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Abstract | Drinking among young adult users of amphetamine-type stimulants (ATS) during episodes of ecstasy and methamphetamine use is reported to have a number of possible functions, such as mitigating the unwanted effects of the drugs, enhancing intoxication and pleasure, and increasing drinking capacity. While there is evidence to suggest a high prevalence of risky drinking among users of ATS in Australia, little is known about how they combine their use of ATS with the consumption of alcohol or why they do so. This paper considers how ATS users consume alcohol during ecstasy and methamphetamine use, and also addresses alcohol abuse and dependence among low-risk and at-risk ATS users.

At-risk users are more likely to have experienced alcohol abuse and dependence during adolescence or early adulthood, suggesting that higher-risk use of ATS may be linked with problematic drinking patterns. The paper suggests that problematic behaviour relating to alcohol and ATS use is interlinked, and may be important in developing appropriate policy responses.

Alcohol use and motivations for drinking among types of young adult illicit stimulant users

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Amphetamine-type stimulants are the second most widely used illicit drugs in Australia after cannabis (AIHW 2014). The use of these substances is relatively prevalent among young adults; in 2010, approximately 24 percent and 15 percent of Australians aged 20–29 years had ever used ecstasy or methamphetamine, respectively (AIHW 2011). Early adulthood is the peak age for both ATS use and for the harmful use of other licit and illicit substances (Stone, Becker, Huber & Catalano 2012). ATS users are predominantly polydrug users, often using ATS concurrently and simultaneously with other licit and illicit substances (Degenhardt et al. 2009; Gouzoulis-Mayfrank & Daumann 2006; Kirkpatrick, Gunderson, Levin, Foltin & Hart 2012).

The use of other substances in combination with ATS represents an emerging area of concern; a growing body of research suggests that such combined use may result in greater harm than separate use of these substances (Fisk, Murphy, Montgomery & Hadjiefthyvoulou 2011; Hedden et al. 2010). However, few studies have examined patterns of combined use or the motivations behind these combinations. The available evidence suggests users report a number of functions of the combined use of other substances with ATS, including:

- to produce pleasurable effects;
- to extend or prolong the effects of a substance;
- to enhance or intensify the effects of a substance; and
- to mitigate the negative effects of a substance (Hunt, Evans, Moloney & Bailey 2009).

One of the substances most commonly used concurrently or simultaneously with ATS by Australian users is alcohol (Breen et al. 2006; Kinner, George, Johnston, Dunn & Degenhardt 2012; Matthews, Bruno & Nicholls 2013). High rates of risky drinking (≥ 5 standard drinks on a single occasion of use; see NHMRC 2009) have previously been observed among ATS users (Breen et al. 2006; Kinner et al. 2012; Matthews et al. 2013; McKetin, Chalmers, Sunderland & Bright 2014). Recent Australian research has observed that, in a sample of stimulant users, those who took stimulants on a night out drank at excessive levels, consuming a median of 20 standard drinks (McKetin et al. 2014). ATS use may facilitate binge or risky patterns of alcohol consumption. Individuals under the influence of ATS are potentially able to consume alcohol without experiencing its usual sedative effects (Hernández-López et al. 2002), consequently facilitating longer wakefulness and extended drinking episodes. Alternatively, ATS users may use alcohol to mitigate the unwanted effects of ATS such as anxiety, agitation and restlessness (Fisk et al. 2011). Further, users may combine ATS and alcohol to increase the desired subjective effects of either of these substances. It has been noted that the combined use of alcohol and ATS may produce a longer-lasting euphoria than the separate use of these substances (Hernández-López et al. 2002).

This study examines patterns of concurrent and simultaneous alcohol and ATS use among a population-based sample of Australian young adult ATS users, comparing users engaged in low-risk and risky use. Three key questions are addressed.

- Are young adult ATS users engaged in risky patterns of ATS use more likely to experience alcohol abuse and dependence?
- Do patterns of drinking during episodes of ecstasy and methamphetamine use differ between low-risk and at-risk users?
- What are the potential motivations for combined alcohol and ATS use among young adult ATS users?

