Pill testing or drug checking in Australia: Acceptability of service design features

Journal:	*Drug and Alcohol Review*
Manuscript ID	CDAR-2016-0275.R3
Manuscript Type:	Original Paper
Date Submitted by the Author:	n/a
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Keywords (Please ensure that the Keywords and a short Running Head are also included in the manuscript file):	Drug Users, Designer Drugs, MDMA, Hallucinogens, Harm Reduction

Pill testing or drug checking in Australia: Acceptability of service design features

Running title: Designing a drug-checking service

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Abstract

Introduction and Aims:

This study aimed to determine design features of a drug-checking service that would be feasible, attractive and likely to be used by Australian festival and nightlife attendees.

Design and Methods:

Web survey of 851 Australians reporting use of psychostimulants and/or hallucinogens and attendance at licensed venues past midnight and/or festivals in the past year (70% male; median age 23 years).

Results:

A drug-checking service located at festivals or clubs would be used by 94%; a fixed-site service external to such events by 85%. Most (80%) were willing to wait an hour for their result. Almost all (94%) would not use a service if there was a possibility of arrest, and a majority (64%) would not use a service that did not provide individual feedback of results. Drug-checking results were only slightly more attractive if they provided comprehensive quantitative results compared with qualitative results of key ingredients. Most (93%) were willing to pay up to $5, and 68% up to $10, per test. One third (33%) reported willingness to donate a whole dose for testing: they were more likely to be male, younger, less experienced, use drugs more frequently and attend venues/festivals less frequently.

Discussions and Conclusions:

In this sample, festival- or club-based drug-checking services with low wait times and low cost appear broadly attractive under conditions of legal amnesty and individualised feedback. Quantitative analysis of Ecstasy pills requiring surrender of a whole pill may appeal to a minority in Australia where pills are more expensive than elsewhere.

Keywords (MeSH): Drug Users, Designer Drugs, MDMA, Hallucinogens, Harm Reduction, Cross-Sectional Survey

Word count abstract = 250

Word count body of paper = 3779

Introduction

Legal psychoactive drugs that pose risks to human health, including pharmaceutical medicines, alcohol, caffeine and nicotine, are subject to strict manufacturing regulations. Supply regulations for the manufacture of prohibited drugs are, obviously, absent. In such unregulated markets, prohibited drugs' risks to human health are amplified: in addition to the risks of consuming a 'standard' dose of a known substance, risks arise from unknowingly consuming a larger dose, or consuming an unexpected substance or hazardous combination. While such quality control problems in illegal drug markets are inevitable and rife, recent trends compound these concerns, with many new psychoactive substances (NPS) being substituted for better-known drugs (1).

Since the 1960s (2), numerous programs globally have provided community-based services for people who use drugs, to test levels of drug adulteration and/or purity. Such services have been called street drug analysis (2), pill testing (3), drug checking (4), adulterant screening (5), drug testing (6), and multi-agency safety testing (7). Drug-checking services currently operate in the Netherlands (6), Spain (8), Portugal (9), Austria (10), Switzerland (11), England (7), Wales (12) and Canada (13). These services reduce harms arising from variable illicit drug quality and composition by changing consumer behaviour at point of consumption (i.e., when the consumer is confronted with an unexpected test result, see 13), facilitating brief intervention and referral to services (11), and/or informing clinical management (14). They may also reduce harms through rapid identification of NPS (15) and discrepancies between expected and actual content (16), important for crafting relevant and effective public health messages. While there has been debate about the utility of drug-checking services and possible negative consequences, most criticism in the peer-reviewed literature relates to the limitations and potential false sense of security of colour reagent test kits (5, 17, 18), rather than current, more sophisticated analytic methods (6).

Test results can prompt significant behaviour change. An Australian study showed 76% of frequent 'ecstasy' consumers (N=178) would not take a pill if a test could not determine the content (19). European research concurs, finding that 85% of 225 dance party attendees would not take a pill under the same scenario (3). Intention to reject a drug following testing relates to the substance detected and the individual's experience with it. For example, 'ecstasy' consumers with no history of ketamine use were more likely to discard 'ecstasy' pills, which unexpectedly contained ketamine, than those with a history of ketamine use (19).

Drug-checking service models vary by level of engagement with service users, time between submission of drug sample and provision of feedback, extent of feedback to the community and other stakeholders, setting, funding, and analytic testing. Testing might be qualitative, revealing only the presence or absence of target drugs, or quantitative, allowing determination of both presence and quantity. Qualitative testing may identify misrepresentations: for example, when a substance sold as a particular drug contains no active compounds or contains unexpected drug/s. Quantitative testing is important when high-dose preparations are circulating, such as very high-dose 3,4-methylenedioxymethamphetamine (MDMA) tablets in Europe recently (8). If doses are particularly high, a 'usual dose' is more likely to cause overdose and death, hence, quantitative information becomes more critical in testing service design. More sophisticated tests can identify NPS and substance combinations.

