IS THERE A DEPENDENCE SYNDROME FOR ECSTASY?

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EXECUTIVE SUMMARY

The concept of the dependence syndrome was originally applied to alcohol but was broadened to include other psychoactive substances following changes in expert opinion regarding the nature of dependence. The conceptualisation influenced the development of Substance Use Disorders in DSM-III-R and DSM-IV, although little research has examined the applicability of these notions to a wider range of substances. DSM-IV contains the diagnosis *amphetamine or similarly acting sympathomimetic substance dependence*, the class of drug to which the amphetamine-related compound ecstasy belongs. Thus, it is possible to be diagnosed as dependent on ecstasy, although the existence of the disorder has not been examined. While recent reports of mortality and psychological morbidity associated with ecstasy have challenged the predominant view of the drug as relatively benign, dependence on ecstasy is generally considered not to exist. This study interviewed 185 current ecstasy users with the structured interview schedule developed by the World Health Organisation to operationalise DSM-IV substance use disorders, in order to examine whether dependence on the drug is possible.

Results showed that almost half the sample met criteria for ecstasy dependence. Further, those who were currently dependent suffered significantly greater levels of associated harm than those who were not. These harms included a wider range of physical and psychological side effects, higher prevalence of financial, relationship and social problems, a wider range of other drug use, more anxieties about their drug-taking, higher levels of HIV-risk taking and criminal behaviour, and a stronger desire to moderate their ecstasy use to overcome or reduce problems, when compared to nondependent subjects. Further, although the sample were engaging in high levels of polydrug use, multivariate analyses indicated that use of other drugs, and particularly use of other stimulants, could not account for these ecstasy-related harms.

However, structural analyses indicated that the dependence syndrome for this drug was not unidimensional, as has been demonstrated for alcohol, opiates and amphetamine. Two principal components underlay the DSM criteria for dependence rather than one. Thus, if ecstasy dependence exists, it differs from that produced by other drugs such as alcohol or the opiates. Moreover, subjects who used ecstasy as infrequently as once per fortnight met criteria for dependence. This was unexpected, and quite different to other drug classes, including nicotine, alcohol, opiates, cannabis and amphetamine, where use on between three and seven days per week is the norm among dependent users. While subjects reported significant levels of ecstasy-related harm, few equated this with "having a problem" with the drug, and this appeared to be related to the fact that they did not use on a majority of days. These unexpected findings suggest either that the dependence criteria are too liberal for this class of drug, or that, if ecstasy dependence exists, it takes a form different to that of other drugs.

1.0 INTRODUCTION

The concept of the "dependence syndrome", originally proposed by Edwards and Gross (1976) for alcohol, was broadened to apply to other psychoactive substances following changes in expert opinion regarding the nature of dependence (Edwards, Arif & Hodgson, 1984). The drug dependence syndrome retained the emphasis of the disease model of addiction on tolerance and withdrawal, but in conceptualising a *dimension* of severity of dependence, also attached greater importance to other symptoms. These comprised compulsion to use, narrowing of the drug-using repertoire, rapid reinstatement of dependence after abstinence, and high salience of drug use in the user's life.

The conceptualisation offered by Edwards *et al.* (1984) influenced the development of the diagnosis of Substance Dependence in the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition - Revised* (DSM-III-R; American Psychiatric Association, 1987) and DSM-IV (American Psychiatric Association, 1994), in which greater emphasis was placed on continued use of a drug in spite of its adverse effects. However, as other authors (eg. Bryant, Rounsaville & Babor, 1991; Woody, Cottler & Cacciola, 1993) have commented, little research has examined the applicability of these notions to a wider range of substances.

DSM-III-R and IV include the diagnosis of *amphetamine or similarly acting sympathomimetic dependence* which "includes all substances of the substituted phenylethylamine structure" (DSM-III-R; p.175), the class to which ecstasy[1] belongs (White, Irvine & Bochner, 1996). Thus, it is possible to be diagnosed as dependent on ecstasy, although the existence of the disorder has not been examined.