Method

Participants

The Natural History Study of Drug Use (NHSDU) is a prospective longitudinal study of drug use among young adults in South East Queensland, Australia, which commenced in 2009 (Smirnov, Kemp, Wells, Legosz & Najman 2014). A one-page drug use screening questionnaire was mailed to 12,079 young adults aged between 19 and 23 years of age, who were randomly selected from the Brisbane and Gold Coast electoral roll. A \$5 payment was included with the screening questionnaire as a pre-paid incentive (ie payment was not contingent upon response to the questionnaire). Additionally, reminder letters and postcards were mailed to recipients who did not respond to the initial screening questionnaire, and

telephone contact was made with those for whom telephone numbers could be found. Individuals self-completed and returned the screener in a reply-paid envelope or were screened by telephone.

A response rate of 49.9 percent was attained based on 6,029 screening questionnaires completed for all drug use questions. Five hundred and twenty-two respondents were eligible to participate in the NHSDU on the basis of their ATS use (ie they had used ecstasy or methamphetamine ≥ 3 times within the last 12 months). Of these 522 eligible ATS users, 352 participated in the baseline interview. A further 4,682 respondents were ATS-naïve (ie had never used ecstasy or methamphetamine). Three hundred and twenty ATS-naïve respondents were randomly selected to participate as the comparison group, of which 204 agreed to participate. This method is described in detail elsewhere (Smirnov et al. 2014).

Data from this study are drawn from the study baseline and the six-month, 12-month, 30-month, and 4½-year follow-up waves. The baseline, 12-month, and 4½-year interviews were predominately conducted face-to-face using computer-assisted personal interviewing (CAPI). A small number of interviews were conducted via Skype and telephone at the 12-month and 4½-year follow-ups. Participants completed the six- and 30-month follow-up surveys online. Participant retention rates for the NHSDU have remained relatively high. Interviews were completed with 79.7 percent ($n=443$) of participants at the 4½-year follow-up (ATS user group: 77.8% [$n=274$]; comparison group: 82.8% [$n=169$]).

In-depth semi-structured interviews of approximately 15–20 minutes were also conducted with almost all (99.4%; $n=350$) ATS users at the baseline interview. These interviews addressed the participant's most recent occasion of ecstasy or methamphetamine use, with a particular focus on the social context and setting of use, the subjective effects of use, the use of other drugs (including alcohol) in conjunction with ecstasy or methamphetamine and recovery from the drug experience. The most recent occasion of use was chosen for a number of reasons, including:

- to maximise the accuracy of participant recall;
- to map the trajectory of a single occasion of use (ie preparations, drug onset, intoxication, comedown and recovery); and
- to attend to specific experiences rather than generalisations about each participant's drug use.

A semi-structured interview guide was provided; however, interviewers were trained in qualitative interviewing techniques and were able to go beyond the provided questions to explore relevant topics and promote open discussion. Interviews were digitally recorded and subsequently transcribed, and the text imported into the qualitative analysis software NVivo 10.

In the current study, 145 cases (41.2%) were excluded due to missing data, including 95 participants (27.0%) who did not complete all follow-up waves of data collection. These 145 excluded participants did not differ significantly from the ATS users included in the current study by age ($t=1.35$, *ns*) or sex ($\chi^2=1.64$, *ns*). Excluded participants were more likely to be in full-time rather than part-time employment at the study baseline (55.9% vs. 39.1%; $\chi^2=10.88$, $p<0.01$) compared with participants in the current study. However, the unemployment rates of excluded participants and participants in the current study at baseline were very similar (14.0% vs. 14.5%). There was no significant difference in employment status between excluded participants and participants in the current study at the 4½-year follow-up ($\chi^2=2.06$, *ns*). With regard to ecstasy use,

there was no significant difference at baseline in the number of ecstasy tablets ever consumed between the excluded participants (mean=166.70, 95% CI 121.69-211.71) and those in the current sample (mean=206.33, 95% CI 136.29-276.36; $z=0.40$, *ns*). There was also no significant difference at baseline between the proportions of the excluded participants (12.8%) and participants in the current study (14.5%) who had used methamphetamine within the last month ($\chi^2=0.19$, *ns*). However, a higher proportion of excluded participants had never used methamphetamine at baseline (27.1%) compared with those in the current study (12.6%; $\chi^2=11.81$, $p<0.01$). The final sample for this study consists of 207 young adult ATS users.

