Received: 30 October 2016 | Revised: 14 February 2017 | Accepted: 27 March 2017

DOI: 10.1002/hup.2599

WILEY

SPECIAL ISSUE ON NOVEL PSYCHOACTIVE SUBSTANCES

Genie in a blotter: A comparative study of LSD and LSD analogues' effects and user profile

Leigh D. Coney[1] | Larissa J. Maier[2] | Jason A. Ferris[3] | Adam R. Winstock[4,5] | Monica J. Barratt[1,6,7]

[1] Drug Policy Modelling Program, National Drug and Alcohol Research Centre, UNSW Australia, Sydney, NSW, Australia

[2] University of Zurich, Zurich, Switzerland

[3] Institute for Social Science Research, University of Queensland, St Lucia, QLD, Australia

[4] University College London, London, UK

[5] Global Drug Survey Ltd, London, UK

[6] National Drug Research Institute, Faculty of Health Sciences, Curtin University, Perth, WA, Australia

[7] Centre of Population Health, Burnet Institute, Melbourne, VIC, Australia

Correspondence
Monica Barratt, Drug Policy Modelling Program, National Drug and Alcohol Research Centre, UNSW Australia, Sydney, NSW 2052, Australia.
Email: m.barratt@unsw.edu.au

Funding Information
National Health and Medical Research Council, Grant/Award Number: APP1070140

Abstract

Objective: This study aimed to describe self-reported patterns of use and effects of lysergic acid diethylamide (LSD) analogues (AL-LAD, 1P-LSD, and ETH-LAD) and the characteristics of those who use them.

Methods: An anonymous self-selected online survey of people who use drugs (Global Drug Survey 2016; *N* = 96,894), which measured perceived drug effects of LSD and its analogues.

Results: Most LSD analogue users (91%) had also tried LSD. The proportion of U.K. and U.S. respondents reporting LSD analogue use in the last 12 months was higher than for LSD only. LSD analogue users described the effects as psychedelic (93%), over half (55%) obtained it online, and almost all (99%) reported an oral route of administration. The modal duration (8 hr) and time to peak (2 hr) of LSD analogues were not significantly different from LSD. Ratings for pleasurable high, strength of effect, comedown, urge to use more drugs, value for money, and risk of harm following use were significantly lower for LSD analogues compared with LSD.

Conclusions: LSD analogues were reported as similar in time to peak and duration as LSD but weaker in strength, pleasurable high, and comedown. Future studies should seek to replicate these findings with chemical confirmation and dose measurement.

KEYWORDS

1P-LSD, AL-LAD, cross-sectional survey, LSD, LSD analogues, new psychoactive substances

1 | INTRODUCTION

Since the first use of lysergic acid diethylamide (LSD) in 1943 by Albert Hofmann (Hofmann, 1980), many similarly structured compounds have emerged such as ALD-52, AL-LAD (or Aladdin), ETH-LAD, PRO-LAD, LSZ, and 1P-LSD, to name just a few (Brandt et al., 2017; Brandt et al., 2016; Peyton & Shulgin, 1994; Watts, Mailman, Lawler, Neve, & Nichols, 1995). The increased speed emergence of these new psychoactive substances (NPS) is partially driven by legislative processes chasing a synthesise–proscribe–synthesise model (Reuter & Pardo, 2017). For example, 1P-LSD use increased in popularity in the UK following prohibition of LSZ and AL-LAD in 2015 (Brandt et al., 2016). Since May 2016, the UK Psychoactive Substances Act prohibited the supply of 1P-LSD and any other compounds deemed to cause a "psychoactive effect" (Reuter & Pardo, 2017). Other countries now have similar blanket bans on all "psychoactive" substances (such as Ireland, Poland, Romania, and Australia; see Barratt, Seear, & Lancaster, 2017) or on analogues of psychoactive substances (United States; see Kau, 2008). Although the effectiveness of these policies is yet to be fully established, they may result in a shift in purchase from "head shops" or high street shops to surface web vendors, cryptomarkets, and into "street" markets (as discussed in Barratt & Lenton, 2017; Reuter & Pardo, 2017). The use of LSD analogues including 1P-LSD has been recently reported amongst nightclub attendees in the United States (Palamar, Acosta, Sherman, Ompad, & Cleland, 2016), and social media and cryptomarket monitoring studies have also recently detected discussion of this class of drugs (Van Hout & Hearne, 2017; Vigna et al., 2016).