Surveys of the Australian general population show an increase between 1990 and 1993 in those having tried ecstasy, from 1% to 3%, which appeared to stabilise in 1995 (Commonwealth Department of Health and Family Services, 1996). Australian studies of ecstasy users conducted in the early 1990s found generally self-limiting patterns of use, with low levels of injecting, few negative health effects and use confined mainly to inner city areas (Fitzgerald & Reid, 1992; Moore, 1993; Solowij, Hall & Lee, 1992). Such results seemed to confirm the prevailing view of the time, that ecstasy is a relatively benign substance with few associated problems (Downing, 1996; Fromberg, 1990; Nichols & Glennon, 1984).

More recent research and anecdotal reports suggest that patterns of ecstasy use may be changing, with injecting becoming more prevalent, a wider range of so-called "party drug" use occurring, and a broader range of users (Hando, O'Brien, Darke, Maher &

[1] "Ecstasy" is preferred to "MDMA" in this report as the term is now so widely used that it may be considered virtually generic for any of the ring substituted amphetamine group. "Ecstasy" may refer to MDMA, analogues of MDMA, or combinations of these (Griffiths & Vingoe, 1997).

Hall, 1997; Boys, Lenton & Norcoss, 1996). Several ecstasy-related deaths in Australia and overseas have emphasised the need for a better understanding of ecstasy-related harms (Henry, Jeffreys & Dawling, 1992; White *et al.*, 1996), as have reports of significant psychological morbidity associated with the drug (Cassidy & Ballard, 1994; McGuire, Cope & Fahy, 1994; Series, Boeles, Dorkins, & Peveler, 1994; Williamson, Gossop, Powis, Griffiths, Fountain & Strang, 1997).

One harm of particular concern is the dependence potential of ecstasy. Addiction to ecstasy is thought to be uncommon (Green, Cross & Goodwin, 1995; White *et al*., 1996). In a study conducted by Solowij *et al.* (1992), only 2% of their sample reported dependence on ecstasy, although almost half believed "addiction" to the drug was possible. Chesher (1993) suggested that the pattern of use described in early studies, involving a rapid development of tolerance and the intensification of unpleasant effects, made it most unlikely that dependence on ecstasy would occur. Hall and Hando (1993) cautioned that the self-limiting nature of ecstasy use might change if injection became the preferred route of administration. More recently, Merrill (1996) described a small group of ecstasy users who administered the drug repeatedly in increasing doses in order to overcome short-term tolerance. With the recent changes in patterns of use, it is possible that dependence on ecstasy is occurring without the awareness of public health authorities. It certainly would not be the first time that the dependence potential of a drug was underestimated because of low prevalence of problems among intermittent users. Recent research has clearly indicated the existence of a dependence syndrome for both amphetamine (Topp & Mattick, 1997a; Topp & Darke, 1997) and cannabis (Didcott, Reilly, Swift & Hall, 1997; Swift, Hall & Copeland, 1997), drugs traditionally considered not to produce dependence.

1.1 Aims of current study

The aims of the present study were:

1. to determine whether it is possible to become dependent on ecstasy in the manner defined by the drug dependence syndrome; and if so,

2. to examine whether dependence on ecstasy is associated with increased ecstasy-related problems.

2.0 METHOD

2.1 Subjects

The sample comprised 185 ecstasy users recruited from all metropolitan regions of Sydney, Australia, through advertisements in local and entertainment newspapers (17.8%), radio (8.6%), the researcher/interviewer (8.1%) and "snowballing" procedures (65.4%). Of the sample, 28.6% resided in the inner city/east; 30.7% in the north/south; and 40.6% in the inner west, west and south-west of Sydney. All subjects were volunteers who were reimbursed AUD$30 for their participation. The great majority of the sample spoke English at home (89.2%), with a number of other languages represented, including Spanish (3.8%), Polish (1.1%), as well as eleven others (5.5%). A minority of the sample (2.7%) were of Aboriginal or Torres Straight Islander descent.