Measures

Ecstasy and methamphetamine use

Participants reported the number of days they had used ecstasy and methamphetamine in the last month (previous 31 days) at four intervals in the study—baseline, six months, 12 months and 30 months. These variables were recoded as:

- no recent use;
- occasional use (1–2 times per month);
- frequent use (3–4 times per month); and
- very frequent use (5 or more times per month).

Substance-related health service contact

Substance-related health service contact refers to visiting a health service (eg a general practitioner, hospital emergency department, alcohol and other drug treatment service, allied health professional or alternative health practitioner) for help with an alcohol-, tobacco-, or other drug-related issue and was measured at baseline, 12 months and 4½ years.

Substance-related police contact

Substance-related police contact (contact initiated by the police or a third party related to the participant's own drug or alcohol use) was measured at the 4½-year follow-up interview. Three categories of substance-related police contact were developed:

- no contact;
- non-intensive contact (eg random breath tests where the participant did not produce a positive alcohol or drug reading); and
- intensive contact.

Intensive substance-related police contact was defined as police contact initiated by the police or a third party in response to the participant's drug or alcohol use, including occasions where the contact involved any of the following:

- being questioned or detained by police;
- being searched by police or checked by sniffer dogs;
- being charged or arrested for a drug- or alcohol-related offence; or

- being tested for drug or drink-driving (but only if the participant was found to be over the legal alcohol limit or if drugs were detected).

Participants were also asked if they had ever been charged with a drug-related offence.

Alcohol abuse and dependence

Alcohol abuse and dependence was evaluated at the 4½-year follow-up using the World Mental Health Survey Initiative version of the World Health Organization's Composite International Diagnostic Interview (WMH-CIDI). The WMH-CIDI applies diagnostic criteria for alcohol dependence and abuse from the Diagnosis and Statistical Manual of Mental Disorders (DSM-IV).

Simultaneous alcohol and ATS use

At baseline, participants reported whether they generally consumed alcohol during episodes of ecstasy and methamphetamine use and at what stage (eg before ecstasy or methamphetamine use, while intoxicated on ecstasy or methamphetamine, or during the comedown).

Analysis

Defining low-risk ATS use

Three patterns of ATS use—low use, intermediate use and high use—were identified by computing trajectory groups for ecstasy and methamphetamine use using K-means cluster analysis with Euclidean distance as the measure of similarity. Trajectory groups for ecstasy and methamphetamine were based on the number of days of use in the last month at four time points (baseline, 6 months, 12 months and 30 months). The low and intermediate use groups were combined and categorised as less frequent patterns of use (ie less than weekly use at baseline). Those users who had less-frequent patterns of use for ecstasy and methamphetamine were classed as having less-frequent patterns of ATS use.

Low-risk ATS users were defined as those with less frequent patterns of ATS use (ie less than weekly at baseline) who had no substance-related health service contact, had no intensive substance-related police contact and had never been charged with a drug-related offence. As such, while users engaged in high-frequency patterns of ATS use were excluded from the low-risk category, users with less frequent patterns of use could be classified as at-risk if they had had substance-related contact with health services or intensive police contact, or had been charged with a drug-related offence.

Statistical tests

Pearson chi-square tests were conducted to examine associations between low-risk ATS use and (1) alcohol dependence and abuse and (2) alcohol use during episodes of ecstasy and methamphetamine use. Data analysis was conducted using Stata/SE version 12.1.

Qualitative data

The qualitative data was analysed using a combination of deductive and inductive thematic analysis. All interviews (n=350) were manually coded by the first author using a number of pre-established themes, with further themes emerging from the data. After the initial coding and examination of

themes, the author returned to the data to re-examine and refine coding. Qualitative analysis was conducted using NVivo 10.

Results

Low-risk and risky amphetamine-type stimulant use

In the current sample, 30.9 percent of ATS users were low-risk users (see Table 1).

Amphetamine-type stimulant users	n (%)
Low-risk ^a	64 (30.9)
At-risk	143 (69.1)
Total	207 (100.0)

a: Refers to amphetamine-type stimulant users engaged in low/intermediate frequency patterns of use who had no substance-related contact with health services and no intensive substance-related contact with police, and who had never been charged with a drug-related offence

Source: NHSDU data collection 2009–2014

Alcohol abuse and dependence among low-risk and at-risk amphetamine-type stimulant users

Table 2 examines the proportions of low-risk and at-risk ATS users who have experienced alcohol abuse and dependence (lifetime and last 12 months), measured at the 4½-year follow-up interview.