Ethnographic research (20) has confirmed the importance of services' cultural and policy contexts when assessing outcomes. For example, Portugal's decriminalisation of drug possession reduces fear of using checking services (20), whereas in Australia police use drug detection dogs to search festival crowds and arrest people for drug possession (21). In addition, drug prices are inflated in Australia, requiring a drug-checking service user in Australia to give up a larger amount of money in order to donate a full dose of a drug for testing than in Europe (e.g. AUD$25 in Australia (22) versus €4 [about AUD$6] in the Netherlands (23)). While qualitative analysis only requires a tiny sample, dosage estimation (quantitative analysis) requires the whole pill or capsule. These contextual differences render testing protocol standardisation impossible.

This paper is intended to inform the development and implementation of an Australian drug-checking service. Although such services have been conducted in research contexts (24), no government-endorsed public-facing testing service currently operates. Political resistance exists, due to concerns pill-testing services may dilute zero tolerance messages regarding ecstasy use, with one government anti-drug campaign line reading 'you don't know what you are getting' (25). Despite this resistance, it is timely to consider how best to design such a service, given ongoing problems with drugs sold as MDMA in Australia containing other, arguably more dangerous compounds (26-28).

We report the results of a web survey of Australian partygoers' perceptions of various design features of pill-testing services as well as barriers to use. We also identify characteristics correlated with recent use of test kits, reasoning that people who use test kits are most likely

to use testing services, as they already actively test their drugs. Furthermore, we identify characteristics correlated with willingness to surrender a whole pill for analysis, as needed for quantitative testing.

Aims

Our aims were:

1. To determine the extent to which specific design features of a drug-checking service would be acceptable to Australian partygoers; and
2. To describe the demographic and drug use characteristics of partygoers who reported (a) last-12-month use of a test kit or drug-checking service, and (b) willingness to surrender a whole dose to a drug-checking service.

Method

Australian residents, who reported illicit psychostimulants and/or hallucinogens use and had attended licensed venues past midnight and/or festivals in the past 12 months—herein 'partygoers'—were invited to complete a web survey. A total of 1593 responses were recorded over four weeks (April–May 2016). After removal of duplicate and test responses (n=7) and respondents who did not answer at least half of the 29 questions (n=735), including the last-12-month test kit/service use and willingness to surrender a whole dose questions, the final sample was comprised of 851 partygoers. This study was approved by the UNSW Australia Human Research Ethics Committee (#HC15532).

The survey was constructed using Lime Survey and hosted on a secure university server. Survey participants were offered no reimbursements or other material incentives. This purposive sample was recruited in two ways. First, 432 Australian responders to the 2015 Global Drug Survey (GDS, see globaldrugsurvey.com) were invited to participate in our survey. These participants were eligible for the survey at GDS completion approximately 18 months earlier, agreed to be re-contacted for further research, and provided valid email addresses. Three contact attempts were made; ultimately, 72 respondents were recruited using this method (17% of 432 contacts). Second, Facebook advertisements targeted population segments based on their demographic characteristics and affiliation with Australian dance music festivals, promoters, websites, clubs and communities. Social news site Reddit and music promotion site InTheMix also promoted the survey. The final sample included recruits from Facebook ads (55%), referrals from friends or organisations (including Facebook

sharing) (30%), referrals from the researchers' emails (including the 72 respondents recruited through GDS) (9%), and other (7%) (N = 823; missing = 28).

Acceptability of design features were measured by asking 'Would you use a drug-checking service if…' and offering a 6-point scale from definitely no ('0') to definitely yes ('5'). In analysis, the 6-point scale was dichotomised. Medians with interquartile range (IQR) were reported for continuous variables, as these were positively skewed. For univariate analysis, Pearson's chi-square tests were used to test differences between categorical groups, using $p<.05$. Confidence intervals for the difference between two independent proportions were calculated (29). A series of bivariable binary logistic regressions were performed to identify which demographic, drug use and nightlife attendance variables were associated with (a) last 12 month use of a test kit and (b) willingness to surrender a whole dose for testing. Multivariable binary logistic regressions used a backwards stepwise approach to identify which variables were uniquely associated with last-12-month testing and willingness to donate a whole dose for testing, when controlling for other variables. Following Hosmer and Lemeshow (30), the stepwise regression excluded variables that were $p>.25$, as using $p<.05$ in this step can result in an overly conservative model. Age was retained regardless of p-value as a control. Diagnostics tests conducted post-estimation found no evidence of collinearity, appropriate specification of the models, and a linear association between the log odds of the outcome and the covariates. Analyses were conducted using Stata/SE 14.1 for Windows (StataCorp, College Station, TX).

Results

Description of partygoer sample

The sample had a median age of 23 years (IQR 20-27, range 18-65, N=851) and was 70% male, 28% female and 1% transgender/gender queer (N=732). The sample was biased towards the two largest Australian states when compared to population estimates for young adults (31): respondents reported residing in New South Wales (42%), Victoria (32%), Queensland (12%), Western Australia (5%), South Australia (3%), Australian Capital Territory (3%), Tasmania (2%) and the Northern Territory (0.2%) (N=851). Use of psychostimulants and attendance at licensed venues after midnight was more common than hallucinogen use at festivals, and partygoers mostly obtained their drugs in advance rather than at events (Table S1). Only 10% reported not seeking information about their drugs' contents in the last 12 months (Table S2). Friends (75%) and dealers (63%) provided content

information to most respondents. Over half (53%) reported consulting pill-report websites, 23% used test kits or advanced testing services, and 12% used a darknet market (see 32) information source. Most respondents (60%) had encountered unexpected substances in the last 12 months, and in response warned friends (51%), did not consume the substance (39%), or used less (28%). Partygoers reported that in the last 12 months, they felt 'sure' about the contents of their drugs in 3 out of 4 cases (median 75%, ICQ 50–90). While almost all reported positive outcomes of their drug use (93%), 44% reported at least one unexpected, unwanted or negative effect, including moderate to severe effects (9%); 2% received ambulance or hospital treatment.

