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Self-reported psychopathology in polydrug users

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There is a large body of work investigating concurrent associations between polysubstance use and psychopathology, but much of this work has either pre-dated or failed to account for the complex and culturally specific patterns of contemporary drug use. In particular, attendees of dance music events report a greater drug history than their peers and engage in a unique lifestyle. To further investigate the consequences of this type of drug use, one hundred subjects who regularly attended dance music events were administered a battery of self-report psychiatric symptom scales. This battery contained the Anxiety Sensitivity Index, the Beck Anxiety Inventory (BAI), the Center for Epidemiologic Studies Depression scale (CES-D), the Dissociative Experiences Scale, the Padua Inventory Revised, and additional questions about substance use. Our study population included abstainers and drug users with a wide history of use. We demonstrated strong associations between use of many different drugs, suggesting that polydrug use is the norm in this type of population. We found weak, but statistically significant, correlations between use of alcohol ($p < 0.05$), amphetamine ($p < 0.01$) and ecstasy ($p < 0.01$) with self-reported score on the BAI. There were also positive associations between dissociative symptomatology and the use of amphetamine ($p < 0.05$) and cocaine ($p < 0.05$). Furthermore, weekly unit intake of alcohol positively correlated with score on the CES-D ($p < 0.05$). As polydrug use was the norm in this sample, we performed regression analysis to investigate the contribution of multiple drug use on self-report. This showed that weekly use of alcohol, and frequency of use of amyl nitrate and cigarettes were significant predictors of BAI score. However, the majority of subjects reported being unworried by these symptoms, which may represent a lack of self-awareness, or acceptance of them as the subacute effects of substance use. It remains to be determined at what point adverse effects of drug use begin to interfere with day-to-day life.

Key words: anxiety, depression, lifestyle, self-reported psychopathology, substance misuse

Introduction

In the UK, it is estimated that approximately one-third of all 16–59-year-olds have ever used a controlled drug (British Crime Survey, BCS; Ramsey *et al*., 2001). Use is most commonly reported in the 16–29-year-old age group, 50% of whom will have ever illegally tried a controlled drug in their lifetime. Within this population, the most popular drugs are (based upon percentage of respondents reporting 'use in last year'): cannabis (22%); non-MDMA (3,4-methylenedioxymethamphetamine, 'Ecstacy') amphetamines (5%); ecstasy (5%); cocaine (5%); and LSD (2%). Figures provided by monitoring systems in other European countries and the USA suggest that reported levels of use are similar elsewhere (Griffiths and Vinghoe, 1997; Johnston *et al*., 2002). Until recently, with the exception of new instances of heroin use, recreational misuse of most controlled drugs has remained relatively stable in the general population. National monitoring surveys now indicate a sharp increase in the proportion of 16–29-year-olds reporting use of recreational drugs. For example, lifetime reporting of cocaine rose sharply from 1% in 1994 to 5% in 2000, and there have also been significant increases in prevalence of ecstasy and other class A drugs (Ramsey *et al*., 2001; Aust *et al*., 2002). In the case of cocaine, this may be because of consistently high purity, increased availability, and/or the reduction in price (King, 1997), but also its perceived safety compared to other controlled drugs, which have received substantial negative media attention (Hammersley *et al*., 2001; Gamma *et al*., 2003).

General population surveys such as the BCS have underestimated the prevalence of drug use within particular subpopulations. Young people attending dance music events report use of a wide range of compounds and have considerably greater drug experience than the general population of a corresponding age. These events are defined by several unique characteristics: (i) larger than average venues; (ii) high ambient temperatures; (iii) prolonged physical exertion in participants (energetic dancing); and (iv) ubiquitous drug use (Bellis *et al*., 2002). Characteristically, dance music event attendees ingest a mixture of stimulants and

hallucinogens, with the overwhelming majority being polydrug users (Riley *et al*., 2001; Winstock *et al*., 2001).

