts”) (e.g., methylo), 8-27 tryptamines (e.g., DMT), 5-18 2C series drugs (e.g., 2C-B), and 1-6 NBOMe series drugs (e.g., 25i-NBOMe). Lists of specific NPS compounds were shortened in later years due to low reported prevalence of use of various compounds. However, compounds removed from the checklist were still listed below the option for “other” compounds in each class not listed. An affirmative response to any compound in a class was coded as an affirmative response to use. For example, those reporting DMT use were coded as reporting tryptamine use. Test-retest reliability (kappa) of drug questions in this study (from the 2017 cohort) was shown to be high ($\kappa=0.88-1.00$) (Palamar, Le et al. 2019).

2.3. Analyses

We estimated prevalence of past-year use of each drug in each year and calculated the absolute and relative changes in prevalence from 2016 to 2019. We then determined whether there was a log-linear trend using logistic regression models by estimating odds of use as a linear function of time as a continuous predictor. We controlled for age, sex, race/ethnicity, education, income, sexual orientation, and type of venue where surveyed (nightclub/warehouse vs. festival) in these models. Since festivals are infrequent events with only a small portion of participants surveyed entering such parties, we also conducted sensitivity tests limiting the sample to those surveyed entering nightclub/warehouse parties. We applied sample weights based on response rate to survey invitation, and self-reported frequency of party attendance, given that those who have higher response rates, and independently, those

who are more frequent attendees, have a higher likelihood of being sampled across venues (MacKellar et al., 2007). Weights were thus included so that results are more generalizable to all party attendees, rather than frequent responders and party attendees. Data were analyzed using Stata 13 SE (StataCorp, College Station, TX) and we utilized survey commands to generate estimates (Heeringa et al., 2010).

3. Results

The majority of participants were male (57.1%), white (50.9%), and heterosexual (81.6%), and 56.0% had a college degree. The mean age was 25.3 (SE=0.1).

Between 2016 and 2019, estimated past-year prevalence of use of ketamine increased from 5.9% to 15.3% (a 157.6% relative increase; $P=.007$), LSD use increased from 9.9% to 16.6% (a 67.7% relative increase, $P<.001$), powder cocaine use increased from 17.3% to 35.2% (a 103.5% relative increase, $P<.001$), and GHB use increased from 1.0% to 4.2% (a 311.8% relative increase; $P=.002$). Estimated “bath salt” use and NBOMe use also increased ($P=.045$ and $.005$, respectively), but trends appear to be driven by relatively large increases in 2018. Estimated use of unknown powders decreased from 2.0% to 1.1% (a relative 44.7% decrease; $P=.038$). Finally, estimated use of any drug examined increased from 41.6% to 49.1% (a relative increase of 18.0%; $P=.009$) and use of 3 drugs examined increased from 12.7% to 20.5% (a 61.4% relative increase; $P=.013$). In our sensitivity analyses focusing only on the subsample of those surveyed entering nightclubs (Supplemental Table 1), we observed similar significant increases in past-year use of powder cocaine, ketamine, GHB, and NBOMe, but significant shifts in trends of past-year use of LSD, “bath salts”, or unknown powders were not observed.

4. Discussion

We estimate significant increases in past-year use of various synthetic party drugs in the EDM party-attending population in NYC in recent years. While prevalence of use of drugs such as ecstasy/MDMA/Molly and amphetamine remained stable, prevalence of use of the common party drugs LSD, ketamine, powder cocaine, and GHB, all significantly increased from 2016 to 2019. Although past-year use of these drugs appears to be relatively stable among high school seniors and young adults in the US (Schulenberg et al., 2019), a recent study examining trends in drug use among past-year ecstasy users in the National Survey on Drug Use and Health detected significant increasing trends in use of various party drugs (Palamar et al., 2017). Specifically, between 2007/09 and 2013/14, among ecstasy users, past-year use of LSD, ketamine, and use of 5 drugs increased (Palamar et al., 2017). Similar shifts in drug use were found among past-year users of tryptamines (Palamar and Le, 2018). Thus, the trends reported here are confirmed in independent data sources.

