Correlates of self-reported significant adverse effects following 'ecstasy' use: Implications for harm reduction

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Key findings:

- Among the 2018 EDRS sample, 12% reported recently experiencing significant adverse effects following ecstasy use.
- Younger age and screening positive for potential ecstasy dependence (SDS score ≥ 3) was associated with significantly greater odds of reporting recent adverse effects.
- These findings suggest more frequent, less severe adverse consequences should perhaps be given more attention than they are currently, and could be an opportunity for early intervention.
- Further efforts should be made to identify novel ways to identify and engage at risk young people. Drug checking services could be one way of engaging this hard-to-reach population.

Introduction

In a number of countries, including Australia, ecstasy-related deaths have become an increasing public health concern (1). According to media reports, in Australia there have been at least 15 deaths linked to drugs sold as 'ecstasy' in the past 5 years alone (2-9). However, official statistics are currently unavailable as the Australian Bureau of Statistics (ABS) use International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) coding which groups ecstasy with wider psychostimulants, such as methamphetamine (10). While Australia also has the National Coronial Information System (NCIS), which allows access to detailed toxicology information for authorised persons, there are normally lags of 1-3 years. Similarly, the number of hospitalisations associated with 'ecstasy' use is also unavailable due to these same coding issues. Although some jurisdictions are beginning to systematically collect and test biological samples from hospital patients, at present these initiatives appear limited (11). Unfortunately, this lack of clear documentation appears to be the case for many countries, making it challenging to determine the true extent of ecstasy-related deaths globally. However, significant increases in ecstasy-related fatalities have been reported throughout the UK (1). Overall, while the true extent of mortality and morbidity associated with 'ecstasy' use is currently unclear, recent deaths highlight the need to better understand the nature and extent of significant adverse effects following ecstasy use to help inform harm reduction initiatives.

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While ecstasy-related deaths have attracted significant media, political and public attention, there has been comparatively less scientific attention. The existing literature on adverse effects following ecstasy use unsurprisingly focuses on extreme cases (predominantly deaths), and mainly consists of individual case studies, or small case series, describing the clinical features, treatment interventions and outcomes (e.g. 12-15). These studies have consistently emphasised the role of environmental factors, with many deaths linked to settings with a high ambient temperature known to increase the risk of hyperthermia (e.g. festivals and raves) (13, 16, 17). Individual risk behaviours have also been identified, such as consuming excessive amounts of water in an attempt to counter adverse effects like hyperthermia (inadvertently leading to hyponatremia) (14, 18, 19).

Beyond simple case studies/series, only one known study has sought to specifically examine significant adverse effects following ecstasy use in Australia. Between 2008 and 2010, a group of researchers conducted a retrospective audit of 236 ecstasy-related presentations at two tertiary hospital emergency departments (EDs) in Melbourne (19). The objective was to describe the patterns and characteristics of these presentations. They found patients had a median age of 25 (IQR=22-29), 60% were male, 27% had a history of substance use and 14% had a history of psychiatric illness. Three-quarters reported concomitant alcohol use and the last recorded locations included 'public locations' (35%; although many had likely exited a licenced venue), 'licenced premises/events' (25%), 'private residences' (31%) and 'dance parties/festivals' (5%). Based on their findings, the authors provided a number of recommendations, including improving harm reduction strategies in licensed venues, increasing availability of colour reagent testing kits and educating young people about the risks of mixing alcohol and ecstasy. While this study illuminated some key characteristics of ecstasy-related ED presentations, the data are now 10 years old and provide little insight into how common significant adverse effects may be currently among people who regularly use ecstasy.

Overall, the existing literature on adverse outcomes following ecstasy use is limited and generally focuses on cases involving death or hospitalisation. In response to increasing concern about ecstasy-related deaths, there is a need to better understand how common significant adverse outcomes are (that do not necessarily result in emergency department attendance), and potential risk factors for such experiences, to better inform harm reduction initiatives. Thus, this bulletin examines the percentage of consumers reporting significant adverse effects following 'ecstasy' use in the preceding 12 months, and correlates of experiencing significant adverse effects, among the 2018 national Ecstasy and related Drugs Reporting System (EDRS) sample.

Method

This bulletin draws on data from the 2018 EDRS. The EDRS has been conducted annually in all Australian jurisdictions since 2003 and remains the most comprehensive national monitoring study aimed at detecting emerging trends in illicit 'party drug' markets. The structured face-to-face interviews ask participants about a range of topics, such as demographic characteristics, drug use patterns, perceptions of the illicit drug market, health measures, help seeking, risk behaviours and crime. The eligibility criteria were: (1) aged at least 17 years old (16 in WA); (2) have used ecstasy or another illicit stimulant drug on at least six occasions in the preceding six months; and (3) have been a resident of the capital city in which the interview took place for the preceding 12 months. Full details of the methods for the annual interviews are available for download.