The mean age of the sample was 22.1 years (SD 5.3; range 15-42), and 53.5% were female. Female subjects were significantly younger than male subjects (20.5 versus 23.9 years; t_{145}=4.46; p<.001). Median number of school years completed was 13 (range 8-13), and the majority of the sample (57.8%) had completed the equivalent of the Higher School Certificate. More than one-third of the sample (42.2%) had also completed courses after school, with 24.9% possessing a trade or technical qualification, and 17.3% having completed a university degree or college course. One-third of the sample (32.4%) were employed on a full-time basis, and a similar proportion (37.8%) were students. Smaller proportions were unemployed (16.2%), employed on a part-time or casual basis (13%) or engaged in home duties (1%). Very few subjects had ever been imprisoned (2.2%) or had dependent children (4.9%).

2.2 Procedure

This sample was interviewed as part of a larger national study examining patterns and correlates of ecstasy use (Hando, Topp & Dillon, *in press*; Topp, Hando & Dillon, *in press*). Subjects contacted the researchers by telephone and were screened for eligibility for the larger study. Criteria for entry were use of ecstasy at least three times in the preceding twelve months including once in the last six months. To be included in the present sample, subjects had to have used ecstasy at least five times in their lives (the requirement of the CIDI; see below). Subjects were assured that all information provided was strictly confidential and anonymous, and that the study would involve a face-to-face interview which would take between 75 and 90 minutes. Interviews took place in varied locations, agreed upon with the subjects, and were conducted by the first author.

2.3 Measures

Subjects were assessed with three different instruments. The first was a detailed questionnaire examining demographics, drug use, ecstasy-related harms, perception of risks, tolerance, withdrawal, treatment seeking, HIV risk-taking (the HIV Risk-Taking Behaviour Sale (HRBS); Darke, Hall, Heather, Ward & Wodak, 1991), and criminal behaviour (the Crime scale of the Opiate Treatment Index (OTI); Darke, Hall, Heather, Wodak & Ward, 1992). All items in this instrument referred to the six months preceding

the interview except for the latter two scales, which related to the preceding month.

The second instrument was the Lifetime Version of Section L, *Disorders resulting from the use of psychoactive substances* of the Composite International Diagnostic Interview for DSM-IV (CIDI Version 2.0; World Health Organisation, 1996). Also administered was the Severity of Dependence Scale (SDS), a five-item scale shown to be a reliable, internally consistent and valid measure of preoccupation with and anxieties about drug-taking in the preceding six months, and "psychological" dependence (Gossop *et al.,* 1995; Topp & Mattick, 1997b).

2.4 Data Analyses

For continuous, normally distributed variables, *t*-tests were employed and means reported. Where continuous variables were highly skewed, medians are reported and the Mann-Whitney *U* test, a non-parametric analogue of the *t*-test, employed. Categorical variables were analysed using χ^2. The internal structure of the DSM-IV measure of dependence was analysed with Principal Components Analysis (PCA), a data reduction technique used to define linear combinations of the original dependence criteria in such a way as to maximise the amount of variance in responses for which could be accounted (Nunnally, 1967). The PCAs were originally conducted on the intercorrelations between the seven binary DSM-IV criteria which indicated whether the criteria had been met, using *SYSTAT, Version 6.0* (Wilkinson, 1990). All other analyses were conducted using *SPSS for Windows, Release 6.0* (Norusis, 1993).