LSD analogues and LSD share the same lysergic backbone. However, they present slight variations in their chemical structure, such as AL-LAD's modification at the N6 position (Brandt et al., 2017). These lysergide derivatives act as an agonist of the 5-HT2A receptor (Brandt et al., 2016), generally considered the mediator of hallucinogenic effects behaviourally and subjectively (Geyer &

Vollenweider, 2008). There are ethical barriers associated with the administration of hallucinogens to humans for research purposes: There is an unknown potential for harm associated with this class of drugs, and the subjectivity of individuals' responses can vary significantly. Therefore, animal behavioural models are useful for investigating the pharmacology of these drugs. Hallucinogenic effects can be illustrated by measuring the head twitch response in mice (Hanks & Gonzalez-Maeso, 2013). The head twitch response in mice is a side-to-side head movement elicited only by a hallucinogenic 5-HT2A agonist, which effectively discriminates between hallucinogenic and non-hallucinogenic 5-HT2A agonists. This response was found for mice that had been administered 1P-LSD (Brandt et al., 2016), indicating that 1P-LSD is indeed likely to have hallucinogenic effects in humans. Although lab-based evidence for human experience of 1P-LSD does not exist, detailed experiences reported by users (see Psychonaut Wiki, 2016a) include auditory and visual perceptual alterations following the consumption of 1P-LSD.

Research on mice regarding the potency of these compounds compared to LSD (ED50 = 132.8 nmol/kg) indicated 1P-LSD (ED50 = 349.6 nmol/kg) to be 38% the potency of LSD (Brandt et al., 2016), AL-LAD slightly less potent (ED50 = 174.9 nmol/kg), and LSZ equipotent (ED50 = 114.2 nmol/kg; Brandt et al., 2017). These varying potencies shown in mice do not reflect reported dosages in humans. The typical dosage of LSD is approximately 150 μg, however, the dosage of AL-LAD ranged between 80 and 160 μg (Shulgin & Shulgin, 1997), LSZ between 100 and 300 μg (Erowid, 2014), and 1P-LSD between 50 and 300 μg (Psychonaut Wiki, 2016a). The duration of the effects of LSD analogues (AL-LAD and LSZ 6–10 hr and 1P-LSD 8–12 hr; Psychonaut Wiki, 2016a, 2016b, 2016c) is, however, comparable to that of typical LSD (6–12 hr).

What we currently know about the use of LSD analogues in humans is based on animal models plus the experience and effect reports posted to websites and wikis. In this paper, we use an anonymous web survey to describe the self-reported effect profile of LSD analogues, including AL-LAD, 1P-LSD, and ETH-LAD, in humans, in comparison to the effect profile of the better-known drug, LSD. We also compare LSD analogue and LSD user profiles.

2 | METHOD

An anonymous online survey on the use of psychoactive substances was designed and conducted by Global Drug Survey (GDS) (http://www.globaldrugsurvey.com/archive/GDS2016/) between November 2015 and February 2016. GDS runs the world's biggest drug survey and is conducted annually, in partnership with global media partners who promote the survey to their audiences. In 2016, the survey was translated into 10 languages. GDS enables rapid assessment and identification of novel drugs as well as new drug trends before their spread to the wider community (e.g., Kaar et al., 2016; Lawn, Barratt, Williams, Horne, & Winstock, 2014; Lawn, Borschmann, Cottrell, & Winstock, 2016). Ethical approval was received from King's College London (PNM1415-18). Participation was voluntary, and no incentives (payments or lotteries) were offered for participation.