This bulletin examines a series of survey questions related to recent stimulant 'overdoses'. The analysis was filtered for those who nominated 'ecstasy' when asked "…what was the main drug you attributed your overdose to…?" For the purpose of the EDRS survey, stimulant 'overdose' was defined to participants as "the experience of these symptoms: nausea, vomiting, chest pain, tremors, increased body temperature, increased heart rate, seizure, extreme paranoia, extreme anxiety, panic, extreme agitation, hallucinations, excited delirium that are outside your normal drug experience, or where professional assistance would have been helpful." It is important to note that while these experiences were described as an 'overdose', the term was broadly used to encapsulate all significant adverse effects (i.e. adverse effects were not necessarily attributed to consuming a high dose of MDMA). Moreover, a caveat to the findings is that attributing adverse effects to a single drug is problematic when they often occur in a context of polydrug use. For these reasons, throughout this bulletin, these experiences will be referred to as 'significant adverse effects following ecstasy use' (rather than 'overdoses').

Descriptive statistics were run to determine the frequency of self-reported significant adverse effects following ecstasy use for selected demographic and drug use characteristics (presented in Table 1). Descriptive statistics were also run to examine the characteristics of these adverse experiences, such as the reported symptom/s, treatment/s received and the location where they occurred. Bivariable and multivariable logistic regressions determined unique predictors of significant adverse effects following ecstasy use. Given the small number of reported events (n=99), the number of predictors which could be included in the multivariable regression model was limited. Thus, candidate variables for the model included demographic or drug use variables with significant bivariable tests in Table 1. To further limit the number of predictors, cross-tabulations and bivariable logistic regression analyses were run to identify strongly correlated variables which could be excluded from the multivariable model. Three variables were identified as being strongly correlated: SDS score, frequency of use and snorting as a route of administration. The SDS score variable was included in the model given it had the highest bivariable significance (see Table 1).

Results

Bivariable and multivariable analysis

Of all participants in 2018, 12% (n=99) reported experiencing significant adverse effects following ecstasy use in the 12 months preceding the interview. As evident in Table 1, the bivariable logistic regression analyses found younger participants (16-19 year olds in particular), participants who reportedly weekly ecstasy use, participants who screened positive for potential ecstasy dependence (according to their severity of dependence scale (SDS) score) and participants who used greater quantities of ecstasy pills and/or capsules were at significantly greater odds of reporting significant adverse effects.

As outlined in the methods, candidate variables for the multivariable analysis were determined after considering bivariable significance and correlation between variables. As evident in Table 2, after controlling for other variables, younger age and screening positive for potential ecstasy dependence (SDS score ≥ 3) remained significantly associated with experiencing significant adverse effects following ecstasy use, while the consumption of high quantities did not (≥ 7 ecstasy pills and/or ≥ 6 capsules). Specifically, those aged 16-19 were at 3.5 times greater odds, and 20-24 year olds were at 2.3 times greater odds than those aged 25 years or older, while those screening positive for potential ecstasy dependence (SDS score ≥ 3) were at 2.2 times greater odds than those who screened negative.

Table 1: Demographic and drug use characteristics of EDRS survey respondents (n=799), 2018

Demographic characteristics	Level	n	Reported recent adverse effects following 'ecstasy' use	Did not report recent adverse effects following 'ecstasy' use	Bivariable		
			(n=99)	(n=700)	OR	95% CI	P-Value
Jurisdiction	NSW	100	15.0	85.0	1.588	0.677-3.728	0.288
	ACT	100	13.0	87.0	1.345	0.560-3.228	0.507
	VIC	100	15.0	85.0	1.588	0.677-3.728	0.288
	TAS	100	8.0	92.0	0.783	0.295-2.073	0.622
	SA	100	18.0	82.0	1.976	0.862-4.526	0.107
	WA	100	4.0	96.0	0.375	0.114-1.238	0.108
	NT	99	16.2	83.8	1.735	0.746-4.037	0.201
	QLD	100	10.0	90.0	1.000		
Age group	16-19	294	17.7	82.3	4.018	1.989-8.117	<0.001***
	20-24	307	12.1	87.9	2.563	1.244-5.281	<0.011*
	≥25	197	5.1	94.9	1.000		
Gender	Female	331	13.2	86.8	1.119	0.731-1.712	0.604
	Male	467	12.0	88.0	1.000		
Sexual identity	Other	128	11.7	88.3	0.928	0.517-1.665	0.801
	Hetero	671	12.5	87.5	1.000		