Drug-checking service design features

Most respondents reported that they would use a device for self-testing (94%), a service at festivals or clubs (94%), or a fixed-site service (85%), while about half (53%) would use a service accepting samples by mail (Table 1). Most (61%) would use a service that required a one-week wait for greater analytic reliability, while a wait of an hour was acceptable to most (80%) and 15 minutes to almost all (95%). Almost all respondents would use a service that provided results confidentially (97%) or publicly (95%), but there was less support for a service that did not provide individual feedback (36%) and even less if only unusual or particularly dangerous test results were released (25%). Almost all (97%) would use a service that police supported by keeping clear, and almost all (94%) would *not* use a service if arrest was a possibility. Two thirds (69%) would use a service even if results were not completely comprehensive, while about half (53%) would use a service even if results were not completely reliable. Almost all were willing to provide drug scrapings for testing (98%), while 55% said they would provide a half-dose and 33% a whole dose. Almost all (93%) were willing to pay up to $5 per test, and 68% up to $10.

The importance of the kind of analytic results that a drug-checking service provided was measured by asking partygoers to imagine that they could receive one of three analysis options (1. limited; 2. comprehensive qualitative; 3. comprehensive quantitative) in two drug-sample scenarios (a. sold as MDMA, contains MDMA and caffeine; b. sold as MDMA, contains methylone, a synthetic cathinone with stimulant effects) (Table 1). The first option was that available through reagent testing, revealing the presence or absence of an MDMA-like substance. Under the scenario of an MDMA/caffeine combination, less than half (45%) would use a service which only provided this limited level of information, while under the

scenario of a methylone capsule sold as MDMA, over two thirds (69%) would find such a service acceptable. The remaining two analysis options for each scenario contrasted comprehensive qualitative and quantitative results. While the most attractive result type was comprehensive quantitative (96% for MDMA/caffeine; 92% for methylone), only slightly fewer respondents would use a comprehensive qualitative service (94% for the MDMA/caffeine, 2% difference, 95%CI 0.14, 4.32%; 89% for methylone, 3% difference, 95%CI 0.23, 6.02%).

[Insert Table 1]

The relationship between acceptability of wait times and reliability and comprehensiveness of test results was investigated (see Figure S1). Partygoers who reported that they would still use a service if results were not completely reliable (52.8%) were significantly more likely to report that they would use a service with a <15m wait time (98% vs 92%; $\chi^2(1) = 15.60$, $p < .001$) or a <1hr wait time (83% vs 76%; $\chi^2(1) = 5.37$, $p = .021$) than the remainder of the sample. Similarly, those who reported that they would still use a service if results were not completely comprehensive (69%) were significantly more likely to report willingness to use a service with a <15m wait time (97% vs 91%; $\chi^2(1) = 15.99$, $p < .001$) or a <1hr wait time (83% vs 72%; $\chi^2(1) = 13.26$, $p < .001$) than other respondents.

Last-12-month testers and future full-dose donators

We determined which demographic, drug use and nightlife attendance characteristics were associated with (a) last-12-month use of a test kit or more advanced testing—'testers' (23%; 193 of 851), and (b) willingness to surrender a whole 'pill/capsule/point' (dose) to a drug-checking service—'donators' (33%; 283 of 851). Testers and donators overlapped little: 8% reported both recent testing and willingness to donate a full dose, 26% reported willingness to donate a full dose but no recent testing, 15% reported recent testing and unwillingness to donate a full dose, and 52% reported no recent testing and unwillingness to donate a full dose ($\chi^2(1) = 0.02$, $p = .887$). In the multivariable model, last-12-month use of test kits or testing services was uniquely correlated with male gender and obtaining drugs in advance of the event (Table 2). The unique correlates of willingness to donate a whole dose to a drug-checking service were male gender, younger age, use of psychostimulants and/or hallucinogens less than 5 times, the use of psychostimulants and/or hallucinogens weekly or more often, and lower frequency of attendance at licensed venues after midnight and/or music festivals (Table 3).

[Insert Table 2 and 3]

A hand-held device for self-testing and a service based at festival or clubs were equally supported by the whole sample, whereas drug-checking at fixed sites or by mail obtained significantly more support from testers and donators than non-testers and non-donators (Table 4). While most of the sample were prepared to wait <15m or <1h for results, both testers and donators were significantly more prepared to wait <1w or <3w for more reliable results than non-testers and non-donators. Donators were significantly more likely to support services feeding results to websites rather than directly to service users than non-donators. Donators and testers were willing to pay more for a drug-checking service than non-donators and non-testers.