A total of 100,711 responses were submitted to GDS. After preparing the data, 3,817 records were excluded due to data capture glitches, duplicate entries, reporting no psychoactive drug use at all, reporting the use of a fake drug, and reported age over 100 years. Almost one third of the remaining 96,894 responses were from Germany (n = 29,865, 31%), followed by Switzerland (n = 8,173, 8%), New Zealand (n = 7,633, 8%), UK (n = 6,015, 6%), United States (n = 5,366, 6%), Netherlands (n = 5,058, 5%), and Australia (n = 4,931, 5%), with the remaining countries accounting for 31%. The average age of respondents was 28.7 years (SD = 11.2, range = 16–95), and the majority were male (64%) with the remaining female (34%), and transgender (1%). The subsample comprised 3,678 respondents who reported LSD analogues or LSD as their last new drug tried. The average age of the subsample was 23.4 years (SD = 5.7, range = 16–56), and the majority were male (74%) with the remaining female (25%), and transgender (1%).

Self-reported lifetime use and recent (last 12 month) use of LSD and LSD analogues were collected. The use of LSD analogues was measured separately for AL-LAD and also as a category, labelled "LSD Analogues (e.g., 1P-LSD and ETH-LAD)." For this paper, variables relating to AL-LAD and LSD Analogues (e.g., 1P-LSD and ETH-LAD) were combined and hereon referred to as "LSD analogues." Although it is possible that respondents may have included others, the three LSD analogues named in the survey were AL-LAD, 1P-LSD, and ETH-LAD. For both LSD and LSD analogues, profiling information was collected regarding route of administration (ROA), source of the drug, and effects such as the type of effect, duration, time to peak, strength (scored from 1 to 10, 10 = *extremely strong*), pleasurable high (scored from 1 to 10, 10 = *best ever had*), comedown (scored from 1 to 10, 10 = *extremely strong*), urge to use more drugs (scored from 1 to 10, 10 = *extremely strong*), negative effects whilst high (scored from 1 to 10, 10 = *extremely strong*), risk of harm following use of the drug (scored from 1 to 10, 10 = *extremely high risk*), and value for money (scored from 1 to 10, 10 = *best experienced*), where these drugs were identified as being the last drug tried for the first time. This profiling set of variables has been used previously by the GDS group to profile NPS, including mephedrone (Winstock et al., 2011), the NBOMe series (Lawn et al., 2014), DMT (Winstock, Kaar, & Borschmann, 2014), and methoxetamine (Winstock, Lawn, Deluca, & Borschmann, 2016).

Prior to running the multivariate analyses, missing value analysis on variables of interest showed no variables with less than 5% missing. Multicollinearity and singularity were also tested using a Pearson product moment correlation. All variables correlated in a meaningful way, ensuring the validity of the statistical analysis used (Tabachnick & Fidell, 2013). Normality and homoscedasticity assumptions for multivariate analyses were met. Linearity appeared to be violated; however, multivariate analysis of variance (MANOVA) is robust to this violation (Tabachnick & Fidell, 2013), and therefore, conducting a MANOVA was deemed acceptable. As described more fully in the results, the univariate assumption of equality of variance was not met for some variables. MANOVA was conducted to compare differences between LSD and LSD analogues on effects such as strength, pleasurable high, negative effects whilst high, comedown, risk of harm following use, and value for money. Independent

samples *t* tests were conducted to determine differences in duration and time to peak. The alpha level was set at .05 and only valid percentages were used.

3 | RESULTS

3.1 | Patterns of use

Amongst the entire sample (*N* = 96,894), 25,953 (27%) reported use of LSD compared with 2,349 (2%) that reported use of LSD analogues (see Table 1). Recent (last 12-month) LSD use was reported by 13% of the entire sample (*n* = 12,491), whereas recent LSD analogue use was reported by 1% (*n* = 1,431). Of the 2,202 respondents with available data who reported ever using LSD analogues, 2,004 (91%) reported lifetime use of LSD. Of the 1,249 with available data who reported using LSD analogues in the last 12 months, 1,055 (85%) also reported LSD use in the last 12 months.