Table 1: Demographic and drug use characteristics of EDRS survey respondents (n=799), 2018 (continued)

Demographic characteristics	Level	n	Reported recent adverse effects following 'ecstasy' use	Did not report recent adverse effects following 'ecstasy' use	Bivariable		
			(n=99)	(n=700)	OR	95% CI	P-Value
Speak English at home	No	49	10.2	98.8	0.793	0.307-2.050	0.632
	Yes	750	12.5	87.5	1.000		
Completed year 12 [a]	No	170	11.2	88.8	0.917	0.535-1.573	0.754
	Yes	572	12.1	87.9	1.00		
Tertiary qual Completed [a]	No	409	14.2	85.8	1.770	1.099-2.852	0.019*
	Yes	328	8.5	91.5	1.000		
Unemployed [a]	No	586	12.8	87.2	1.581	0.852-2.932	0.146
	Yes	153	8.5	91.5	1.000		
Self-reported mental health problem	No	418	12.4	87.6	0.976	0.640-1.489	0.912
	Yes	370	12.7	87.3	1.000		
K10 score 30 or more	No	708	12.0	88.0	0.721	0.390-1.333	0.297
	Yes	88	15.9	84.1	1.000		
Drug use characteristics							
Frequency of recent ecstasy use	≥24	214	16.8	83.2	2.066	1.218-3.503	0.007**
	12-23 days	259	12.7	87.3	1.491	0.875-2.541	0.142
	≤11 days	314	8.9	91.1	1.000		
Has snorted ecstasy in the past six months	No	642	11.1	88.9	0.573	0.355-0.923	0.022*
	Yes	157	17.8	82.2	1.000		
Max ecstasy pills used in a session	<4	259	11.2	88.8	0.560	0.317-0.990	0.046*
	4-6.9	183	12.0	88.0	0.330	0.330-1.118	0.109
	≥7	147	18.4	81.6	1.000		
Max ecstasy capsules used in a session	<3	210	10.0	90.0	0.560	0.301-10.44	0.068
	3-5.9	208	13.9	86.1	0.817	0.457-1.460	0.494
	6≥	151	16.6	83.4	1.000		
Use large quantities [b]	No	485	9.9	90.1	0.535	0.341-0.842	0.007**
	Yes	235	17.0	83.0	1.000		
Recent binge	No	494	10.9	89.1	0.698	0.457-1.067	0.097
	Yes	301	15.0	85.0	1.000		
Number of drugs last stimulant use	1-2	196	13.8	86.2	1.128	0.681-1.868	0.640
	3	202	10.9	89.1	0.863	0.506-1.473	0.589
	4≥	395	12.4	87.6	1.000		
SDS score 3 or more (dependent)	No	625	10.2	89.8	0.407	0.258-0.642	<0.001*
	Yes	160	21.9	78.1	1.000		
AUDIT score 8 or more (hazardous)	No	184	10.9	89.1	0.793	0.471-1.338	0.386
	Yes	578	13.3	86.7	1.000		

[a] Among those 18 and over

[b] Reported using a max of ≥ 7 ecstasy pills and/or ≥ 6 capsules in a single occasion.

Table 2: Correlates of self-reported 'overdose' attributed to 'ecstasy' (multivariable logistic regression)

Variable	Level	n	Recent adverse effects	Did nit	Bivariable			Multivariable		
			%12.5 (n=88)	%87.5 (n=618)	OR	95% CI	P-Value	OR	95% CI	P-Value
Age	16-19 20-24 25>	266 273 167	17.3 12.5 4.8	82.7 87.5 95.2	4.156 2.827 1.000	1.909-9.048 1.276-6.268	<0.001*** 0.010*	3.472 2.315 1.000	1.576-7.650 1.032-5.191	0.002** 0.042*
SDS score ≥3	≥3 <3	152 554	23.0 9.6	60.2 39.8	2.828 1.000	1.764-4.533	<0.001***	2.201 1.000	1.344-3.605	0.002**
Use large quantities [a]	Yes No	229 477	17.5 10.0	82.5 89.9	1.892 1.000	1.202-2.976	0.006**	1.584 1.000	0.985-2.549	0.058

Model $\chi 2$ (4) = 32.800, p<0.001. Adjusted R square = 0.045 (Cox & Snell), 0.086 (Nagelkerke). Hosmer-Lemeshow goodness of fit test, P=0.923, n=516. AOR, adjusted odds ratio; CI, confidence interval.
[a] Reported using a max of ≥ 7 ecstasy pills and/or ≥ 6 capsules in a single occasion.