The fact that the dependence criteria were binary would dictate the use of tetrachric correlations rather than Pearson's product-moment, as the latter assumes an underlying normal distribution (Nunnally, 1967). However, initial analyses indicated that the use of tetrachoric correlations introduced a severe and unexpected pathology into the model. When tetrachoric correlations between the binary DSM criteria were performed, tolerance was negatively correlated with all other criteria (r=-.08 to -.44). However, Pearson's correlations between the criteria did not follow this pattern, with tolerance positively correlated with the six other dependence criteria (r=.05 to .28). To further investigate this anomaly, the phi coefficient was employed. This nonparametric statistic is a measure of the extent of association between two variables, each of which may only take on two values (Siegal & Castellan, 1988). The phi coefficient indicated that tolerance was positively associated with all other dependence criteria (with phi values ranging between .05 and .27). As these further statistical analyses indicated that tolerance was **not** negatively related to the other criteria, it was decided that the Pearson's correlation matrix, while technically not the most appropriate correlation matrix to form the basis of the PCAs, would suffice in the present instance. Other authors have been forced to abandon the most appropriate correlation matrix (in this case, polychoric correlations, of which tetrachoric correlations are a special case; Nunnally, 1967) due to the introduction of similar unexpected pathologies when they were used (Lynskey, 1996), and it was decided to do the same in this case. Cronbach's alpha (Cronbach, 1951), a measure of internal consistency reliability, was calculated for the two dependence measures (the DSM and the SDS).

In order to elucidate the nature of ecstasy dependence, comparisons of key variables

were made between those subjects classified as currently dependent on ecstasy and those who were not. Multiple linear regressions were performed in order to predict a number of ecstasy-related harms. Backwards elimination was used to select the most appropriate models.

3.0 RESULTS

3.1 Ecstasy Use

3.1.1 Patterns of ecstasy use

The median age at which subjects first used ecstasy was 17 years (range 13-38), with a mean use duration of 3.4 years (SD 2.4; range six months-10 years). Female subjects began to use ecstasy at a significantly earlier age than male subjects (median 17 years versus 18 years; U=3118.5; p<.005). The majority of subjects had used ecstasy at least monthly at some stage (95.1% of the sample), and the median age at which they first did so was 18 years (range 13-38). Thirty percent of the sample had ever injected a drug, and 13% had injected ecstasy. The mean age at which they first injected ecstasy was 21.9 years (SD 4.9; range 15-31 years). Ecstasy was the first drug injected for only a minority of the injectors (10.9%), most having commenced injecting with either amphetamine (49.1%) or heroin (21.8%).

All subjects had swallowed ecstasy and 98.9% had done so in the preceding six months; 59.5% had snorted it and 37.8% had done so in the preceding six months; and 25.9% had smoked ecstasy mixed with cannabis, with 15.1% having done so in the preceding six months. The majority of subjects had mainly swallowed ecstasy in the preceding six months (91.9% of the sample), followed by mainly snorted (3.8%) and mainly injected (2.7%). The remaining subjects either mainly administered ecstasy anally ("shelving" or "shafting"), or had no method of administration that they used more frequently than others. Ecstasy was the preferred drug of 53.5% of the sample, followed by amphetamine (11.4%), cannabis (8.6%), LSD (7.6%) and cocaine (7.6%).

Subjects had used ecstasy on a median of 12 days in the preceding six months (range 2-100 days), approximating fortnightly use. Of the sample, 22.8% had used ecstasy once a month or less, 38.1% had used between once a month and once a fortnight, 26.1% had used between once a fortnight and once a week, 10.3% had used one or two days a week, and 2.7% had used more than two days a week (maximum 4 days per week). The median number of ecstasy tablets used in an average use episode was 1.5 (range 0.5-8 tablets), and in their heaviest ecstasy use episode, subjects had used a median of 2.5 tablets (range 1-30 tablets). Over one-third of the sample (36.8%) had "binged" on ecstasy in the preceding twelve months, defined as using the drug on a continuous basis without sleep for 48 hours or more (Ovendon & Loxley, 1996). The median number of days for which their longest binge lasted was three days (range 2-14 days).