The focus of much research into the recreational use of drugs is the concurrent association between substance misuse and psychopathology (Milich *et al*., 2000) and, in general, published work tends to the conclusion that there is a quantifiable link between them (Campbell and Stark, 1990). However, despite widespread polydrug use, many such studies have concentrated on individual substances (e.g. cannabis users; Dumas *et al*., 2002) or atypical user groups (e.g. drug-dependent populations; Brown *et al*., 1998), which may not reflect wider trends. This study therefore sought to determine if there were higher levels of self-reported anxious, dissociative, obsessive–compulsive, and depressive symptomatology in a random volunteer population of dance music event attendees using scales suitable for community-based assessments.

Methods

Subjects

One hundred and nineteen subjects who regularly attended nightclubs and other dance music events were recruited by posters across the University campus and city centre, internet advertisements, the 'snowball' technique, and the key informant access method; all standard methods of recruitment for this type of research. This population was chosen for study because of the high reported incidence of controlled drug use and homogeneity of lifestyle. Inclusion criteria were current participation in the dance music culture, and the study was open to both drug users and abstainers. Recruitment strategies did not mention that controlled drugs were being investigated (the study was advertised as a project investigating the club lifestyle and the health and well-being of 'clubbers'), but it became clear during subject screening interviews that many respondents had associated the research with drug use. General exclusion criteria included current or past use of prescribed psychiatric medication, or lifetime diagnosis of a psychological or affective disorder (or within the immediate family). One subject was excluded because English was not their first language. Another subject was removed after reporting use of the fictitious drug bromocapnine (see section on Drug Use Assessment). Furthermore, 12 subjects were excluded when it transpired that they had recently been intoxicated (cannabis and/or ecstasy within 24 h). All remaining subjects reported being drug free for at least 3 days before testing. Five subjects had previously experienced psychological problems (warranting clinical intervention) which they attributed to their drug use. These subjects were also excluded. As the overwhelming majority of recreational users did not self-report clinically relevant psychopathology, it was considered appropriate to exclude these subjects from the current analysis. This exclusion criteria is standard practice in studies of this nature. In total, 100 unpaid participants were included in the final study population.

Questionnaire design

Drug use assessment

A questionnaire was specifically designed for this study to record the drug use patterns of the subjects. A variety of information was requested, including which drugs had ever been used, which were taken regularly, over what time periods, in what quantities, and how frequently. Although use of a wide variety of substances was assessed, more detailed information was requested for use of some of the more commonly used recreational drugs (alcohol, amphetamine, cannabis cocaine, ecstasy, ketamine and LSD). Respondents reported great difficulty in accurately estimating their lifetime cannabis intake in terms of standard units (i.e. 'joints') so it was not possible to obtain more detailed information about this drug. Bromocapnine was included in the list to identify subjects who falsely reported their drug use.

Psychopathology scales

The subjects were administered a questionnaire containing the Anxiety Sensitivity Index (ASI; Reiss *et al*., 1986), the Beck Anxiety Inventory (BAI; Beck *et al*., 1988), the Center for Epidemiological Studies Depression scale (CES-D; Radloff, 1977), the Dissociative Experiences Scale (DES; Bernstein and Putman, 1986), and the Padua Inventory Revised (PI-R; van Oppen *et al*., 1995).

The ASI is a 16-item inventory assessing beliefs that anxiety experiences will have negative implications, rather than frequency of symptom occurrence. The scale has been validated in normal and clinical populations, and is particularly sensitive to those individuals prone to panic-related cognitions and agoraphobia, with high scores predictive of actual panic attacks in subsequent weeks (Reiss *et al*., 1986).

The BAI is a standard anxiety inventory containing 21 items assessing the degree to which the respondent has been affected by the physical or cognitive symptoms of anxiety during the past week. Items of the BAI are also thought to reflect panic attack symptoms (Beck *et al*., 1988).