[Insert Table 4]

Discussion

Quality control problems in illegal drug markets were important to the Australian partygoers surveyed here, as measured by their reported past behaviours (90% reported at least one method of trying to determine chemical content of psychostimulants and/or hallucinogens) and their reported future behaviours, in that there was broad support for engagement with a drug-checking service of some kind. Reported actions in response to discovering unexpected or suspicious drug content included warning friends and not consuming drugs. If replicated in the wider partygoer population, these results suggest that behavioural changes at the point of consumption—likely to reduce the risks of ingesting an unknown substance—would follow drug-checking service implementation, supporting previous research (3, 13, 19).

While on-site and off-site drug-checking models were broadly acceptable among this Australian partygoer sample, on-site services were equally acceptable regardless of the partygoer's recent use of test kits or willingness to donate a whole dose. Locating a service on-site (e.g. at a festival) is advantageous because it provides the service close to the likely drug use event. However, fixed-site services (e.g., centrally located offices or booths) may be better equipped to serve Australian partygoers who attend single-day festivals or nightclub events, because less time is available for drug-checking than at multi-day events. Drug-checking booths at central locations can increase proximity to the drug use event through offering services in evenings prior to weekend nights (to anticipate drug use in nightlife settings). For example, in Amsterdam, partygoers can access drug-checking booths on weekday evenings and Saturday afternoons (33). Off-site services would be feasible for the

majority (67%) who reported mostly obtaining their drugs in advance of the event, but in the Australian context, users of off-site checking services intent on consumption at festivals would need to get their drugs past police drug detection dogs or consume them before entry, increasing risk. Recent Australian research indicates that partygoers are more likely to buy drugs within festival grounds when entry is policed using drug detection dogs (34). Buying within festival grounds, where suppliers are more likely to be strangers, may increase the risk of unknown content and purity, and increase the need for an in-situ checking service.

Regardless of the service setting, our data confirm that drug-checking services will only be used if service users can be guaranteed protection from arrest or targeting by law enforcement. Public health providers and law enforcement collaborate successfully in other countries, such as the Netherlands (15) and the UK (7). The unique monitoring data generated and its rapid collection and dissemination are valuable to law enforcement agencies who share the goal of increased public safety. It is also apparent that most service users desire individualised test results, and are unlikely to support a service that publicises only unusual or particularly dangerous test results. Regardless of drug-checking service policies, partygoers are likely to share results with their friendship networks and the public through uploading results to pill-test websites (35). To pre-empt such sharing and the potential for inaccuracy and astroturfing, a drug-checking service could incorporate a publicly accessible digital alert system.

In drug-checking service design, three elements trade off: (a) reliability, comprehensiveness and capacity to estimate dosage, (b) wait times, and (c) cost. Well-funded services may achieve greater reliability and comprehensiveness with acceptably low wait times, but with fewer funds, testing technologies may be unable to estimate dosage and/or detect all substances. In our sample, low reliability of results would deter half from using a service, while lack of comprehensiveness of results would deter a third. While a 15-minute wait was acceptable to almost all respondents, 61% were prepared to wait a week for a result, indicating willingness to access a comprehensive and reliable test result that is not paired with the consumption event. While it may still be advisable from an equity perspective to avoid a user-pays model, in this sample, two thirds were willing to pay $10 and almost all were willing to pay $5. A co-payment or donation by service users, combined with government and/or industry funding, may be feasible. Note that partygoers with no recent history of test-kit use and/or no willingness to donate a whole dose were less willing to pay and less willing to wait than testers and donators, but just as interested in accessing

comprehensive and reliable results.

Despite willingness to wait and to pay, only one third of the sample would surrender a whole pill for analysis—crucial for quantitative analysis, when determining the amount of MDMA in a pill without assuming the MDMA and other constituents are evenly mixed. In this sample, most would still use a service that provided comprehensive qualitative test results (listing all ingredients) rather than comprehensive quantitative (listing amounts of ingredients). Quantitative testing may become a greater priority if Australia's ecstasy markets follow European trends, where MDMA tablet doses vary greatly, meaning unpredictable overdose risk (8, 36). If a drug-checking model requiring surrender of a whole pill were implemented, our findings show that it would be more likely to attract younger males in their first 12 months of drug use, who reported more frequent drug use, than other users. Qualitative research has also found that inexperienced and younger users are more likely to go to greater lengths to determine the content of ecstasy, perhaps because more experienced users accept the chance of a 'bad' or 'dud' pill (37).

Limitations

The findings are limited by their reliance upon measuring behavioural intentions. Past behaviour (use of test kits) might predict future behaviour (willingness to donate full dose to test service) (38), but these measures were unrelated. Possible explanations include that partygoers realise test kits are often flawed so do not use them even though they would use a drug-checking service with better technology, and/or partygoers who already use test kits may see less value in sacrificing a full dose to a drug-checking service when a scraping can be tested at home. Also, we did not measure some demographics that could explain willingness to submit a whole dose, such as income and employment status. Our self-selected sample is not necessarily representative of the Australian partygoer population, although recruitment primarily through Facebook ads to people who 'like' dance music promoters could be considered less biased than recruitment through activist groups. While activist groups were not explicitly targeted, the advertisements promoted the study as a 'new harm reduction survey', increasing the likelihood that the sample was biased towards people interested in harm reduction. Due to the self-selected sample, these findings should not be used as estimates of demand for a testing service in Australia.