Significantly higher proportions of at-risk ATS users had experienced lifetime (77.6% vs. 46.9%) and last 12 month (30.1% vs. 14.1%) alcohol abuse, compared to low-risk users. There was also a significant association between at-risk ATS use and lifetime alcohol dependence, with 41.3 percent of at-risk users having experienced alcohol dependence in their lifetime compared to 21.9 percent of low-risk users. While a higher proportion of at-risk users (19.6%) had experienced alcohol dependence in the last 12 months at the 4½-year follow-up compared with low-risk users (10.9%), this difference was not significant.

Drinking during episodes of ecstasy and methamphetamine use among low-risk and at-risk ATS users

Figure 1 examines the proportions of low-risk and at-risk ATS users who, at baseline, reported usually consuming alcohol during episodes of ecstasy and methamphetamine use and the stage at which they usually drank (while 'up', or intoxicated on ecstasy or methamphetamine, vs during the comedown). Most ATS users usually drank during episodes of ecstasy use (low-risk users: 93.7%; at-risk users: 95.1%) and methamphetamine use (low-risk users: 80.9%; at-risk users 82.1%). Alcohol was most commonly consumed while up, and rates of usually drinking while up were similar for low-risk and at-risk users (ecstasy: 90.5% vs 94.4% - $\chi^2=1.07$, *ns*; methamphetamine: 80.9% vs. 82.1% - $\chi^2=0.04$, *ns*). In contrast, a significantly higher proportion of at-risk users usually drank while coming down from ecstasy (46.2% vs. 30.2%; $\chi^2=4.62$, $p<0.05$), compared with low-risk users. While a higher

proportion of at-risk users usually drank while coming down from methamphetamine compared with low-risk users (44.0% vs. 29.8%), this association only borders on significance ($\chi^2=2.93$, $p=0.09$).

Table 2: Alcohol abuse and dependence, by low-risk (n=64) and at-risk ATS users (n=147)

	Alcohol abuse and dependence ^a							
	Lifetime abuse n (%)	χ^2	Last 12 month abuse n (%)	χ^2	Lifetime dependence n (%)	χ^2	Last 12 month dependence n (%)	χ^2
Amphetamine-type stimulant users		19.25***		6.02*		7.28**		2.35
Low-risk ^b	30 (46.9)		9 (14.1)		14 (21.9)		7 (10.9)	
At-risk	111 (77.6)		43 (30.1)		59 (41.3)		28 (19.6)	

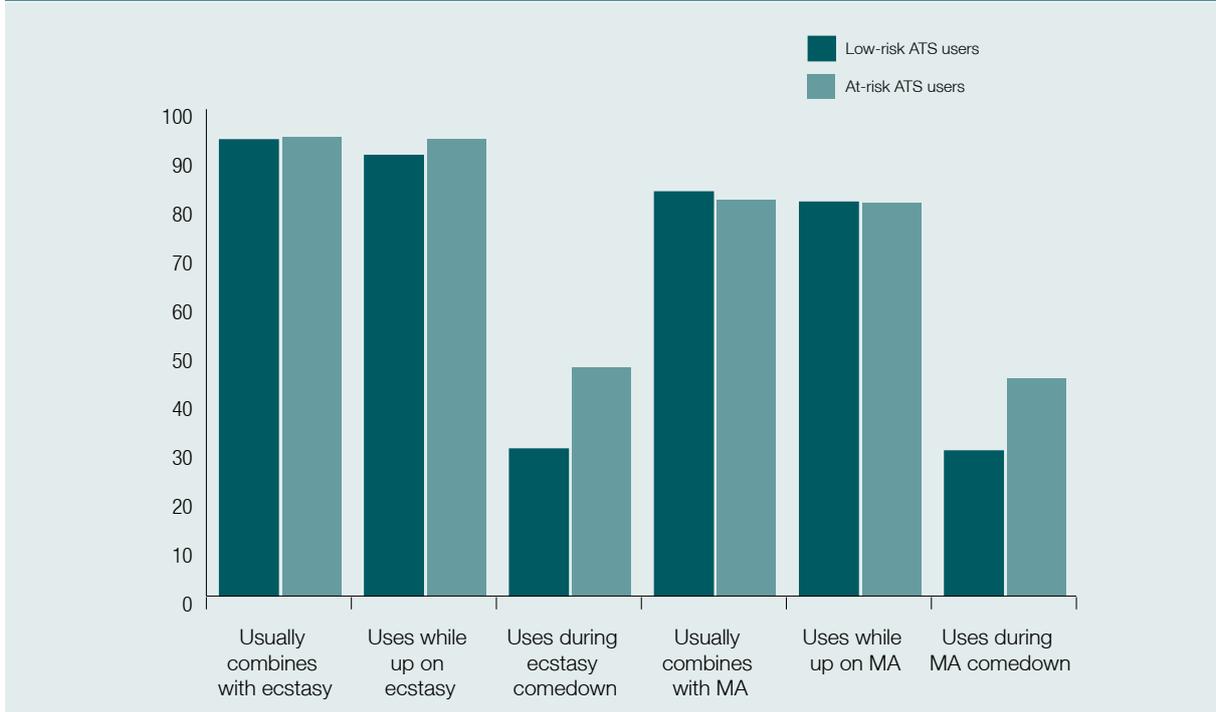
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