3.1.2 Tolerance to and withdrawal from ecstasy

The majority (82.7%) of subjects had noted diminishing effects of ecstasy over the course of their use histories, manifested as needing more to get the same effects or the same amount of drug having less effect. Of this group, 11.8% used the same amount of ecstasy as when they first started, 17.4% used a little more, 45.1% used double the amount that they started with, and 25.7% used more than double. The effects of ecstasy most frequently reported to be less intense were: the euphoria/pleasure (89.6% of those who reported diminished effects), the length of time for which the effects lasted (84.7%), the stimulant effect of energy (33.3%) and the confidence with which ecstasy imbued the user (13.2%). When asked why they thought it was that the effects were not as intense as they were at the beginning of their use histories, subjects' most common explanations were: variations in quality and purity of the drug (95.8% of those who reported diminished effects), tolerance ("Your body gets used to it"; 83.3%), and that it depends on your mood (51.4%), the setting (50.7%) or other recent drug use (32.6%).

The majority of subjects also reported that the nature of the "come down" period following use of ecstasy had changed over the course of their use history. Very few subjects (1.6%) reported that they did not "come down" from ecstasy at all, while 25.9% said that their come down was the same as it had always been. A quarter (25.4%) of the sample reported that the come down was less intense now than it had been at the start. In the majority of these cases, the come down was perceived as less intense because subjects had learnt methods for making it more bearable, rather than because the symptoms themselves were less intense. Almost one-half of the sample (47%) reported that the come down was more intense now, either a little more intense (27%) or a lot (20%).

3.2 DSM ecstasy dependence symptoms

According to DSM-IV criteria, assessed by the CIDI, 15.1% of the sample did not qualify for any ecstasy-related diagnosis. One-fifth of the sample (21.1%) qualified at some time in their lives for a diagnosis of ecstasy *abuse*, and the remainder of the sample (63.8%) had a lifetime diagnosis of ecstasy *dependence*. The mean number of DSM-IV lifetime symptoms of dependence experienced by the sample as a whole was 3.5 (SD 1.7; range 0-7), and 4.5 among those diagnosed as dependent (SD 1.2; range 3-7). There was no significant difference in the proportions of females and males assigned a diagnosis (82.8% versus 87.2%), nor in each specific diagnosis (*No diagnosis:* 17.2% versus 12.8%; *Abuse:* 22.2% versus 19.8%; *Dependence:* 60.6% versus 67.4%).

Of those assigned a dependence diagnosis, 81.4% were current (that is, in the preceding six months, subjects had experienced three or more dependence symptoms), and 82.1% of abuse diagnoses were also current (that is, in the preceding six months, subjects had experienced one or more symptoms of abuse). In general, the period in which the diagnosis applied corresponded to subjects' self-reported periods of heaviest use of ecstasy. Mean length of time for which diagnoses had applied was 2.2 years (SD 2.0 years; range <1 year - 9 years). Among those assigned a diagnosis, mean length of heaviest use period was 1.4 years (SD 1.2 years; range <1 year - 6 years). The majority of heaviest use episodes involved use of the drug on one or two days per week

(65.6% of those diagnosed). A minority (8.3%) had used ecstasy three or four days per week in their heaviest use episodes; a quarter (24.8%) on one to three days per month, and 1.3% had used ecstasy less than once per month in their heaviest use episode. All those who had used the drug three to four days per week, and none of those who used less than once per month, were diagnosed as dependent on ecstasy. The longest a diagnosis of abuse had applied was four years, while the longest a diagnosis of dependence had applied was six years. The great majority of both diagnoses and heaviest use episodes lasted for a maximum of three years (79.6% of diagnoses and 93.6% of heaviest use episodes), suggesting that ecstasy is a drug which, in general, will not be used heavily on a long term basis.

Table 1 displays the proportion of the sample endorsing lifetime experience of each of the DSM-IV criteria for dependence and abuse. It shows that each of the DSM-IV criteria for *abuse* were endorsed by approximately half of the sample. Withdrawal from and tolerance to ecstasy were the two most commonly endorsed *dependence* criteria; the other dependence criteria were experienced by between one-quarter and just under one-half of the sample. There were significant gender differences for two of the criteria. Compared to females, males were significantly more likely to use ecstasy recurrently in a situation in which it was physically hazardous, for example, while driving (60.5% of males versus 39.4% of females; Pearson's χ^2=8.2; p<.005). Conversely, females were significantly more likely to continue to use ecstasy despite knowledge of a persistent or recurrent physical or psychological problem likely to have been caused or exacerbated by ecstasy (35.4% of females versus 19.8% of males; Pearson's χ^2=5.5; p=.01).