The CES-D was specifically developed for use in epidemiological studies of depression in the general population. It is well validated and has been used extensively in studying community samples. The scale measures current levels of depressive symptomatology with 20 items tapping dimensions of depressed mood, hopelessness, appetite loss, sleep disturbance and energy level.

The DES consists of 27 visual analogue scales of 100 mm length. Subjects are required to make vertical slashes to indicate where they fall on a continuum for each question. The DES shows good reliability and has been validated in a variety of normal and psychiatric populations (Bernstein and Putman, 1986).

The PI-R inventory contains 41 items which are used to produce five factors of obsessive–compulsive thoughts and behaviour: (i) impulses; (ii) washing; (iii) checking; (iv) rumination; and (v) precision. The scale has been validated in both normal and clinical populations and distinguishes between patients with obsessive–compulsive disorder and other psychiatric disorders (van Oppen *et al*., 1995).

Statistical analysis

Drug use data were analysed by Spearman's or Pearson's correlation analyses. Relationships between self-reported drug use parameters and psychopathology were analysed by Spearman's correlation with a modified Bonferroni correction applied to significant results to control for type I statistical errors (Jaccard and Wan, 1996). Mann–Whitney *U*-tests were used to compare scale scores between drug users and abstainers. Non-parametric data were log transformed, and then forward stepwise linear regression

analyses undertaken to investigate which drug use parameters predicted self-reported psychopathology. All data were analysed using SPSS version 11 (SPSS Inc., Chicago, IL, USA).

Results

Population characteristics and self-reported drug use

The mean (± SD) age of the sample was 24.3 ± 5.0 (range 18–40) years, 44% were male and 56% female. Over half (51%) of the sample were students in University education, whereas the majority of others were either in skilled or creative occupations. Within the sample, 19 subjects reported never having taken controlled drugs, a figure which compares well with other surveys of this type of population (see Introduction). Night-clubs, house parties and dance music events were the most common places to take drugs, whilst cannabis was used ubiquitously across social environments (data not shown).

All volunteers reported use of alcohol. Forty-six participants were current tobacco smokers using a mean of 15.3 ± 1.7 cigarettes a day. A mean of 13.3 ± 50.6 weeks had elapsed since the last use of a controlled drug suggesting that the population contained both current and former users, although none of the drug users specifically described themselves as an 'ex-user' when asked. As shown in Table 1, amphetamine (typically amphetamine sulphate in the UK) was the most popular illicit drug (in terms of the number of lifetime exposures) followed by ecstasy, although more people reported a lifetime use of cannabis (n = 90). Although over half the sample had ever tried cocaine (n = 57), lifetime use was limited (11.6 ± 25.3 'lines'), suggesting experimentation rather than regular use. A number of volunteers also reported sporadic use of other (non-)controlled substances such as; psilocybin containing mushrooms (most commonly *psilocybe semilanceata* ('Liberty Cap') in the (UK), *amanita muscaria*, dimethyltryptamine (DMT), mescaline, 4-bromo-2,5-dimethoxyphenethylamine (2-CB), γ-hydroxybutyrate (GHB), amyl nitrate ('poppers'), both legitimate and illicitly obtained opiates, solvents, *salvia divinorum* (a plant of central American origin containing the potent diterpine hallucinogen Salvinorin A), *datura stramonium* (reported as 'jimson weed'), crack cocaine and valium-like compounds ('downers'/tranquilizers). With the exception of amyl nitrate, these compounds were not reported frequently enough to warrant further analysis but are mentioned here to demonstrate the wide variety of substances consumed by some contemporary polydrug users.

Correlation analysis indicated relationships between parameters of use of different drugs (Table 2). For example, there were significant correlations between self-reported lifetime use of ecstasy and units/week of alcohol consumed (r = 0.291; $p < 0.01$), lifetime use of cocaine (r = 0.762, $p < 0.001$), ketamine (r = 0.22; $p < 0.001$) and LSD (r = 0.38; $p < 0.001$). There were also significant correlations between lifetime use of drugs, use per individual episode, and use per week (Table 3). Alcohol, cannabis and cigarettes were not included in lifetime analyses because of the extreme difficulty that all subjects had in estimating consumption.