Conclusion

This sample of Australian partygoers strongly supports the introduction of drug-checking

services, assuming legal amnesty and individualised feedback. Future research could measure the responses of partygoers to different testing service scenarios. For example, what proportion will discard or otherwise not take a substance if specific NPS are detected? Capsules sold as MDMA in Australia have been found to contain a mixture of 4-FA and 25C-NBOMe, undoubtedly a dangerous combination, associated with deaths and hospitalisations in three Australian jurisdictions (26-28). We need to better understand the behavioural response of partygoers to the earlier and more rapid identification of such misrepresentations, as well as remove highly dangerous combinations from drug markets altogether. Supply reduction policing has a clear role, but so too do drug checking services, when integrated with a brief intervention with qualified personnel ('integrated drug checking', see 4, 10) and combined with public safety interventions (e.g., festival outreach, safe spaces, water, environmental modifications, self-care, access to first aid, medical care, information, etc.). Rapid identification of novel substances or particularly dangerous preparations should appeal to all stakeholders concerned with improving the safety of nightlife and festival settings.

Acknowledgements

Thank you to our survey respondents for the generous amount of time you donated to completing our survey. Thank you to Global Drug Survey for facilitating contact with potential respondents. Thank you to Campbell Aitken for his editorial assistance. MB and AR are supported by fellowships from the NHMRC (APP1070140 and APP1021988). The National Drug and Alcohol Research Centre, National Drug Research Institute and St Vincent's Hospital Alcohol and Drug Service receive funding from the Australian Government under the Substance Misuse Prevention and Service Improvement Grants Fund. We also acknowledge the contribution of the Victorian Operational Infrastructure Support Program received by the Burnet Institute. No project-specific funds were used to complete this research, and none of our funders had any role in the research process or the decision to publish these findings.

Declaration of interests

There are no relevant interests to declare.

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Table 1: Likelihood of drug-checking service utilisation by service design features (%)

Would you use a drug-checking service…	Tot. N	% Yes
In the following settings:		
Hand-held device for self-testing, with access to lab for unidentified substances	834	94
A service based at clubs or festivals where health workers operate a testing device	840	94
A fixed-site service (central loc) where health workers operate a testing device	828	85
A service that accepts samples by mail for testing in a laboratory	826	53
With the following wait times and reliability:		
< 15 m wait; reliable for common drugs but not for unusual or combinations	840	95
< 1 hr wait; reliable for common drugs but not for unusual or combinations	840	80
Up to 1 wk wait; greater level of reliability	835	61
Up to 3 wk wait; highest level of reliability	828	43
With the following feedback mechanisms:		
Results were ONLY provided to you, confidentially	842	97
Results were provided to you AND released publicly (i.e. on a public website but you would not be identified)	840	95
Results were NOT provided to you, but were released on a public website	818	36
Results were NOT provided to you, but ONLY the results where an unusual or highly dangerous substance was identified were released on a public website	821	25
No feedback: Results were neither released to you nor to the public	809	2
If the following statements were true:		
Police supported the service by not stationing police near or around it	846	97
There was a possibility of arrest by police for drug use offences	851	6
The test result may not be comprehensive (e.g. might not identify everything)	846	69
The results may not be completely reliable	850	53
You had to provide a whole tablet, capsule or point [a]	851	33
You had to provide half a tablet, capsule or point [a]	850	55
You had to provide a scraping of a tablet, capsule or point [a]	849	98
How much would you pay to use a drug-checking service?		
I would only use the service if it were free	843	7
Up to $5 per test	843	25
Up to $10 per test	843	41
Up to $20 per test	843	24
Up to $50 per test	843	2
Imagine you had a capsule that you believed to only contain MDMA, but actually contained MDMA (60mg) and caffeine (100mg). Would you use a service if it provided the following kinds of results?		
This capsule contains an MDMA-like substance	813	45
This capsule contains a mix of MDMA and caffeine	830	94
This capsule contains MDMA 60mg and caffeine 100mg	838	96
Now, imagine you had a capsule that you believed to contain MDMA, but actually contained methylone (100 mg). Methylone is a synthetic cathinone. Would you use a service if it gave you the following results?		
This capsule does not contain an MDMA-like substance	822	69
This capsule contains methylone	821	89
This capsule contains 100mg methylone	828	92

[a] A 'point' refers to a powdered or crystalline substance sold as 0.1g. Note: lab=laboratory, loc=location.

Table 2: Correlates of past-12-month use of testing kit or testing service (multivariable binary logistic regression)