Table 1: Lifetime symptoms of DSM-IV ecstasy abuse and dependence (*N*=185)

DSM-IV Criteria	Males (%)	Females (%)	Persons (%)
Abuse criteria:			
Failure to fulfil role obligations	48	56	52
Recurrent legal problems/ continued use despite interpersonal problems *	47	57	52
Use when physically hazardous	61	39	49
Dependence criteria:			
Withdrawal #	100	97	98
Tolerance	86	80	83
Unsuccessful attempts to stop	45	41	43
Withdrawal relief #	41	42	42
Used more/longer than intended	41	31	36
Great deal of time spent using etc.	33	31	32
Continued use despite problems	20	35	28
Gave up other activities to use	26	27	27
Percent abuse (DSM-IV)	19.8	22.2	21.1
Percent dependent (DSM-IV)	67.4	60.6	63.8

* these two criteria, while separate in DSM-IV, are assessed with the same item by the CIDI.

\# withdrawal and/or withdrawal relief together form one criterion for dependence in DSM-IV.

One possibility is that the unexpectedly high rate of dependence among the sample was partly due to the way in which the CIDI measures withdrawal from and tolerance to a drug. The withdrawal item was, "Within a few hours or days of stopping or cutting down on ecstasy, did you have any ... problems like fatigue, anxiety, depression, irritability ...". As shown in Table 1, 98.4% endorsed experiencing withdrawal from ecstasy as conceptualised by the CIDI. It is possible that some, if not most subjects who reported experiencing withdrawal may have been referring to the "crash" phase of psychostimulant withdrawal, distinguished by Gawin & Ellinwood (1988) from the "withdrawal" that heavy, chronic users will experience for up to 18 weeks after cessation of use. An important area of future research will be a clearer delineation of acute versus chronic stimulant abstinence symptomatology (Topp & Darke, 1997). While most subjects also reported tolerance to ecstasy (82.7%), it is possible that the purity of street ecstasy has decreased in recent years, and this may have contributed to the perceived diminishing effects. For parsimony, in the remainder of the analyses, only those subjects who reported engaging in withdrawal relief drug-taking were classified as experiencing withdrawal (41.6% of the sample). Further, only those who reported that they presently used at least double the amount of ecstasy that they started with, were classified as experiencing tolerance (55.7% of the sample).

These changes reduced the proportions of subjects receiving the different diagnoses. Using the modified criteria, 47.6% met criteria for a DSM-IV diagnosis of ecstasy *dependence*, and 84.1% (n=74) of these were current, that is, the diagnosis had applied in the preceding six months. One-third (35.7%) of the sample met criteria for *abuse*, 77.3% (n=51) of which were current; and 16.8% did not qualify for an ecstasy-related diagnosis. When the modified criteria were implemented, the mean number of dependence criteria met for the sample as a whole was 2.6 (SD 2.0; range 0-7), and for those classified as dependent was 4.4 (SD 1.2; range 3-7). The majority of dependent subjects (78.4%) met between three and five criteria, and only 5.7% endorsed all seven criteria, indicating that most were dependent on ecstasy in only the mild to moderate range of severity.

Subjects who were diagnosed as currently dependent on ecstasy by DSM-IV had used ecstasy on a significantly greater number of days than nondependent subjects (median 20 versus 10 days; U=1059.5; p<.0001), and were using more ecstasy tablets in both typical (median 2 versus 1 tablet; U=2134.0; p<.0001) and heavy use episodes (median 3.75 versus 2 tablets; U=1842.0; p<.0001). They were also significantly more likely to have "binged" on ecstasy (χ^2_1=21.2; p<.0001), and their binges were significantly longer (median 3 versus 0 days; U=2749.0; p<.0001). Currently dependent subjects were significantly more likely to have injected ecstasy (χ^2_1=5.8; p=.02) than nondependent subjects, and were also more likely to be using at least double the amount of ecstasy that they started with (χ^2_4=37.9; p<.001).