Sixty-eight percent of respondents reported *regularly* mixing drugs (more than two substances) over the course of an evening or use-episode, 75% reported that they had 'ever' done this. There were a wide variety of combinations reported (this was an open

Table 1 Self reported drug use in randomly sampled selection of rave attendees

Drug (standard units)	% subjects reporting use (n = 100)	Lifetime exposure		Length of regular use (months)		Use per episode[a]	
		Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Alcohol (units/week)	100	16.93 (16.45)	0–50	76.22 (56.77)	0–300	10.63 (8.43)	0–25
Amphetamine ('wraps')	68	39.43 (112.24)	0–1000	21.74 (30.25)	0–120	0.66 (0.89)	0–5
Amphetamine/week	–	0.55 (1.52)	0–10.5	–	–	–	–
Cannabis[b]	69	–	–	51.2 (55.5)	0–288	28.5	0–12
Cocaine ('lines')	57	11.60 (25.25)	0–200	9.98 (17.29)	0–72	0.78 (1.36)	0–10
Cocaine/week	–	0.27 (1.07)	0–10	–	–	–	–
Ecstasy (tablets)	64	85.54 (142.00)	0–500	23.70 (32.74)	0–180	1.35 (1.53)	0–6
Ecstasy/week	–	0.80 (1.50)	0–10.5	–	–	–	–
Ketamine ('hits')	31	2.09 (6.76)	0–50	2.7 (10.51)	0–72	0.57 (1.47)	0–10
Ketamine/week	–	0.05 (0.16)	0–0.94	–	–	–	–
LSD ('tabs')	50	25.09 (58.10)	0–350	23.34 (36.69)	0–168	0.59 (0.86)	0–5
LSD/week	–	0.21 (0.53)	0–3.75	–	–	–	–
Weeks since last drug use episode	–	13.26 (50.60)	1–468	–	–	–	–

[a]Subjects were asked to answer with regards to a 'typical' use episode. [b]Although subjects were able to estimate length of use and use per session, many found it impossible to quantify lifetime consumption of cannabis (see discussion) Regarding alcohol, respondents referred to, for example, a 'night out' rather than a 'mid-week' glass of wine, hence the mean is high.

Table 2 Correlations between reported lifetime use of drugs

	Alcohol	Amphetamine	Cocaine	Ecstasy	Ketamine	LSD
Alcohol	–	0.21*	0.27**	0.29**	0.08	0.02
Amphetamine	0.21*	–	0.68***	0.70***	0.43***	0.52***
Cocaine	0.27**	0.68***	–	0.76***	0.35***	0.38***
Ecstasy	0.29**	0.70***	0.76***	–	0.48***	0.43***
Ketamine	0.08	0.43***	0.35***	0.48***	–	0.53***
LSD	0.02	0.52***	0.38***	0.43***	0.53***	–

Data are correlation coefficients (Spearman's rho); *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

response question), but the most popular combinations were alcohol and cannabis (reported by 52% of subjects who regularly mixed drugs), and ecstasy and amphetamine (reported by 20%).

Psychopathological measures

Correlation analysis

The results of the correlation analysis are summarized in Table 4. There were weak, but statistically significant, positive correlations between score on the BAI and lifetime use of amphetamine ($r = 0.27$, $p < 0.01$) and ecstasy ($r = 0.26$, $p < 0.01$). Weekly use of alcohol ($r = 0.26$, $p < 0.01$) and ecstasy ($r = 0.25$; $p < 0.05$) also correlated with scores on the same scale. Although, initially, there were also significant correlations between lifetime use of cocaine ($r = 0.20$; $p < 0.05$) and amphetamine used per week ($r = 0.20$; $p < 0.05$) with BAI score, these did not remain after the use of the modified Bonferroni correction, suggesting that these findings were statistical artefacts. Further significant correlations were observed between DES score and lifetime amphetamine use ($r = 0.25$; $p < 0.05$), weekly use of amphetamine ($r = 0.21$; $p < 0.05$), and lifetime use of cocaine ($r = 0.23$; $p < 0.05$). Finally, there was also a significant negative correlation between lifetime use of LSD and score on the cleaning subscale of the PI-R ($r = –0.26$; $p < 0.01$).