Variables	Did test (N=193) % or median (IQR)	Did not test (N=658) % or median (IQR)	Bivariable OR (95% CI)	p value	Multivariable aOR (95% CI)	p value
Gender (male vs others)	80	68	1.87 (1.23, 2.84)	0.003	1.92 (1.25, 2.95)	0.003
Age (continuous)	23 (20-27.5)	22 (20-27)	1.00 (0.98, 1.02)	0.892	1.00 (0.97, 1.02)	0.722
Experience level (psychostimulants and/or hallucinogens)						
<5 times	2	6	1.00		[a]	
5 times +, only in last 12 months	9	11	1.93 (0.59, 6.29)	0.274		
5 times +, started over 12 months ago	89	83	2.61 (0.91, 7.48)	0.075		
Frequency of use in last 12 months (psychostimulants and/or hallucinogens)						
less than monthly	39	45	1.00		1.00	
monthly to fortnightly	49	46	1.21 (0.86, 1.71)	0.272	1.16 (0.79, 1.71)	0.446
weekly or more often	12	9	1.63 (0.95, 2.79)	0.077	1.83 (0.98, 3.43)	0.060
Frequency attendance in last 12 months (licensed venues and/or festivals)						
less than monthly	30	27	1.00		[a]	
monthly to fortnightly	48	52	0.82 (0.55, 1.22)	0.327		
weekly or more often	22	21	0.93 (0.57, 1.51)	0.769		
What proportion of the time did you obtain the drugs in advance or at the event? [b]						
Mostly to always in advance	80	64	1.00		1.00	
About half and half	13	23	0.47 (0.29, 0.77)	0.003	0.48 (0.29, 0.79)	0.004
Mostly to always at the event	7	14	0.39 (0.20, 0.76)	0.006	0.40 (0.20, 0.79)	0.008

IQR=Interquartile Range. OR=Odds Ratio. aOR=Adjusted Odds Ratio. CI=Confidence Interval.

[a] Removed from the model through backwards stepwise approach (p>.25). Note: age retained regardless of p-value due to theoretical importance.

[b] Of those who reported taking drugs at events in the last year.

Regarding the multivariable logistic regression: Hosmer and Lemeshow Test: $\chi^2(8) = 3.58$, $p = .89$. Out of the total sample of 851 cases, 718 were included; 133 cases were excluded due to missing values on at least one covariate. Out of all included cases, 163 (23%) reported past-12-month use of testing kit or testing service.

Table 3: Correlates of willingness to donate a whole pill/capsule/point to a drug-checking service (multivariable binary logistic regression)

Variables	Willing (N=283) % or median (IQR)	Not willing (N=568) % or median (IQR)	Bivariable OR (95% CI)	p value	Multivariable aOR (95% CI)	p value
Gender (male vs others)	77	67	1.65 (1.16, 2.36)	0.005	1.69 (1.17, 2.43)	0.005
Age (continuous)	22 (20-26)	23 (20-28)	0.97 (0.95, 0.99)	0.010	0.96 (0.93, 0.99)	0.005
Experience level (psychostimulants and/or hallucinogens)						
<5 times	8	4	1.00		1.00	
5 times +, only in last 12 months	10	11	0.44 (0.20, 0.98)	0.044	0.39 (0.17, 0.93)	0.033
5 times +, started over 12 months ago	82	85	0.45 (0.23, 0.88)	0.019	0.46 (0.22, 0.98)	0.044
Frequency of use in last 12 months (psychostimulants and/or hallucinogens)						
less than monthly	44	43	1.00		1.00	
monthly to fortnightly	44	49	0.88 (0.65, 1.20)	0.425	1.04 (0.72, 1.51)	0.830
weekly or more often	13	8	1.55 (0.95, 2.53)	0.076	2.03 (1.08, 3.83)	0.028
Frequency attendance in last 12 months (licensed venues and/or festivals)						
less than monthly	27	28	1.00		1.00	
monthly to fortnightly	54	50	1.14 (0.79, 1.64)	0.477	0.89 (0.59, 1.34)	0.584
weekly or more often	20	23	0.92 (0.59, 1.44)	0.715	0.57 (0.34, 0.97)	0.039
What proportion of the time did you obtain the drugs in advance or at the event? [a]						
Mostly to always in advance	68	67	1.00		1.00	
About half and half	22	20	1.09 (0.74, 1.60)	0.669	1.05 (0.70, 1.58)	0.802
Mostly to always at the event	10	13	0.71 (0.44, 1.18)	0.186	0.59 (0.34, 1.02)	0.060

IQR=Interquartile Range. OR=Odds Ratio. aOR=Adjusted Odds Ratio. CI=Confidence Interval.

[a] Of those who reported taking drugs at events in the last year.

Regarding the multivariable logistic regression: Hosmer and Lemeshow Test: $\chi^2(8) = 1.86$, $p = .98$. Out of the total sample of 851 cases, 706 were included; 145 cases were excluded due to missing values on at least one covariate. Out of all included cases, 236 (33%) reported willingness to donate a whole pill/capsule/point to a drug-checking service. Note: All variables were retained in the model using a backwards stepwise approach (p>.25).

Table 4: Drug-checking service design features by willingness to donate a whole dose and last-12-month test kit use