While national surveys query perceived availability of select drugs in the US, is unknown to what extent availability of the drugs examined in this study has shifted in this scene in recent years. Changes in prevalence of use might be due, in part, to the EDM party landscape shifting. EDM scenes both inside and outside of the US have experienced major shifts over the past three decades (e.g., from “raves” to nightclubs to dance festivals) (Collin, 2010),

and in recent years, many EDM parties in NYC have shifted back to warehouses. It is unknown whether such shifts are driving trends in drug use among attendees. More research is needed to determine whether changes in the scene may be influencing drug availability and drug use. It is also possible that newcomers to the scene are influencing trends.

Increasing prevalence of use of ketamine and LSD use is of particular concern. Ketamine was US Food and Drug Administration (FDA)-approved for use as an anti-depressant in 2019, and while not FDA-regulated, there has been substantial discussion of LSD and other psychedelics as mental health treatment in recent years (Pollan, 2018). However, it is unknown to what extent increased awareness of effects of these drugs translates to increased interest in non-medical use. MDMA, however, has also been widely covered by the media in recent years, and in 2017, the FDA granted breakthrough therapy designation for this drug. However, we did not detect significant shifts in prevalence of use. We believe research on beliefs and opinions about recreational use of such drugs is warranted.

4.1. Limitations

Limited recall could have affected reporting of drug use and intentional underreporting is also a potential limitation. Users only reported what drugs they believed they used. Drugs such as ecstasy are commonly adulterated with other drugs and a large portion of people who use such synthetic drugs are unknowingly exposed to drugs like “bath salts” (Oliver et al., 2018); thus, use of NPS use was likely underreported. The smaller sample size in 2019 limits precision in prevalence estimates, and not all significant shifts detected in the full sample were detected in the subsample limited to those surveyed entering nightclubs. We were unable to determine which participants frequent each type of venue so we could not examine this further, but more research is needed to examine patterns of drug use in various EDM scenes. There were minor shifts in the order of questions about drug use across years, but we do not believe order effects were likely because the survey typically only took ~10 minutes to complete. The number of drugs listed on checklists for NPS drug classes shifted over time, but specific drugs removed from list were included as examples for “other” non-listed drugs in each class. Due to major shifts in question wording regarding nonmedical opioid and benzodiazepine use we could not examine trends. Surveys were limited to summer months, but this was consistent across years and we do not believe potential seasonal effects would greatly influence past-year use.

4.2. Conclusions

Use of powder cocaine, LSD, ketamine, and GHB in particular is becoming more prevalent in this high-risk population. Prevention and harm reduction efforts are needed to address increasing use. Research is also needed to examine whether increasing media coverage of medical use of ketamine and other psychedelics affects prevalence of recreational use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

J. Palamar is funded by the National Institutes of Health (NIH) (R01DA044207 and K01DA038800)

Role of funding source

Research reported in this publication was supported by the National Institute on Drug Abuse of the National Institutes of Health under Award Numbers R01DA044207 and K01DA038800. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