a: Measured at the 4½-year follow-up; assessed using the WMH-CIDI 3.0, which applies diagnostic criteria from the DSM-IV

b: Refers to ATS users engaged in low/intermediate frequency patterns of use who had no substance-related contact with health services and no intensive substance related contact with police, and who had never been charged with a drug-related offence

Source: NHSDU data collection 2009–2014

Figure 1: Consumption of alcohol during episodes of ecstasy (n=206^a) and methamphetamine use (n=181^b), by low-risk (n=64) and at-risk ATS users (n=147)^c



a: 1 participant had never used ecstasy

b: 26 participants had never used methamphetamine

c: Measured at baseline

Source: NHSDU data collection 2009–2014

Exploring potential motivations for simultaneous alcohol and ATS use

Examination of the qualitative data revealed a number of potential motivations for the combined use of alcohol and ATS among young adult users, including to reduce anxiety regarding ‘coming on’ or waiting for the drug to take effect, to increase capacity to drink, to alter the effects of ATS and to help with coming down.

Reducing anxiety

Some ATS users reported experiencing anxiety while waiting for the effects of ATS to come on or during the initial phase of coming on:

Um, the alcohol is probably um, I always like to drink if I’m using ecstasy mainly prior to taking the ecstasy as a, as a method of um sort of taking my mind off the fact that I’ve taken this thing so I’m not sitting there sort of waiting for it to come on or whatever like that. So just sort of as a distraction but then also just because I like to drink and just have a good time. (19 year old male ATS user)

Like, the onset of ecstasy I don’t really like because it’s...your brain gets really scattered and it’s like this sort of rush of speed or whatever’s coming on and, yeah, just sort of doesn’t make me

feel comfortable. [Interviewer: Right?] It's like frantic sort of...your body starts going all over the place and, you know, I think the drinking really just helps you ease into that state. (22 year old male ATS user)

In these circumstances, users explained that alcohol reduced their anxiety.

Increasing drinking capacity

A number of ATS users highlighted that they experienced an increased capacity to drink during ATS intoxication. For some users this was a positive effect of combining alcohol and ATS, which allowed them to extend their drinking episodes:

And you're able to drink more without feeling sick. Um, that's how pills usually affect me; I could have heaps of shots and not feel sick. So, yeah, can last longer. (22 year old female ATS user)

No, I took the night before as well, but I think I just had speed the night before, just to stay awake and keep...stay awake drinking and partying, pretty much. [Interviewer: Okay. So were you taking it for the effects or because you can drink lots when you're on speed and ecstasy?] Yeah, both, both. (22 year old male ATS user)

It's more of, like, um, I take it to drink more...So you don't end up asleep in the corner. [Interviewer: Oh, I see, alright]. Not so much for the exactly emotional and physical feelings of it, it's just to...Basically keep, keep you going. (22 year old male ATS user)

Further, these examples suggest that some young adults use ATS in combination with alcohol specifically to increase their capacity to drink and to extend their drinking sessions.