Would you use a drug-checking service…	Willing to donate whole dose			Last-12-month test kit use		
	Yes (%) N=283	No (%) N=568	p value chi sq	Yes (%) N=193	No (%) N=658	p value chi sq
In the following settings:						
Hand-held device for self-testing, with access to lab. for unidentified substances	95	93	.201	95	94	.591
A service based at clubs or festivals where health workers operate a testing device	96	93	.074	95	94	.410
A fixed-site service (central loc.) where health workers operate a testing device	90	83	.003	92	83	.005
A service that accepts samples by mail for testing in a laboratory	62	49	.001	67	49	<.001
With the following wait times and reliability:						
< 15 m wait; reliable for common drugs but not for unusual or combinations	94	96	.208	92	96	.008
< 1 hr wait; reliable for common drugs but not for unusual or combinations	89	75	<.001	82	79	.382
Up to 1 wk wait; greater level of reliability	75	54	<.001	72	58	<.001
Up to 3 wk wait; highest level of reliability	55	37	<.001	57	38	<.001
With the following feedback mechanisms:						
Results were ONLY provided to you, confidentially	98	97	.298	97	98	.592
Results were provided to you AND released publicly (i.e. on a public website but you would not be identified)	98	94	.019	96	95	.344
Results were NOT provided to you, but were released on a public website	43	32	.001	38	35	.504
Results were NOT provided to you, but ONLY the results where an unusual or highly dangerous substance was identified were released on a public website	31	22	.006	24	26	.681
No feedback: Results were neither released to you nor to the public	5	1	.002	3	2	.797
If the following statements were true:						
Police supported the service by not stationing police near or around it	99	97	.079	96	97	.452
There was a possibility of arrest by police for drug use offences	8	5	.106	9	5	.043
The test result may not be comprehensive (e.g. might not identify everything)	72	67	.085	73	67	.125
The results may not be completely reliable	61	49	.001	54	53	.737
You had to provide a whole tablet, capsule or point [a]	na			34	33	.887
You had to provide half a tablet, capsule or point [a]	na			57	55	.707

You had to provide a scraping of a tablet, capsule or point [a]	na			100	98	.163
How much would you pay to use a drug-checking service?						
I would only use the service if it were free	4	8	<.001	4	8	.031
Up to $5 per test	13	31		20	26	
Up to $10 per test	38	43		46	40	
Up to $20 per test	39	17		26	24	
Up to $50 per test	5	1		4	2	

[a] A 'point' refers to a powdered or crystalline substance sold as 0.1g.

Table S1: Engagement with drugs and nightlife among partygoer sample (%)

	Psychostimulants	Hallucinogens	Either
Lifetime experience	N=727	N=772	N=728
Never used or not in last 12 months	1.8	36.1	0.0 [a]
<5 times	6.2	16.7	5.1
5 times +, only in last 12 months	11.1	5.4	10.9
5 times +, started over 12 months ago	80.9	41.7	84.1
Frequency use in last 12 months	N=851	N=851	N=851
none	1.5	32.8	0.0 [a]
a few times (less than monthly)	45.6	56.2	43.5
monthly	28.4	7.5	30.0
fortnightly	15.3	2.4	16.9
weekly or more often	9.2	1.2	9.8
	Licensed venues after midnight	Music festivals	Either
Frequency attendance in last 12 months	N=733	N=728	N=733
none	2.6	7.0	0.0 [a]
a few times (less than monthly)	27.3	73.1	27.6
monthly	25.4	18.1	27.3
fortnightly	23.3	0.8	23.6
weekly or more often	21.4	1.0	21.6
			All
Obtained drugs in advance or at event in last 12 months [b]			N=723
Always or almost always in advance			41.2
Mostly in advance			26.1
About half and half			20.6
Mostly at the event			7.5
Always or almost always at the event			4.6

Note. 'Psychostimulants' were defined as 'Ecstasy/ 3,4-Methylenedioxymethamphetamine (MDMA), meth/amphetamine, cocaine, or any other drug with a stimulant effect, also known as 'uppers', excluding caffeine'. Hallucinogens were defined as 'LSD, mushrooms, DMT, or any other substance with a hallucinogenic effect, also known as 'tripping', excluding cannabis'.

[a] Respondents were excluded from the sample if they did not report either psychostimulant or hallucinogen use in the last 12 months, or if they had not attended either a licensed venue after midnight or a music festival in the last 12 months.

[b] Of those who reported taking drugs at events in the 12 months.

Table S2: Content/purity information sources, actions taken and outcomes of drug use among partygoers in the last 12 months

	%
What methods did you use to work out the content of the psychostimulants or hallucinogens you consumed (either before or after consumption)?	N=851
Information passed on from friends	74.6
Information from dealer/vendor	63.1
Pill report websites/forums	52.6
Any darknet information source	12.3
Advertisements by darknet market vendors	8.2
User feedback posted to darknet market vendor listings	9.8
Mass media (e.g. if an adulterated pill was reported on)	7.4
Any testing including test kits and advanced services	22.7
Colour reagent test kit, self-administered	16.5
Colour reagent test kit, administered by friend	7.2
Colour reagent test kit, administered by peer worker at festival or event	1.4
More advanced testing provided by a service or individual	3.3
Other methods (not elsewhere classified)	3.3
Did not try to determine content in the last 12 months	10.1
What did you do when you found out your drugs contained unexpected, unknown or suspicious substances? [a]	N=718
Not applicable	40.0
Some action taken (includes 'consumed same amount as usual')	60.0
What did you do when you found out your drugs contained unexpected, unknown or suspicious substances? [b]	N=431
Did not consume it at all	39.0
Used less of it	28.3
Consumed the same amount as usual	14.6
Warned my friends	51.0
Told my dealer	27.1
Went to another dealer	23.7
Did not purchase it (testing occurred prior to purchase)	13.7
Sold it	5.8
Threw it away	24.1
Inquired about possible risks	16.9
Did something else (not elsewhere classified)	6.0
About what percentage of the psychostimulants and hallucinogens you consumed did you feel sure that you knew what drug it contained?	N=815
Median (IQR)	75 (50-90)
Thinking about the last year, what outcomes did you experience following your consumption of psychostimulants and hallucinogens?	N=848
Expected drug effects	88.2
Positive outcomes (e.g. 'had a great night', 'increased sociability', 'enjoyed the feeling')	93.2
Any unexpected, unwanted or negative effects	43.5
Unexpected effects	16.4