References

- Collin M, 2010 *Altered State: The Story of Ecstasy Culture and Acid House*. Serpent's Tail; London.
- Heeringa SG, West BT, Berglund PA, 2010 *Applied Survey Data Analysis*. Chapman & Hall/CRC, Boca Raton, FL.
- Hughes CE, Moxham-Hall V, Ritter A, Weatherburn D, MacCoun R, 2017 The deterrent effects of Australian street-level drug law enforcement on illicit drug offending at outdoor music festivals. *Int. J. Drug Policy* 41, 91–100. [PubMed: 28131615]
- Kariisa M, Scholl L, Wilson N, Seth P, Hoots B, 2019 Drug overdose deaths involving cocaine and psychostimulants with abuse potential - United States, 2003–2017. *MMWR Morb. Mortal. Wkly. Rep* 68, 388–395. [PubMed: 31048676]
- Krotulski AJ, Mohr ALA, Fogarty MF, Logan BK, 2018 The detection of novel stimulants in oral fluid from users reporting ecstasy, Molly and MDMA ingestion. *J. Anal. Toxicol* 42, 544–553. [PubMed: 30371847]
- Kurtz SP, Buttram ME, Pagano ME, Surratt HL, 2017 A randomized trial of brief assessment interventions for young adults who use drugs in the club scene. *J. Subst. Abuse Treat* 78, 64–73. [PubMed: 28554606]
- MacKellar DA, Gallagher KM, Finlayson T, Sanchez T, Lansky A, Sullivan PS, 2007 Surveillance of HIV risk and prevention behaviors of men who have sex with men—a national application of venue-based, time-space sampling. *Public Health Rep.* 122, 39–47. [PubMed: 17354526]
- Oliver CF, Palamar J, Salomone A, Simmons SJ, Philogene-Khalid H, Stokes-McCloskey N, Rawls S, 2018 Synthetic cathinone adulteration of illegal drugs. *Psychopharmacol.* 236, 869–879.
- Palamar JJ, Griffin-Tomas M, Ompad DC, 2015 Illicit drug use among rave attendees in a nationally representative sample of US high school seniors. *Drug Alcohol Depend.* 152, 24–31. [PubMed: 26005041]
- Palamar JJ, Acosta P, Le A, Cleland CM, Nelson LS, 2019 Adverse drug-related effects among electronic dance music party attendees. *Int. J. Drug Policy* 73, 81–87. [PubMed: 31349134]
- Palamar JJ, Le A, Acosta P, Cleland CM, 2019 Consistency of self-reported drug use among electronic dance music party attendees. *Drug Alcohol Rev.* 38, 798–806. [PubMed: 31523872]
- Palamar JJ, Mauro P, Han B, Martins SS, 2017 Shifting characteristics of ecstasy users ages 12–34 in the United States, 2007–2014. *Drug Alcohol Depend.* 181, 20–24. [PubMed: 29028555]
- Palamar JJ, Le A, 2018 Trends in DMT and other tryptamine use among young adults in the United States. *Am. J. Addict* 27, 578–585. [PubMed: 30260086]
- Parsons JT, Grov C, Kelly BC, 2008 Comparing the effectiveness of two forms of time-space sampling to identify club drug-using young adults. *J. Drug Issues* 38, 1061–1081. [PubMed: 20686625]
- Pollan M, 2018 *How to Change Your Mind: What the New Science of Psychedelics Teaches Us About Consciousness, Dying, Addiction, Depression, and Transcendence*. Penguin Press, New York, NY.
- Ramo DE, Grov C, Delucchi KL, Kelly BC, Parsons JT, 2011 Cocaine use trajectories of club drug-using young adults recruited using time-space sampling. *Addict. Behav* 36, 292–300.
- Schulenberg JE, Johnston LD, O'Malley PM, Bachman JG, Miech RA, Patrick ME, 2019 *Monitoring the Future national survey results on drug use, 1975–2018: Volume II, College students and adults ages 19–60*. University of Michigan, Ann Arbor, MI Accessed 19 November 2019 <https://deepblue.lib.umich.edu/bitstream/handle/2027.42/150623/2018-19%20VOL%20II%20FINAL%20.pdf?sequence=1&isAllowed=y>.

- U.S. Drug Enforcement Administration, 2019 Emerging threat report: mid-year 2019. Special Testing and Research Laboratory Accessed 19 November 2019 <https://ndews.umd.edu/sites/ndews.umd.edu/files/Emerging-Threat-Report-2019-Mid-Year.pdf>.
- Watson K, 2018 IMS business report 2018-an annual study of the electronic music industry. International Music Summit, Ibiza Accessed 19 November 2019 <https://www.internationalmusicsummit.com/wp-content/uploads/2018/05/IMS-Business-Report-2018-vFinal2.pdf>
- Watson K, 2019 IMS business report 2019-an annual study of the electronic music industry. International Music Summit, Ibiza Accessed 19 November 2019 <https://www.internationalmusicsummit.com/wp-content/uploads/2019/05/IMS-Business-Report-2019-vFinal.pdf>.