TABLE 1 Recency of LSD and LSD analogue use (%)

	LSD	LSD analogues
	(*N* = 25,953)	(*N* = 2,349)
Yes, but not in the last 12 months	50%	35%
Yes, in the last 12 months, but not in the last 30 days	34%	48%
Yes, in the last 30 days, but not in the last 7 days	11%	12%
Yes, in the last 7 days	5%	5%

Note. Base for percentage is the number of respondents who reported ever use of LSD or LSD analogues. LSD = lysergic acid diethylamide.

3.2 | Demographics of LSD analogue users

Comparisons of demographic characteristics were performed between individuals who reported (a) use of LSD analogues in the last 12 months and (b) use of LSD in the last 12 months but not LSD analogues (see Table 2). There was a significantly higher proportion of recent LSD analogue users in the UK and the United States compared with recent LSD users. Overall, recent LSD analogue users had a younger mean age and were more likely to be male compared with recent LSD users.

3.3 | Description by those whom an LSD analogue was "the last new drug tried"

Almost all participants reporting LSD analogues as their last new drug tried described the effects as mostly psychedelic (LSD/ketamine like; 93%), whereas 2% described it as mostly stimulant (cocaine/amphetamine like), 1% mostly cannabis like, and 1% mostly empathogenic (MDMA/ecstasy like). Additionally 2% of the group described the effects as "other." The most common source of LSD analogues was online (*n* = 186, 56%), followed by a friend (*n* = 111, 33%), then a dealer (*n* = 28, 8%); these reported sources were significantly different from the ones reported for LSD, $\chi(5) = 649.20$, $p < .001$, which was less likely to be sourced online (*n* = 260, 8%) and more likely to be sourced from a

TABLE 2 Demographic characteristics of recent (in the last 12 months) LSD and LSD analogue users[a]

		Recent LSD analogue use	Recent LSD use (excludes LSD analogue use)	
Variables	Level (*n*)	*N* = 1,249	*N* = 11,055	Test for difference
Country[b]	Germany (29,685)	16% (199)	18% (2,002)	$\chi(1) = 3.62$, $p = .057$
	Switzerland (8,173)	1% (18)	4% (413)	$\chi(1) = 17.48$, $p < .001$
	New Zealand (7,633)	3% (42)	5% (528)	$\chi(1) = 5.08$, $p = .024$
	United Kingdom (6,015)	19% (237)	9% (962)	$\chi(1) = 134.66$, $p < .001$
	United States (5,366)	17% (217)	14% (1,574)	$\chi(1) = 8.87$, $p = .003$
	Netherlands (5,058)	2% (23)	3% (272)	$\chi(1) = 1.84$, $p = .175$
	Australia (4,931)	1% (18)	2% (188)	$\chi(1) = .46$, $p = .498$
Ethnicity	White (84,971)	80% (998)	78% (8,658)	$\chi(1) = 1.67$, $p = .196$
	Non-White (11,923)	20% (251)	22% (2,379)	
Age	(95,799)	$M = 23.37$, $SD = 6.22$	$M = 24.16$, $SD = 6.51$	$t(12164) = 4.11$, $p < .001$
Gender	Male (62,583)	81% (1,008)	75% (8,131)	$\chi(2) = 30.69$, $p < .001$
	Female (32,587)	18% (217)	24% (2,689)	
	Transgender (443)	1% (9)	1% (72)	
Currently studying	Full time (31,482)	44% (542)	40% (4,369)	$\chi(2) = 6.35$, $p = .042$
	Part time (8,314)	11% (134)	12% (1,256)	
	Not studying (54,722)	45% (553)	48% (5,162)	
Occupation	Professional (23,406)	21% (251)	24% (2,450)	$\chi(8) = 21.38$, $p = .006$
	Sales worker (8,111)	13% (151)	13% (1,362)	
	Labourer (6,726)	12% (140)	11% (1,138)	
	Manager/administrator (12,775)	8% (97)	10% (1056)	
	Technician/tradesperson (7,888)	11% (129)	9% (957)	
	Community/personal Service (7,787)	10% (117)	10% (979)	
	Clerical workers (8,589)	5% (61)	6% (657)	
	Machinery workers (1,079)	2% (25)	2% (157)	
	Never worked (13,129)	17% (212)	15% (1,562)	

Note. GDS = Global Drug Survey; LSD = lysergic acid diethylamide.