Examining patterns of drug use in more detail, there were significant, but again weak, correlations between BAI score and the frequency of use of alcohol ($r = 0.31$; $p < 0.01$), amphetamines ($r = 0.29$; $p < 0.01$), cannabis ($r = 0.27$; $p < 0.01$), ecstasy ($r = 0.30$; $p < 0.01$), cigarettes ($r = 0.27$; $p < 0.01$), amyl nitrate ($r = 0.34$; $p = 0.01$), and ketamine ($r = 0.23$, $p < 0.05$). Similarly, BAI score correlated with length of use of amphetamine ($r = 0.21$, $p < 0.05$), ecstasy ($r = 0.31$, $p < 0.01$), and ketamine ($r = 0.23$, $p < 0.05$). There were negative correlations between frequency of use of cannabis ($r = –0.26$; $p < 0.05$), cigarettes ($r = –0.22$; $p < 0.05$); cocaine ($r = –0.21$; $p < 0.05$) and LSD ($r = –0.26$; $p < 0.05$) with score on the washing subscale of the PI-R. Other significant correlations are displayed in Table 5. Cannabis used per episode significantly correlated with BAI score ($r = 0.31$, $p < 0.01$); amphetamine with BAI score ($r = 0.21$, $p < 0.05$); alcohol with CESD report ($r = 0.21$, $p < 0.05$) and ecstasy with BAI ($r = 0.31$, $p < 0.01$) and the precision ($r = 0.23$, $p < 0.05$) subscale of the PI-R.

There were no relationships between scale score and time elapsed since the most recent drug use episode, but after categorization of subjects depending upon whether they had used particular drugs in the previous month, it was evident that those who reported ecstasy ($U = 749.0$, $p < 0.05$) or cannabis ($U = 721.5$, $p < 0.001$) scored more highly on the BAI than non-users. However, the disparity in numbers between groups (approximate $n = 2 : 1$; approximate $n = 1 : 2$, respectively) means that these results should be interpreted cautiously.

Table 3 Correlations between estimated lifetime drug consumption and use/session and use/week

Lifetime use of drug	Use/episode	Use/week
Amphetamine	0.27**	0.66**
Cocaine	0.16	0.37**
Ecstasy	0.55**	0.60**
Ketamine	0.37**	0.42**
LSD	0.77**	0.38**

Data are correlation coefficients (Spearman's rho); **$p < 0.01$.

Table 4 Correlation matrix (Spearman's rho): lifetime, and weekly drug use and self reported psychopathology

	BAI	CES-D	DES	ASI	Padua	Impulsivity	Washing
Units alcohol/week	0.26**	0.30**	0.15	0.18	0.09	0.15	–0.04
Amphetamine	0.27**	0.14	0.25*	0.08	0.06	0.01	–0.10
Amphetamine/week	0.20	–0.00	0.21*	0.06	–0.02	–0.01	–0.10
Cocaine	0.20	0.149	0.23*	0.01	0.08	0.16	–0.17
Ecstasy	0.26**	0.175	0.20	–0.00	0.13	0.12	–0.09
Ecstasy/week	0.25*	0.186	0.12	–0.00	0.09	0.10	0.00
LSD	0.05	–0.03	0.04	–0.12	–0.10	–0.04	–0.26**
Weeks since last drug use episode	–0.06	0.06	0.10	–0.00	0.02	–0.00	0.18

For clarity, only drugs and scale measures producing statistically significant values are presented). *$p < 0.05$, **$p < 0.01$. BAI, Beck Anxiety Inventory; CES-D, Center for Epidemiologic Studies Depression scale; DES, Dissociative Experiences Scale; ASI, Anxiety Sensitivity Index.