Characteristics of significant adverse effects following 'ecstasy' use

As evident in Table 3, most experiences of significant adverse effects following 'ecstasy' use occurred in recreational music settings, such as nightclubs (30%), live music events/festivals (19%) and raves (5%). However, more than a third took place in private settings, such as private homes (26%) and parties (9%). A sober person was reportedly present to assist in 50% of all cases. The most common drugs used concomitantly were alcohol (76%), cannabis (38%) and LSD (11%). The most common severe symptom was vomiting (25%), but a similar proportion reported a psychological complaint as being the most severe symptom (e.g. anxiety, paranoia or panic). The vast majority reported receiving no treatment (82%), but 6% presented to a hospital ED, half via ambulance attendance (n=3%). Two also reported receiving treatment from event medical services (grouped within 'other' in Table 3).

Table 3: Self-reported recent (past 12 month) 'overdose' attributed to 'ecstasy' (n=99)

Variable (%)	Level	National (n=99)
Location	Nightclub	29.6
	Live music event	19.4
	Friend's home	15.3
	Home	10.2
	Private party	9.2
	Rave/doof	5.1
	Public place	3.1
	Pub	1.0
	Car	1.0
	Outdoors	1.0
	Other	5.1
Sober person able to assist	No	50.0
	Yes	50.0

Table 3 (continued)

Variable (%)	Level	National (n=99)
Other drugs taken	Alcohol	75.5
	Cannabis	37.8
	Cocaine	12.2
	LSD	11.2
	Amyl nitrate	5.1
	Ketamine	5.1
	Nitrous oxide	4.1
	GHB	2.0
	Anti-depressants	1.0
	Heroin	1.0
	MDA	1.0
	Meth powder	1.0
	Pharm stims	1.0
	Other	4.1
	None	7.1
Most severe symptom	Vomiting	24.7
	Passed out	9.9
	Hallucination- visual	8.6
	Increased heart rate	7.4
	Extreme anxiety	6.2
	Nausea	6.2
	Tremors	6.2
	Panic	4.9
	Increased body temp	4.9
	Paranoia	4.9
	Seizure	3.7
	Chest pain	3.1
	Delirium/confusion	1.9
	Extreme agitation	1.2
	Dizziness	1.2
	Muscle twitches	1.2
	Other	2.5
Other symptoms	Increased heart rate	45.4
	Increased body temp	39.3
	Nausea	38.0
	Extreme anxiety	29.4
	Tremors	29.4
	Dizziness	27.0
	Panic	27.0
	Paranoia	25.8
	Hallucination visual	25.8
	Vomiting	25.2
	Delirium/confusion	22.1
	Muscle twitches	22.1
	Agitation	21.5
	Rapid breathing	18.4
	Extreme agitation	16.0
	Headache	15.3
	Auditory hallucination	13.5
	Chest pain	12.9
	Passed out	12.3
	Shallow breathing	10.4
	Tactile hallucination	7.4
	Seizure	3.7
	None	7.4
	Other	9.2
Treatment received	No treatment	81.8
	Hospital ED	7.6
	Ambulance attended	5.5
	GP	0.6
	Don't know	2.4
	Other	6.1

Discussion

This bulletin sought to examine how common significant adverse effects following 'ecstasy' use were among the 2018 EDRS sample, as well the characteristics and correlates of these experiences. The analysis revealed one in ten reported experiencing significant adverse effects in the preceding 12 months. It is again important to emphasise that these cases do not necessarily involve the consumption of high doses of MDMA. For the purpose of the EDRS interviews, the term 'overdose' was used to broadly describe experiences featuring significant adverse effects where participants believe professional help would have been useful. Thus, it is possible adverse outcomes were related to other individual, environmental or drug factors (e.g. warm weather and drug misrepresentation–drugs sold as 'ecstasy' do necessarily contain MDMA). The underlying cause notwithstanding, the frequency of significant adverse events in this sample is concerning and suggests that, while ecstasy-related deaths may be uncommon (albeit potentially on an upward trend (1, 6, 21)), the experience of significant problems may not be. This further highlights the importance of better understanding adverse experiences to help inform harm reduction efforts.