HIGHLIGHTS

- We examined trends in drug use among electronic dance music party attendees in NYC
- Between 2016 and 2019, prevalence of ketamine use increased from 5.9% to 15.3%
- LSD use increased from 9.9% to 16.6% and cocaine use increased from 17.3% to 35.2%
- Use of >3 drugs increased from 12.7% to 20.5% and use of unknown powders decreased
- Prevention and harm reduction efforts should address increasing use in this scene

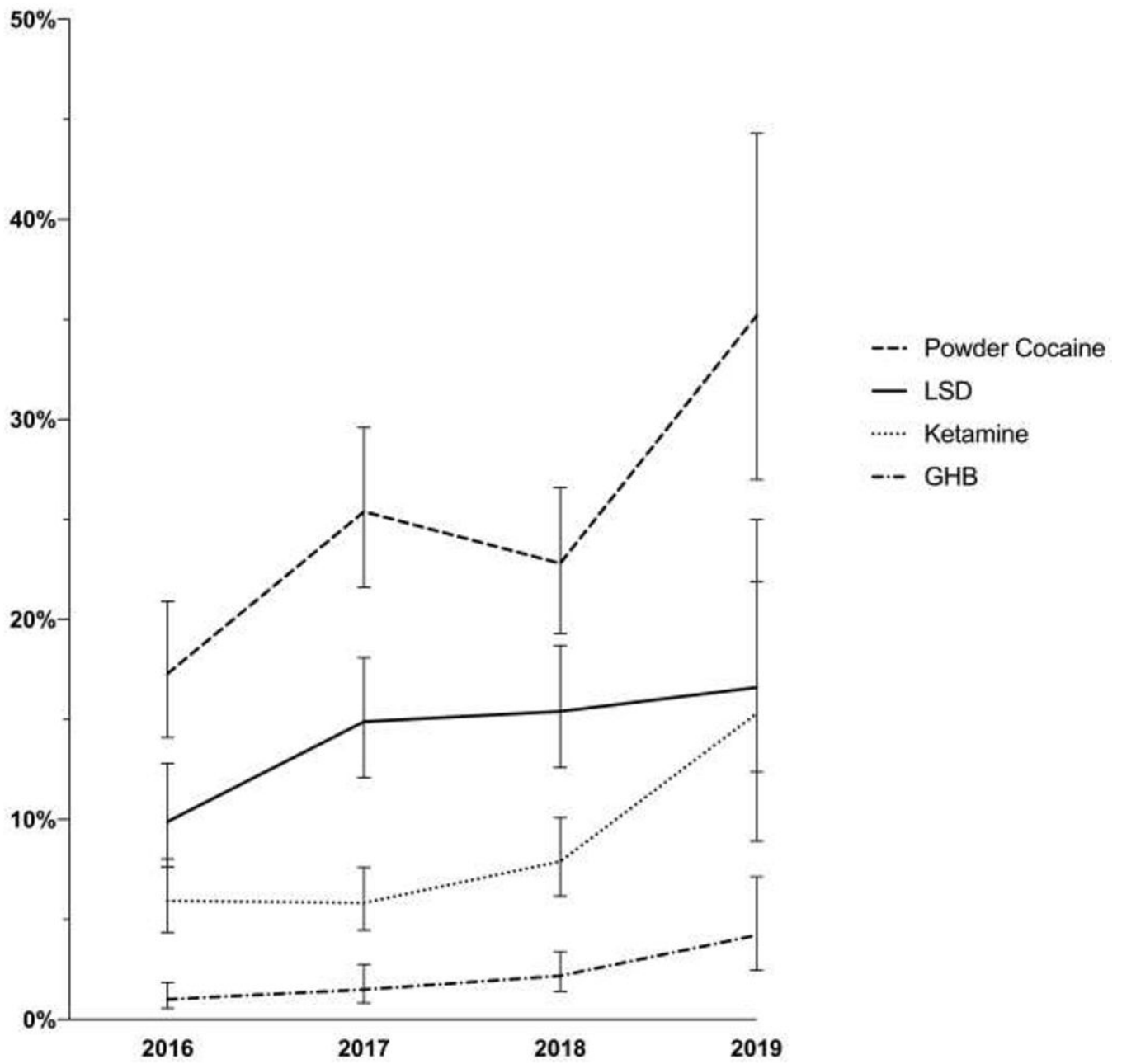


Fig. 1.
Trends in use of select party drugs, 2016–2019.