Unwanted effects, but mild	32.8
Any moderate to severe effects	9.3
Unwanted effects, moderate to severe but did not call for help	8.3
Any treatment for moderate to severe effects	1.7
Attendance by ambulance	0.7
Presentation to hospital emergency department	0.9
Admission to hospital or other inpatient unit	0.8
Other unexpected, unwanted or negative effects	2.9

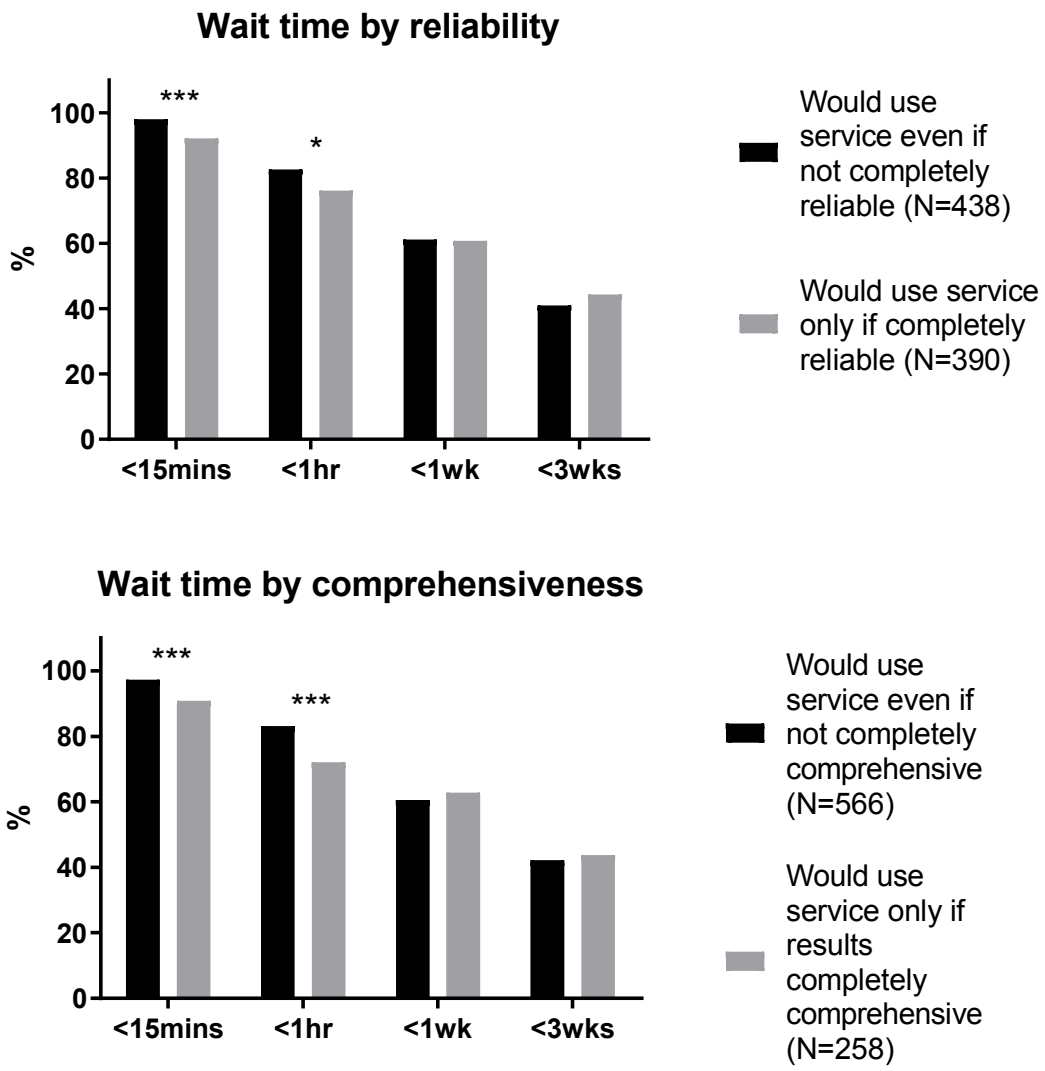
IQR=Interquartile Range.

[a] This question was not asked of respondents who reported 'I have not tried to determine the content of the psychostimulants or hallucinogens I consumed In the last year'.

[b] Percentages are calculated using the number who reported at least one action, including 'same as usual' as the denominator, because the questionnaire did not directly ask whether respondents had received information that their drugs contained unexpected, unknown or suspicious substances in the last 12 months.

Supplementary Figure 1

Acceptability of testing service wait times among consumers interested in drug checking, stratified according to consumer preferences for reliability and comprehensiveness



* p<.05, ** p<.01, *** p<.001