3.3 Structure of DSM-IV dependence

Table 2 shows the results of the PCA run on the *modified* DSM-IV criteria. Following examination of a number of possible solutions, the two-factor solution with varimax rotation was chosen as the most appropriate, as it was conceptually interpretable, accounted for just over half of the variance in responses (51.8%), eliminated split loadings, and all variables loaded on one or other PC at an acceptable level of 0.45 or greater (Hair, Anderson, Tatham & Black, 1995; Nunnally, 1967). Table 2 indicates that the first rotated PC, accounting for 37.3% of the variance, consisted of the DSM criteria giving up important activities because of ecstasy, unsuccessful attempts to quit or cut back, withdrawal, spending a great deal of time obtaining or using ecstasy, and using despite problems. This factor can be interpreted as *compulsive use* of ecstasy. The second rotated PC, accounting for 14.5% of the variance, consisted of the DSM criteria tolerance and using more or for longer than intended. Together, these criteria capture the notion of *escalating use* of ecstasy. It is reasonable to assume that those who often use more than they plan will develop significant tolerance to the drug, and conversely, that those who are tolerant may often be forced to use more than they intend in order to achieve the desired effect. Cronbach's alpha for the first PC was 0.69, an acceptable level of internal consistency (Nunnally, 1967; Streiner & Norman, 1995). Given that there are only two variables loading on the second PC, Cronbach's alpha cannot be calculated, as the alpha value is equal to the average correlation between items on a test (Nunnally, 1967). A better measure of the extent of association between the two variables *tolerance* and *using more than intended* is provided by the phi coefficient, which was equal to .28 (p<.001).

While the PCA yielded interpretable factors and accounted for an acceptable proportion of variance, and Cronbach's alpha indicated acceptable internal reliability, these results do not fit with the concept of a drug dependence syndrome as proposed by Edwards *et al.* (1984). For a unidimensional syndrome to underlie the seven dependence criteria, they must all load onto a single PC. This was not the case in the present data set.

Table 2: PCA loadings and Cronbach's coefficient alpha for DSM-IV ecstasy dependence criteria.

	Unrotated		Rotated	
	PC1	**PC2**	**PC1**	**PC2**
DSM-IV Criteria:				
Withdrawal (as measured by withdrawal relief drug-taking)	.72	-.03	.63	.35
Tolerance (at least two-fold)	.41	.77	-.04	.87
Unsuccessful attempts to stop	.74	-.16	.72	.25
Used more/longer than intended	.58	.41	.28	.65
Great deal of time spent using etc.	.67	-.07	.61	.29
Continued use to despite problems	.38	-.30	.48	-.05
Gave up other activities to use	.67	-.39	.77	.02
Percent variance accounts for	-	-	37.3	14.5
Cronbach's alpha	-	-	0.69	phi= 0.28

3.4 Psychological components of dependence (the SDS)

The SDS has a possible range of scores of 0-15, and median score for ecstasy dependence among this sample was 2 (range 0-11). Earlier work with amphetamine users indicated that a cut-off of four on the SDS is indicative of dependence on amphetamine (Topp & Mattick, 1997b), and a minority of subjects in the present sample would be classified as dependent on ecstasy by this instrument if the same cut-off was used (20.5%). The majority of subjects indicated that, in the preceding six months, they had never considered their ecstasy use to be out of control (75.1%), the prospect of not being able to get any ecstasy had not worried them (60%), they had never wished they could stop using (76.8%) and they considered it would not be difficult to stop using (53.5%). About half of the sample (50.8%) had worried about their ecstasy use in the preceding six months.