Characteristics

A number of the characteristics of these adverse experiences warrant attention. Firstly, the location should be considered. While media reports suggest the majority of recent ecstasy-related deaths in Australia have occurred at festivals (22, 23), resulting in festivals being the focus of most harm reduction debate, nightclubs were the most common location for adverse effects reported in this sample. Consistent with recommendations made by Horyniak, Degenhardt (20), these findings are a reminder that night-time entertainment districts are also key spaces for targeting harm reduction initiatives. Secondly, the finding that about one in three of these adverse experiences occurred in private settings raises concern about the level of support available to those who use ecstasy at home or at private parties. Indeed, less than one-third (32%) of those who experienced significant adverse effects in private settings reported having someone sober to assist them, compared to more than two-thirds in public settings (68%) (Analysis excluded ambiguous locations, such as 'outdoors'). This has implications for educating people who use ecstasy to recognise red flag symptoms, and to seek help as early as possible from medical professionals. Greater promotion of easy to access online resources, such as the online education/training provided by Save-a-Mate for a recent music festival in Perth, may be worthwhile (24).

The second characteristic to consider is polydrug use. Three-quarters (76%) of those reporting significant adverse effects following ecstasy use also reported concomitant alcohol use–almost the same proportion reported in the aforementioned study of ecstasy-related ED presentations (75%) (20).

While the bivariable analyses for this bulletin found the number of different drugs people used during their last occasion of stimulant use did not significantly increase the odds of reporting a recent adverse experience following ecstasy use, the data cannot tell us whether concomitant alcohol use, or excessive alcohol use, during a single occasion of ecstasy use increased the odds of significant adverse effects. Overall, the high frequency of concurrent alcohol use suggests there is an ongoing need to educate people who use ecstasy about the potential risks of mixing these two drugs.

Correlates

The multivariable analysis identified two unique predictors which could be considered when designing and targeting interventions aimed at reducing the risk of ecstasy-related harm. Firstly, younger people, particularly those 16-19 years old, were at significantly greater odds of reporting significant adverse effects recently. This contrasts with Horyniak, Degenhardt (20) which found patients presenting to the ED had a median age of 25 (20) (median age for those reporting adverse effects in the 2018 EDRS sample=19, IQR=18-22). Two possibilities for this inconsistency could be: (1) younger people may be less likely to present to an ED due to comfortability/lack of confidence due to their age, uncertainty on where to go and/or concern about parents being notified (25); or (2) given Horyniak, Degenhardt (20) collected data ten years ago, more young people may be using ecstasy now (although not supported by population-based data (26)), or younger people may be using ecstasy in more hazardous ways than their older counterparts. If the former is true and younger people are indeed hesitating to seek help, there are implications for raising awareness about how and when to seek help, and alleviating potential concerns young people may have. While Horyniak, Degenhardt (20) proposed educating people on how to manage less serious conditions in private settings to avoid the burden on EDs, given preliminary indications of increasing deaths (1), one would instead encourage young people to seek urgent medical attention if they are unsure. If younger people are using ecstasy in more hazardous ways than their older counterparts, there are implications for targeting these age groups with harm reduction messages, particularly when considering the potential risks to the developing brain (27, 28).

Secondly, those screening as potentially dependent were at more than double the odds of experiencing significant adverse effects. One interpretation of this finding could be that, contrary to what some might expect, it was the more entrenched users who were at greater odds of experiencing problems. This interpretation is partly supported by the bivariable analyses which found those who used ecstasy more frequently and used greater amounts were at greater odds than those reporting lesser frequency or quantity of use. One possibility for this finding is that people who are dependent may not exercise the same level of caution as other people who use ecstasy (e.g. using smaller amounts, taking breaks between occasions of use).

Overall, this finding suggests there may be merit in building the SDS into other online initiatives and/or promoting harm reduction messages which encourage people who use ecstasy to reflect on their patterns of use and avoid complacency (e.g. are you using more frequently than you use to? Here are a few things you may want to consider…). It may also be useful to remind young people that, regardless of their level of experience with ecstasy, there is an ongoing risk of new psychoactive substance (NPS) misrepresentation, and shifting purity trends may increase the risk of overdose. More generally, given one in five EDRS participants screened as potentially dependent on ecstasy, there are implications for raising awareness of the different types of support available. It is likely free, informal and private options will have greater appeal (e.g. online instant messaging).

Conclusions

Overall, the experience of recent significant adverse effects following ecstasy use was not uncommon in this sample. Thus, while it is deaths that are attracting significant concern and debate, these findings suggest more frequent, less severe adverse consequences should perhaps be given more attention than they are currently, and could be an opportunity for early intervention. These data also suggest that harm reduction and intervention efforts should be targeted at people who are younger and people who are potentially dependent on ecstasy. Further efforts should be made to identify novel ways to identify and engage at risk young people. As explained elsewhere (29), drug checking services could be one way of engaging some members of this hard-to-reach population.

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