However, increased tolerance for alcohol during ATS intoxication may create a financial disincentive for combined alcohol and ATS use:

We try and stay away from drinking when we're on speed, because we know we're just gonna waste all our money because it doesn't, doesn't do it...doesn't get you drunk. 'Coz you're too, you know, too much on...you're off your head really. (22 year old female ATS user)

But yeah, so you drink more I would say. [Interviewer: Yeah?] I do, yeah. Tend to drink more. [Interviewer: Yeah yeah, fair enough] Which sucks. Costs too much money. (22 year old male ATS user)

A small minority of ATS users may try to avoid alcohol for this reason on occasions of ATS use.

Additionally, some ATS users reflected on the harms associated with this increased capacity to drink:

So, yeah, we didn't really have any before but the alcohol, it didn't matter if we had any or if we didn't have any at all, all the pills and like the meth and stuff kicking in. It was...alcohol meant nothing. It played no part at all. [Interviewer: Really?] Yeah, like I said, you could have given us a bottle of vodka and just said 'Yeah, it's water' and we would have just drank it and thought it was water. Like, it's terrible like that because alcohol poisoning is, like, right around the corner. (20 year old male ATS user)

I know people who do drink and because of the way speed works you've got to drink like four times the amount just to get tipsy and it's just pointless because you're just, you know, punishing your body. It's just horrible. (23 year old female ATS user).

However, while the harms of excessive drinking during episodes of ATS use were acknowledged, these users did not appear to regret drinking.

Altering the effects of ATS

A further motivation for combining alcohol and ATS identified in the qualitative data was to alter the physiological and subjective effects of ATS use. A number of ATS users described using alcohol to bring on the effects of ATS more quickly or to produce a stronger high:

Um I think that if you drink before you take them it, ah, it makes it come on quicker and it makes it a more enjoyable experience because it's um like missing...a drug feeling without being, without getting all messy. (22 year old female ATS user)

Um to be honest, it probably, yeah...I'd say it probably would have enhanced the experience. I think basically there is a different feeling that comes with just taking ecstasy and getting drunk and taking ecstasy. I think if you do have alcohol in your system as well the two can, can probably react and, and make the experience probably more powerful than it otherwise would have been. (23 year old male ATS user)

For others, combining alcohol with ATS resulted in a more mellow or relaxed high:

How was it different? Um I'd say it was probably better having a few drinks rather than just getting on the pills. Because I know especially without 'em um really you [are] just sitting there tapping your leg all night, you just want to get up and keep moving and dance or just...really haven't got any control over what you're doing. You're just exploding. Want to go do something. But after a couple of drinks, you know, you're just really amped up to have a good night and you're still socialising and all that sort of stuff...Keeps you feeling good. But, yeah. Keeps you not feeling that you're going to, I don't know, do something stupid or you can't control yourself. (20 year old male ATS user)

Some users also reported using alcohol in combination with ATS to lengthen the high experienced from ATS:

Um...it definitely helps it last longer. [Interviewer: Yeah?] And then vice-versa, if we're taking ecstasy at the same time I'm not as drunk. Like, if I had drunk...I mean, 10 doesn't really sound like a lot. But if I had drunk 10 drinks then I would have felt much more intoxicated than I was if I wasn't on pills as well. [Interviewer: Okay, okay]. Um but towards the end of the night we were kind of drinking instead of having another pill because it would just make it last a bit longer. (23 year old female ATS user)

Yeah. It does, 'coz it kind of prolongs the effect, actually. Because if you're just taking that and not drinking anything you probably come down a little quicker but if you're a little intoxicated like by alcohol as well, you kind of don't feel the comedown for as long...Keep going a bit longer. (23 year old female ATS user)

Helping with the comedown

ATS users in the study described a number of motivations for consuming alcohol while coming down from ATS. As one user described, alcohol could be used to extend the feeling of being intoxicated while coming down:

But very much at the same time you feel when it's [ATS] wearing off you know you're just like there's nothing left. Like I can't...for you, like...and that's when I think a lot more people go out and then they call their friends or they do something to try and get more, because that is the high and it's going away so quickly. But like when you're drinking it's sort of that little...like again, not like a balance but it's sort of...they're, they're sort of together on that centre line. So, if that one's wearing off you're still sort of drunk and it's not like the world's gonna end. Like you could always grab another scotch or something, have a drink, start like...just jump in a cab home or something. (22 year old male ATS user)