Table 5 Correlations (Spearman's rho) between frequency of drug use and self-reported psychopathology

Drug	BAI	CESD	DES	PI-R	Washing	Ruminations	Precision
Alcohol	0.31**	0.20*	0.20	0.09	–0.17	0.17	0.03
Cannabis	0.27**	0.05	0.08	0.02	–0.26*	0.10	0.10
LSD	0.10	0.04	0.11	0.05	–0.22*	0.14	0.11
Amphetamine	0.29**	0.16	0.24*	0.11	–0.12	0.19	0.12
Cocaine	0.22	0.12	0.16	0.09	–0.21*	0.15	0.14
Ecstasy	0.30**	0.21*	0.22*	0.09	–0.13	0.12	0.11
Cigarettes	0.27**	0.19	0.17	–0.02	–0.22*	0.06	–0.03
Amyl Nitrate	0.34**	0.18	0.19	0.21*	0.00	0.22*	0.15
Opiates	0.14	0.14	0.12	0.12	–0.04	0.15	0.24*
Ketamine	0.23*	0.07	0.00	0.05	–0.11	0.15	0.15

For clarity, only drugs and scale measures producing statistically significant values are presented). *$p < 0.05$, **$p < 0.01$. BAI, Beck Anxiety Inventory; CES-D, Center for Epidemiologic Studies Depression scale; DES, Dissociative Experiences Scale; PI-R, Padua Inventory Revised.

Regression analysis

Because the analysis of drug use data revealed a strong tendency towards concomitant polydrug use, forward stepwise regression analysis was used to explore the associations between drug use and self-reported symptomatology. The scale (dependent) and drug use (independent) variables were selected upon the basis of significant correlation analysis. Because of the large variation in reported use, lifetime drug variables were (log x + 1) transformed to reduce skewness. Where BAI was the dependent variable the regression model [adjusted r^2 = 0.184, $F(1,92)$ = 8.008, $p < 0.001$] was predicted by frequency of amyl nitrate use (t = 3.153, $p < 0.01$, β = 0.299), frequency of cigarette use (t = 2.149, $p < 0.05$, β = 0.202), and units of alcohol drunk/week (t = 2.538, $p < 0.05$, β = 0.241). None of the other regression models were statistically significant.

Discussion

The results of this study suggest that current users of a wide variety of controlled drugs self-report increased psychopathological symptoms, and this appears related to the frequency and/or extent of lifetime drug use. In particular, heavier use of alcohol, amphetamine and ecstasy were associated with increased anxious symptomatology. Individuals reporting higher weekly consumption of alcohol also reported greater depressive symptomatology. Increased dissociative symptomatology appeared to be related to lifetime history of amphetamine and cocaine use. By contrast, lifetime use of other popular recreational drugs, such as LSD, ketamine and cannabis, did not appear related to increases in any self-reported score. We found evidence of a relationship between the use of many different drugs, suggesting that a history of polydrug use rather than use of particular drugs *per se* were more responsible for these findings. Subsequent regression analysis of the relationship between drug use measures and psychopathological symptoms found that BAI scores were best predicted by frequency of use of amyl nitrate, cigarettes and units of alcohol drunk per week. However, as the amount of variance explained by the regression models and correlations was low, statistical relationships alone cannot explain these findings. An immediate confounding factor is that we have no control of the quantity or purity of any of the drugs consumed; hence, we cannot describe with absolute confidence the exact relationship between drug use history and the scale scores reported. It is also important to note that our data set does not allow us to make mechanistic interpretations regarding causation.