[a]LSD analogue group included respondents who reported use of LSD analogues in the last 12 months, and the LSD group included respondents who reported use of LSD in the last 12 months but not LSD analogues.

[b]Results from the top seven countries in the whole GDS sample are reported here.

friend (*n* = 2,251, 68%). The majority of participants reported swallowing as the common ROA (*n* = 278, 83%) whereas the 17% of other ROA commonly reported "sublingual," "blotter," and "tab," which are all oral routes. Only one participant reported snorting and one other reported injecting. Reported ROA for LSD did not significantly differ from LSD analogues ROA, $\chi(5) = 7.69$, $p = .174$.

3.4 | Comparison of effects of LSD and LSD analogues

The modal duration of effect for both LSD and LSD analogues was 8 hr. The results indicated no significant difference in duration between LSD and LSD analogue groups, $t(443) = 1.50$, $p = .134$. The modal time to peak was 2 hr for both LSD and LSD analogues. There were no significant difference in mean times to peak for LSD and LSD analogues, $t(3601) = .85$, $p = .398$.

A MANOVA was conducted to compare LSD (*n* = 3,015) and LSD analogues (*n* = 306) on pleasurable high, strength of effect, negative effects whilst high, comedown, urge to use more, value for money, and risk of harm following use of the drug. The assumption of equality of variance was not met for pleasurable high, $F(1, 3319) = 7.37$, $p = .007$, negative effects when high, $F(1, 3319) = 10.41$, $p = .001$, comedown, $F(1, 3319) = 4.94$, $p = .026$, urge to use more drugs, $F(1, 3319) = 13.39$, $p < .001$, and risk of harm, $F(1, 3319) = 47.85$, $p < .001$. The MANOVA yielded significant findings on the combined variables measuring the effects of the last new drug used, $F(7, 3313) = 4.74$, $p < .001$, $\dot{\eta}^2 = .01$, power ≥ 1. Results showed that ratings of LSD did not differ from ratings of LSD analogues on negative effects when high, $F(1, 3319) = 0.81$, $p = .368$. However, ratings of LSD were significantly higher than ratings of LSD analogues on pleasurable high, $F(1, 3319) = 5.50$, $p = .019$, $\dot{\eta}^2 = .01$, power = .65, strength of effect, $F(1, 3319) = 5.51$, $p = .019$, $\dot{\eta}^2 = .01$, power = .65, comedown, $F(1, 3319) = 5.37$, $p = .021$, $\dot{\eta}^2 = .01$, power = .64, urge to use more drugs, $F(1, 3319) = 3.89$, $p = .049$, $\dot{\eta}^2 = .01$, power = .50, value for money, $F(1, 3319) = 10.78$, $p = .001$, $\dot{\eta}^2 = .01$, power = .91, and risk of harm, $F(1, 3319) = 27.32$, $p < .001$, $\dot{\eta}^2 = .01$, power = .99; see Table 3).

TABLE 3 Drug effect ratings by LSD and LSD analogues (mean, *SD*)

Drug effect	Last new drug tried		MANOVA *p* value
	LSD (*n* = 3,015)	LSD analogues (*n* = 306)	
Pleasurable high	7.88 (1.98)	7.60 (1.74)	.019
Strength of effect	7.85 (1.97)	7.57 (1.94)	.019
Negative effects when high	2.97 (2.55)	2.83 (2.23)	.368
Comedown	3.32 (2.78)	2.93 (2.61)	.021
Urge to use more drugs when using	1.45 (2.27)	1.19 (1.99)	.049
Value for money	7.97 (2.29)	7.52 (2.29)	.001
Risk of harm following use	2.44 (2.54)	1.66 (1.91)	<.001

Note. Effect ratings were on a scale of 1 (*lowest*) to 10 (*highest*). LSD = lysergic acid diethylamide; MANOVA = multivariate analysis of variance.