Another function of drinking during the comedown that ATS users noted was to enable users to sleep after episodes of ecstasy or methamphetamine use:

That alcohol takes a big factor into it. Most people drink water. But, yeah, I get on the piss so I can sleep afterwards. (20 year old male ATS user)

Discussion

The findings of this study suggest that young adult ATS users who are engaging in more risky patterns of ATS use are also engaging in problematic drinking, with significantly higher proportions of at-risk users experiencing alcohol abuse and dependence. Drinking during episodes of ecstasy use appears to be the norm among both low-risk and at-risk young adult ATS users. The findings indicate that young adult ATS users may have a number of motivations for combining alcohol with ecstasy and methamphetamine including to increase drinking capacity, to produce a stronger or better high and to mitigate the negative effects of ATS use (eg anxiety around coming on and the negative effects of coming down). However, patterns of drinking may differ between these groups. While a majority of both groups drank while up on ecstasy, a significantly higher proportion of at-risk compared to low-risk users drank during the comedown.

There were clear differences between low-risk and at-risk young adult ATS users in regard to alcohol abuse and dependence. Over three quarters of at-risk ATS users had experienced alcohol abuse and approximately 41 percent had been alcohol-dependent in their lifetime, compared with approximately 47 percent and 22 percent of low-risk users, respectively. This association between risky patterns of ATS use and alcohol abuse and dependence among young adult users is concerning. While ecstasy and methamphetamine dependence were not addressed in this study, research suggests that alcohol dependent individuals are at greater risk of comorbid drug-use disorders (Stinson et al. 2005). Further, alcohol dependence is not a one-off or limited-duration event, but is likely to be a trajectory that has the potential to continue for a relatively substantial period of time. For individuals who are alcohol-dependent in late adolescence or early adulthood, this dependence may continue beyond early adulthood (McCarty et al. 2004). Consequently, these young adults who are engaged in risky patterns of ATS use, and more likely to be alcohol-dependent, may be exposed to high levels of risk over extended periods.

However, it is important to note that the potential mechanisms underlying the association between risky ATS use and alcohol abuse and dependence are unclear. Individuals who engage in risky ATS use may also be more likely to engage in a wide range of risky behaviours including hazardous alcohol use

(see Pennay et al. 2015). Further research is needed to examine the relationship between patterns of ATS and alcohol use.

Combined alcohol and ATS use was ubiquitous among the young adult ATS users in this study. Almost all ATS users usually drank during episodes of ecstasy use (approximately 94%), with a slightly lower proportion usually drinking during episodes of methamphetamine use (approximately 82%). Considering the emerging evidence of high rates of risky patterns of drinking among stimulant users in Australia (Breen et al. 2006; Kinner et al. 2012; Matthews et al. 2013; McKetin et al. 2014), this group's motivations for drinking are an important factor that has been largely unexamined. This research suggests drinking may play a functional role in episodes of ecstasy and methamphetamine use. Young adult ATS users in this study reported drinking during episodes of ecstasy and methamphetamine use to mitigate the unwanted effects of either substance (eg anxiety regarding coming on, excess energy from stimulant use and negative effects of the comedown), to enhance intoxication and feelings of pleasure and to increase their capacity to drink. These findings regarding the functional role of drug combinations align with previous research that has emphasised the extent to which users are 'active agents' in their drug use (Hunt et al. 2009).

These findings suggest that at-risk ATS users may be engaging in differing patterns of simultaneous alcohol and ATS use compared with low-risk users. Similar proportions of low-risk and at-risk ATS users reported usually drinking during episodes of ecstasy and methamphetamine use and, in particular, while up (or intoxicated) on ecstasy or methamphetamine. However, significantly higher proportions of at-risk ATS users reported usually drinking while coming down from ecstasy (46.2% vs 30.2%), compared with low-risk users. A marginally higher proportion of at-risk users also reported usually drinking while coming down from methamphetamine (44.0% vs 29.8%), compared with low-risk users. At-risk ATS users' alcohol consumption during the comedown from ATS suggests that at-risk users drink in situations in which low-risk users generally do not. At-risk users may drink outside of scheduled social activities, and their drinking may be motivated by factors other than social goals. In addition, as at-risk users are drinking during the comedown, their length of exposure to alcohol on any occasion of use is extended, compared with low-risk users.