Contemporary patterns of polydrug use are complex. The 'social normalization' of drug use has lead to a 'pick and mix' attitude in young consumers, whereby different drugs are selected for particular purposes and effects (Measham *et al*., 1994; Parker *et al*., 1998). Some authors have even suggested that drug experimentation in adolescence is part of normal psychological development (Shedler and Block, 1990). The most common drugs used at dance music events are alcohol, amphetamine and ecstasy, closely followed by cocaine and LSD (Forsyth, 1996; Bean *et al*., 1997). This mirrored the drug choices of our respondents. Furthermore, despite our selection criteria (i.e. participants in the dance music scene), the relative popularity of substances reported was comparable to both national and international figures suggesting that our sample was representative of the wider population of drug users (United Nations, 1997; Ramsey *et al*., 2001). Investigating the dance music culture may therefore provide access to easily identifiable and representative populations of drug user. However, it is important that populations currently underrepresented in work of this type (e.g. non-students, and individuals from ethnic minority backgrounds) are engaged in future studies. The extent and variety of substance misuse reported in our sample is not uncommon and reflects findings in similar studies that have shown a clear tendency towards concomitant polydrug use (Gervin *et al*., 2001; Golub *et al*., 2001; Siliquini *et al*., 2001; Staines *et al*., 2001; Morgan *et al*., 2002; Parry *et al*., 2002). Because it is known that pharmacological interactions between drugs of abuse have both acute and long-term consequences (Lukas and Orozco, 2001; O'Loinsigh *et al*., 2001), it is important that the evaluation of the potential detrimental effects of drugs recognize the prevalence of polydrug use, and the complex reasons for drug choice (Boys and Marsden, 2003). Future studies should incorporate appropriate designs and analyses to model these behaviours. Avoiding the creation of 'artificial' groups clustered around use of a single compound (e.g. 'amphetamine-users') may help to achieve this (Simon and Mattick, 2003).

Although we excluded individuals who self-reported a clinical history, we found evidence for increased self-reported anxious, depressive, and dissociative symptomatology, which correlated (albeit weakly) with lifetime and frequency of use of a variety of drugs. Essentially, these findings support previous studies in this area (Williamson *et al*., 1997; Milich *et al*., 2000; Morgan *et al*., 2002; Boys and Marsden, 2003), although research in this field is far from conclusive (Degenhardt *et al*., 2001; Lieb *et al*., 2002). Examining individual scores on the BAI in more detail we found that 63% of subjects scored < 9, which reflects 'normal' reporting of anxiety on this scale (although validity scale studies in normal university undergraduate populations suggest that the mean in this group is 13) (Beck *et al*., 1988), indicating that this population did not report clinically relevant symptomatology. By contrast, almost all subjects (82%) scored above the 'normal' population cut-off on the DES (median 4.38). Transient feelings of depersonalization are part of normal experience (Myers and Grant, 1970) and, when questioned further, these respondents reported that dissociative symptoms did not trouble them and some were even enjoyed. This may reflect the similarity of scale items to experiences of drug-induced dissociative states (see below).

Epidemiological studies demonstrate that there is a high rate of comorbidity between substance use disorders and other psychiatric disorders (Kushner *et al*., 1990). This indicates that substance use disorders co-occur with psychiatric disorders at rates exceeding those predicted by chance alone. The precise causal relationship is more difficult to determine. This suggests two groups of comorbid substance abuser: (i) those with a primary independent psychiatric condition which predates the substance use, and (ii) those with a substance-related psychiatric disorder. Certain childhood problems and personality traits, such as attention deficit behaviours and sensation seeking/impulsivity, are associated with an increased risk of experimenting with controlled drugs and developing substance abuse problems in later life (Lynskey and Fergusson, 1995). Such childhood problems and personality traits are also associated with an increased risk of developing adult psychopathology (Giancola *et al*., 1996; Tapert and Brown, 2000). These premorbid conditions may be more common in the substance misusing population and may give a misleading impression that increased psychopathology