4 | DISCUSSION

To our knowledge, this paper is the first to describe patterns of use and self-reported effects of LSD analogues (AL-LAD, 1P-LSD, and ETH-LAD) in humans. In this sample, "typical" users of these analogues were males aged in their mid-20s, identifying as "White," who were mostly full-time students or employed. These characteristics were similar to the demographics of other psychedelic drug users (e.g., Lawn et al., 2014; Winstock et al., 2014), although they may also reflect the bias of people inclined to complete the GDS. Nonetheless, some differences were identified between LSD and LSD analogue users. There were significantly higher proportions of respondents from the UK and the United States reporting recent LSD analogue use compared to recent LSD only use. It should be noted that these survey data were collected during a period when 1P-LSD was still legal in the UK, therefore this trend may be subject to change in future years. The majority of participants who had used LSD analogues reported that they had obtained LSD analogues online, which significantly differed from methods used to obtain LSD, matching with previous reports on the widespread availability of NPS online (Brandt, King, & Evans-Brown, 2014; Van Buskirk, Naicker, Roxburgh, Bruno, & Burns, 2016). The most common ROA was oral, and the majority of participants reported the type of effect as psychedelic (LSD/ketamine like), which did not significantly differ from LSD. The modal duration of effect reported for LSD analogues (8 hr) as well as the time to peak (2 hr) was the same as LSD. A comparison of the reports on perceived effects of LSD analogues and LSD showed that LSD was rated significantly higher for pleasurable high, strength, urge to use more drugs, value for money, risk of harm following use, and comedown. These results suggest that LSD analogues are "weaker" versions of LSD. This result is consistent with animal research showing LSD analogues such as 1P-LSD having a lower potency than LSD in mice (Brandt et al., 2016).

This study has several limitations. The main weakness of this study was the possible drug reporting inaccuracies, both intentional and unintentional as well as manufacturer mislabelling. It is possible that users led to believe they were taking LSD were in fact consuming one of its analogues and vice versa. Also, it is plausible that the substances taken were unrelated to LSD such as those from the NBOMe series (Caldicott, Bright, & Barratt, 2013; Martins et al., 2017 under review). Future studies should seek to replicate these findings with chemical confirmation. In addition, future studies should investigate harms of LSD analogues, both short term and long term. Measuring additional detail regarding the experience such as dosage and whether or not other drugs were consumed concurrently should be considered to gain a better understanding of LSD analogue effects in humans. A further limitation is that the survey sample was self-selected, and therefore, not necessarily representative of a wider population of psychedelic users.

5 | CONCLUSION

This is the first study to describe the self-reported effect profile of LSD analogues, including AL-LAD, 1P-LSD, and ETH-LAD, in humans. The profile of LSD analogues was reported to be very similar to LSD in

relation to duration, time to peak, and ROA (oral). However, LSD analogues were considered weaker in regard to strength, pleasurable high, and comedown. Future research should monitor and test the substances subject to investigation and seek to replicate and confirm these initial findings.

ACKNOWLEDGEMENTS

We would like to thank the participants who gave so generously of their time to complete the Global Drug Survey 2016. We are grateful for the promotion of GDS by a long list of world media partners, see www.globaldrugsurvey.com. We are also indebted to Stuart Newman for his programming skills and patience and Chris Parsons for managing the survey translation site.