While motives for drinking during episodes of ecstasy and methamphetamine use were not systematically analysed, the greater proportion of at-risk users who drink when coming down from ATS use suggests that motivations for drinking may differ between low-risk and at-risk ATS users. It is possible that ATS users who drink to cope with negative effects of ATS use, especially the depressive symptoms of the comedown, may also use drinking as a coping mechanism in other scenarios. Further, ATS users who have had problems with both alcohol and ATS may be more likely than other ATS users to report psychological distress (Matthews & Bruno 2010). Evidence suggests individuals with alcohol- and substance-use disorders are at higher risk of mood, anxiety and personality disorders (Dawson, Grant, Stinson & Chou 2005; Kessler 2004). Drinking to self-medicate psychological symptoms may explain the more problematic patterns of alcohol use observed among at-risk ATS users in this study. In contrast, low-risk users may be primarily motivated by a desire for social connection or integration (wanting to fit in), or wanting to have a good time or good social experience.

Implications

In light of the relatively high population prevalence of ATS use among young adults (AIHW 2011), the high rates of drinking during ATS use and the association between risky ATS use and alcohol abuse and dependence, ATS-using young adults are an important target group for alcohol interventions. The study's findings show that problematic behaviours relating to alcohol and ATS use are not two separate issues but, rather, these issues are interlinked. This has important implications for frontline workers, such as police and drug and alcohol workers, who deal with these issues. Problematic alcohol and ATS use may lead to behavioural problems and, consequently, these young adults are more likely to come into contact with frontline workers. There are likely to be psychological problems underlying these behaviours, which need to be addressed through mechanisms of referral or diversion where appropriate.

The findings of this study also raise the question of whether the synergistic use of alcohol with illicit stimulants, particularly ecstasy, may lead to increased short- and long-term physical and social harms than the separate use of these substances. The combined use of alcohol and stimulants has been linked with risky behaviours including extremely risky levels of drinking (McKetin et al. 2014) and risky sexual behaviour (Breen et al. 2006). Further research is necessary to examine the potential adverse health and social outcomes of combined alcohol and stimulant use.

Limitations

Some limitations of the study design should be noted. Firstly, the conceptualisation of low-risk ATS use in this study draws on trajectories of ecstasy and methamphetamine use, contact with substance-related health services and substance-related contact with police. However, it is possible that a lack of engagement with health services may indicate barriers to access, or inadequate services, rather than low-risk use. Additionally, contact with police could be a matter of chance and there may be varied reasons for contact. Further, as the study measured users' substance-related contact with health services and police broadly, these occasions of contact cannot be specifically linked to ecstasy or methamphetamine use. It should also be noted that, even among at-risk ATS users, the frequency of ATS use had declined significantly by the 4½-year follow-up; consequently, the term 'at-risk ATS user' should be treated with caution.

Secondly, while the study examined potential motivations for combined alcohol and ATS use, it did not compare the extent to which different motives were endorsed by low-risk and at-risk ATS users. Further research is required to examine the significance of different motivations for drinking among users engaged in various patterns of stimulant use.

Finally, not all substances sold as ecstasy in Australia comprise MDMA and, consequently, these findings are not specific to that drug.

Conclusion

This study highlights high levels of simultaneous alcohol and ATS use among Australian young adult ATS users in a population-based sample. Drinking during episodes of ecstasy and methamphetamine use appears to have a number of possible functions for young adult users such as mitigating

unwanted effects (eg anxiety regarding coming on, excess energy from stimulant use and the negative effects of coming down), enhancing intoxication and pleasure and increasing drinking capacity. While the prevalence of drinking during episodes of ecstasy and methamphetamine use was similar for low-risk and at-risk young adult ATS users, at-risk users were more likely to drink while coming down from ecstasy, suggesting these users may be engaged in different patterns of drinking. Further, at-risk users were more likely to have experienced alcohol abuse and dependence in adolescence or early adulthood, suggesting that risky patterns of ATS use may be linked with problematic patterns of drinking. This has important implications for frontline service workers dealing with these issues.

Problematic behaviour relating to alcohol and ATS use are not two separate issues; rather, these are often interlinked and are likely to have particular importance for developing appropriate policy responses.

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