is associated with substance misuse. It is impossible to distinguish a causal direction using our present retrospective study design, but one recent prospective longitudinal investigation of temporal patterns of ecstasy use and psychiatric disorders has indicated that drug use is secondary to the onset of psychiatric disorders (Lieb *et al*., 2002). Similarly, it may be hypothesized that our findings represent premorbid traits. For example, alcohol is well known for its role in the self-medication of anxiety (Cooper *et al*., 1995), and there is a close relationship between increasing drug experience and the perceived function that use fulfils (e.g. perceived symptom or negative mood alleviation through drug use) (Boys and Marsden, 2003). However, the statistical associations that we found between the use of amphetamine (which acutely increases anxiety in human volunteers) and self-reported anxious symptomatology complicates this discussion because it is unlikely that this drug would be used for self-medication. We would also suggest that lifestyle factors may make an important contribution to our findings. In particular, dance music event attendees regularly experience extended periods of vigorous physical exercise (all-night dancing), sleep deprivation, and poor nutrition (Measham *et al*., 2001).

The majority of studies in this field, including the present, do not quantify if subjects are drug free at the time of testing. Although subjects may self-report that they are drug free, recent use of drugs may still influence performance on any tests and assessments. In particular, cannabis has been shown to influence cognitive performance up to 48 h after a single 'joint' (Heishman *et al*., 1990) and chronic cannabis smokers remain impaired for weeks after cessation of use (Solowij, 1998). Weekend use of ecstasy and ketamine has been shown to have subacute effects upon mood up to four days post-ingestion (Curran and Morgan, 2000; Verheyden *et al*., 2002). Furthermore, most, if not all, self-report psychopathological inventories require respondents to answer with respect to the previous week or month. In a population of current drug users, this will inevitably include periods of acute and subacute intoxication, and drug 'hangover'. Despite instructions to the contrary, a not insignificant proportion of our study subjects may have inadvertently reported acute adverse side-effects of drugs. For example, Somatic and subjective items in the BAI overlap with reports of the clinical effects of *d*-amphetamine and MDMA (Holdstock and de Wit, 2001; Liechti *et al*., 2001). It was therefore interesting that individuals reporting use of cannabis and ecstasy in the previous month scored more highly on the BAI than those who did not. However, in this context, it was unusual that the use of ketamine, a drug which produces dissociative states at subanaesthetic doses in both clinical volunteers and recreational users, appeared unrelated to score on the DES, despite a great overlap of inventory items and ketamine-induced psychological effects (Krystal *et al*., 1999; Jansen, 2001). Being unable to effectively discriminate between residual drug effects and long-term psychopathology limits our interpretation of the current data and we cannot draw conclusions that extend beyond periods of current drug use. Because we found no association between symptomatology and time elapsed since previous drug use, it does not initially appear that these effects are long-lasting, although it will be of great importance to reassess such individuals after extended periods of abstinence.

Overall, how these findings impact upon well-being and function is uncertain because our subjects did not report problems or an awareness of troubling symptoms during the screening or debriefing interviews. From this, we may infer that, in this sample at least, drug-related psychopathological symptomatology does not unduly interfere with day-to-day life. This is an interesting area for future investigation. Alternatively, in accordance with the cost–benefit analysis model of drug use (Parker *et al*., 1998), this sample of drug users may accept these symptoms as part of the subacute drug experience and thus not be unduly worried by them (see above). This is not to suggest that drug use will be without noticeable consequence. Even without self-awareness (which may not be an accurate predictor of negative drug effects; Sumnall *et al*., 2003), if young people are spending a significant proportion of their time intoxicated or suffering from the 'hangover' effects of drugs, the resulting effects on work, study and relationships may have long lasting implications.

Conclusion

Recreational drug use as part of the dance music culture/lifestyle may be associated with increased reporting of anxious symptomatology. However, whether these symptoms pre-date initiation of drug use or unduly affect day-to-day life remains uncertain and needs to be determined in future studies.

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