TABLE 1—

Trends in Estimated Prevalence of Past-Year Drug Use among EDM Party Attendees in New York City, 2016-2019

	2016 (n=1,087) Weighted % (SE)	2017 (n=962) Weighted % (SE)	2018 (n=1,029) Weighted % (SE)	2019 (n=504) Weighted % (SE)	% Absolute Change from 2016 to 2019	% Relative Change from 2016-2019	P
Common Party Drugs							
Ecstasy/MDMA/Molly	26.2 (2.0)	25.0 (2.0)	28.5 (2.0)	25.8 (3.4)	-0.4	-1.5	0.687
Powder cocaine	17.3 (1.7)	25.4 (2.0)	22.8 (1.8)	35.2 (4.5)	17.9	103.5	<0.001
Amphetamine	12.4 (1.5)	13.0 (1.5)	10.9 (1.5)	14.9 (2.7)	2.5	20.2	0.506
LSD	9.9 (1.3)	14.9 (1.5)	15.4 (1.6)	16.6 (2.4)	6.7	67.7	<0.001
Ketamine	5.9 (0.9)	5.8 (0.8)	7.9 (1.0)	15.3 (4.1)	9.4	157.6	0.007
Other Synthetic Drugs							
Synthetic Cannabinoids	4.3 (0.9)	2.4 (0.7)	3.2 (1.0)	1.7 (0.7)	-2.6	-60.6	0.276
2C Series	2.6 (0.7)	1.1 (0.5)	1.2 (0.4)	1.8 (0.6)	-0.8	-31.8	0.229
Bath salts	2.5 (0.7)	1.1 (0.4)	5.2 (1.1)	2.0 (0.7)	-0.4	-17.1	0.045
MDA	2.3 (0.5)	1.8 (0.5)	1.2 (0.4)	1.7 (0.6)	-0.6	-25.1	0.470
Tryptamines	2.0 (0.5)	1.7 (0.5)	2.0 (0.7)	1.8 (1.0)	-0.2	-8.2	0.669
Unknown powders	2.0 (0.7)	3.8 (1.0)	0.5 (0.2)	1.1 (0.5)	-0.9	-44.7	0.038
Unknown pills	1.6 (0.4)	2.2 (0.5)	0.7 (0.3)	0.9 (0.5)	-0.7	-44.1	0.103
Methamphetamine	1.5 (0.6)	2.0 (0.7)	2.0 (0.6)	5.2 (1.5)	3.7	242.1	0.113
GHB	1.0 (0.3)	1.5 (0.5)	2.2 (0.5)	4.2 (1.2)	3.2	311.8	0.002
NBOMe	0.8 (0.3)	0.4 (0.1)	3.5 (0.8)	0.6 (0.4)	-0.2	-21.3	0.005
Heroin	0.6 (0.2)	1.3 (0.5)	0.4 (0.2)	0.8 (0.6)	0.2	45.2	0.801
Number of Drugs Used							
Used Any drug	41.6 (2.4)	43.6 (2.5)	50.5 (2.5)	49.1 (4.5)	7.5	18.0	0.009
Used 1-2 drugs	28.9 (2.2)	27.6 (2.3)	36.4 (2.3)	28.6 (4.3)	-0.3	-1.0	0.245
Used 3 drugs	12.7 (1.4)	16.0 (1.5)	14.1 (1.4)	20.5 (3.1)	7.8	61.4	0.013

Note. Log-linear trends were examined using logistic regression models which estimated odds of use as a linear function of time as a continuous predictor. Amphetamine use refers to nonmedical use which was defined as using without a prescription or in a manner in which it was not prescribed—for example, to get high. SE = standard error; MDMA = 3,4-methylenedioxyamphetamine; LSD = *lysergic acid* diethylamide; MDA = 3,4-methylenedioxyamphetamine; GHB = gamma-hydroxybutyrate; NBOMe = 2,5-Dimethoxy-*N*-(2-methoxybenzyl)phenethylamine