FUNDING INFORMATION

No external funding was received specifically for this study. Monica Barratt and Jason Ferris are supported by National Health & Medical Research Council Early Career Researcher Fellowships (APP1070140 and APP1089395). The National Drug and Alcohol Research Centre at UNSW Australia and the National Drug Research Institute in the Faculty of Health Sciences at Curtin University are supported by funding from the Australian Government under the Substance Misuse Prevention and Service Improvement Grants Fund. M. B. gratefully acknowledges the contribution to this work of the Victorian Operational Infrastructure Support Program received by the Burnet Institute. The funders played no further part in the research process, and the views expressed in this paper should not be seen as representative of the views of the funders.

CONFLICT OF INTEREST

Adam Winstock is founder and director of Global Drug Survey Ltd, an independent data exchange hub. There are no other conflicts to declare.

AUTHOR CONTRIBUTIONS

L. C. conducted all statistical analyses and drafted the paper. M. B. supervised the analysis and critically revised the paper. L. M., J. F., and A. W. critically revised the paper. J. F., L. M., and M. B. managed data translation, preparation, and cleaning. A. W. is principle director of the GDS project, managing its relationships with media partners and its scientific direction. All authors have contributed to read and agreed to this manuscript.

REFERENCES

Barratt, M. J., & Lenton, S. (2017). Drugs and the internet. In A. Ritter, T. King, & N. Lee (Eds.), *Drug use in Australian society* (2nd ed., pp. Forthcoming)). Melbourne: Oxford University Press.

Barratt, M. J., Seear, K., & Lancaster, K. (2017). A critical examination of the definition of 'psychoactive effect' in Australian drug legislation. *International Journal of Drug Policy*, *40*, 16–25.

Brandt, S. D., Kavanagh, P. V., Westphal, F., Elliott, S. P., Wallach, J., Colestock, T., … Halberstadt, A. L. (2017). Return of the lysergamides. Part II: Analytical and behavioural characterization of N6-allyl-6-norlysergic acid diethylamide (AL-LAD) and (2′S,4′S)-lysergic acid 2,4-dimethylazetidide (LSZ). *Drug Testing and Analysis*, *9*, 38–50.

Brandt, S. D., Kavanagh, P. V., Westphal, F., Stratford, A., Elliott, S. P., Hoang, K., … Halberstadt, A. L. (2016). Return of the lysergamides. Part I: Analytical and behavioural characterization of 1-propionyl-d-lysergic acid diethylamide (1P-LSD). *Drug Testing and Analysis*, *8*, 891–902.

Brandt, S. D., King, L. A., & Evans-Brown, M. (2014). The new drug phenomenon. *Drug Testing and Analysis*, *6*, 587–597.

Caldicott, D. G., Bright, S. J., & Barratt, M. J. (2013). NBOMe—a very different kettle of fish. *Medical Journal of Australia*, *199*(5), 322–323.

Erowid. (2014). LSZ Dose. from https://www.erowid.org/chemicals/lsz/lsz_dose.shtml

Geyer, M. A., & Vollenweider, F. X. (2008). Serotonin research: Contributions to understanding psychoses. *Trends in Pharmacological Sciences*, *29*(9), 445–453.

Hanks, J. B., & Gonzalez-Maeso, J. (2013). Animal models of serotonergic psychedelics. *ACS Chemical Neuroscience*, *4*(1), 33–42.

Hofmann, A. (1980). *LSD—My problem child*. New York, NY: McGraw-Hill.

Kaar, S. J., Ferris, J., Waldron, J., Devaney, M., Ramsey, J., & Winstock, A. R. (2016). Up: The rise of nitrous oxide abuse. An international survey of contemporary nitrous oxide use. *Journal of Psychopharmacology*, *30*, 395–401.

Kau, G. (2008). Flashback to the Federal Analog Act of 1986: Mixing rules and standards in the Cauldron. *University of Pennsylvania Law Review*, *156*(4), 1077–1115.

Lawn, W., Barratt, M., Williams, M., Horne, A., & Winstock, A. (2014). The NBOMe hallucinogenic drug series: Patterns of use, characteristics of users and self-reported effects in a large international sample. *Journal of Psychopharmacology*, *28*, 780–788.

Lawn, W., Borschmann, R., Cottrell, A., & Winstock, A. (2016). Methoxetamine: Prevalence of use in the USA and UK and associated urinary problems. *Journal of Substance Use*, *21*, 115–120.

Martins, D., Barratt, M. J., Vale Pires, C., Carvalho, H., Ventura Vilamala, M., Fornís Espinosa, I., & Valente, H. (2017). under reviewThe detection and prevention of unintentional consumption of DOx and 25x-NBOMe at boom festival. *Human Psychopharmacology: Clinical and Experimental*.

Palamar, J. J., Acosta, P., Sherman, S., Ompad, D. C., & Cleland, C. M. (2016). Self-reported use of novel psychoactive substances among attendees of electronic dance music venues. *American Journal of Drug and Alcohol Abuse*, *42*, 624–632.

Peyton, J. III, & Shulgin, A. T. (1994). Structure-activity relationships of the classic hallucinogens and their analogs. In G. C. Lin, & R. A. Glennon (Eds.), *Hallucinogens: An update (NIDA Research Monograph 146)* (pp. 74–91). . Rockville, MD: National Institute on Drug Abuse.

Psychonaut Wiki. (2016a). 1P-LSD. From https://psychonautwiki.org/wiki/1P-LSD

Psychonaut Wiki. (2016b). AL-LAD. From https://psychonautwiki.org/wiki/AL-LAD

Psychonaut Wiki. (2016c). LSZ. From https://psychonautwiki.org/wiki/LSZ

Reuter, P., & Pardo, B. (2017). New psychoactive substances: Are there any good options for regulating new psychoactive substances? *International Journal of Drug Policy*, *40*, 117–122.

Shulgin, A. T., & Shulgin, A. (1997). *TIHKAL: Tryptamines I have known and loved: The continuation*. California: Transform Press.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.

Van Buskirk, J., Naicker, S., Roxburgh, A., Bruno, R., & Burns, L. (2016). Who sells what? Country specific differences in substance availability on the Agora dark net marketplace. *International Journal of Drug Policy*, *35*, 16–23.

Van Hout, M. C., & Hearne, E. (2017). New psychoactive substances (NPS) on cryptomarket fora: An exploratory study of characteristics of forum activity between NPS buyers and vendors. *International Journal of Drug Policy*, *40*, 102–110.

Vigna, F. D., Avvenuti, M., Bacciu, C., Deluca, P., Marchetti, A., Petrocchi, M., & Tesconi, M. (2016). Spotting the diffusion of new psychoactive

substances over the internet. *arXiv*, *Subjects: Computers and Society (cs.CY); Social and Information Networks (cs.SI)*. doi: arXiv:1605.03817

Watts, V. J., Mailman, R. B., Lawler, C. P., Neve, K. A., & Nichols, D. E. (1995). LSD and structural analogs: Pharmacological evaluation at D1 dopamine receptors. *Psychopharmacology*, *118*, 401–409.

Winstock, A. R., Kaar, S., & Borschmann, R. (2014). Dimethyltryptamine (DMT): Prevalence, user characteristics and abuse liability in a large global sample. *Journal of Psychopharmacology*, *28*, 49–54.

Winstock, A. R., Lawn, W., Deluca, P., & Borschmann, R. (2016). Methoxetamine: An early report on the motivations for use, effect profile and prevalence of use in a UK clubbing sample. *Drug and Alcohol Review*, *35*, 212–217.

Winstock, A., Mitcheson, L., Ramsey, J., Davies, S., Puchnarewicz, M., & Marsden, J. (2011). Mephedrone: Use, subjective effects and health risks. *Addiction*, *106*, 1991–1996.

How to cite this article: Coney LD, Maier LJ, Ferris JA, Winstock AR, Barratt MJ. Genie in a blotter: A comparative study of LSD and LSD analogues' effects and user profile. *Hum Psychopharmacol Clin Exp*. 2017;e2599. https://doi.org/10.1002/hup.2599