On average, subjects currently dependent by DSM-IV criteria had significantly higher SDS scores than nondependent subjects (median 3 versus 1; U=1670.0; p<.0001). Compared to nondependent subjects, they had more often thought their ecstasy use was out of control (χ^2_2=22.8; p<.0001), were more often anxious at the prospect of being

unable to get ecstasy (χ^2_3=21.4; p<.0001), had more often worried about their ecstasy use (χ^2_3=24.8; p<.0001), had more often wished they could stop using the drug (χ^2_3=21.5; p<.0001), and were more likely to consider it would be difficult to stop using (χ^2_2=18.3; p<.0001).

The internal structure of the SDS was examined through PCA in order to determine the usefulness of the instrument in the measurement of ecstasy dependence. A single factor with an eigenvalue of greater than one was extracted, which accounted for 43.7% of the variance in responses. All the SDS items loaded on this factor at a satisfactory level, with loadings between .50 and .77. Cronbach's alpha calculated from the intercorrelations between the five items (α=.66) indicated satisfactory but not high internal consistency according to the conventions proposed by Nunnally (1967), α=.60, and fell just short of those proposed by Streiner & Norman (1995), α=.70. These results indicate that the SDS has some utility in the measurement of ecstasy dependence, but it has been shown to have better psychometric properties when administered to users of other drugs, particularly amphetamine, heroin and cocaine (Gossop et al., 1995; Topp & Mattick, 1997b).

3.5 Polydrug use

Polydrug use was the norm among the sample, as has been found with users of other illicit drugs (Darke and Hall, 1995). Table 3 displays information about the use of other drugs by the sample. The sample had experimented with a mean of 10.4 drugs (SD 2.3; range 1-16), most frequently alcohol, cannabis, amphetamine, LSD, tobacco, amyl nitrate and cocaine (Table 3). In the preceding six months, the sample had used a mean of 8.1 drugs (SD 2.0; range 1-13), most frequently alcohol, cannabis, amphetamine, tobacco, LSD, amyl nitrate and cocaine. Dependent subjects had used a significantly greater number of drugs than nondependent subjects, both ever in their lives (10.3 versus 8.8; t_{183}=-4.65; p<.001) and in the preceding six months (7.9 versus 6.5; t_{183}=-4.84; p<.001).

The majority of subjects typically used other drugs both in combination with ecstasy (96.8% of the sample) and in the "come down" period (Gawin & Ellinwood's (1988) "crash") after using ecstasy (90.3%). "Typically" was defined as at least two-thirds of the time. The drugs most commonly used in conjunction with ecstasy were: tobacco (70.3% of the sample), cannabis (53%), amphetamine (43.2%), and alcohol (40.5%). Of those that typically drank alcohol while using ecstasy, 45.3% typically consumed more than five standard drinks in an episode. Other drugs used with ecstasy included amyl nitrate (10.8% of the sample), LSD (9.2%) and nitrous oxide (4.9%). The drugs most commonly used when "coming down" from ecstasy were cannabis (64.9% of the sample), tobacco (63.8%) and alcohol (21.1%). Other drugs used in this period included benzodiazepines (10.8%), nitrous oxide (7.0%), amphetamine (6.5%) and heroin (3.2%). Mean number of drugs used when coming down was 1.8 (SD 1.1; range 0-6), and dependent subjects used a significantly greater number of drugs when coming down than nondependent subjects (2.1 versus 1.6; t_{183}=2.8; p=.006).

Table 3: Patterns of other drug use of the 185 ecstasy users in the study

Drug Class	Ever Used (%)	Used last 6 months (%)	No. days used last 6 months (median)
Alcohol	99.5	93.0	24
Cannabis	98.4	92.4	48
Amphetamine	97.3	89.7	9
LSD	96.8	69.2	4
Tobacco	85.9	76.2	180
Amyl nitrate	82.7	53.5	3
Cocaine	71.9	47.6	2
Nitrous oxide	69.2	41.6	4
Benzodiazepines	58.9	44.3	4
MDA	58.4	37.8	2
Other opiates	37.3	25.4	4
Heroin	28.1	15.1	7
Antidepressants	21.1	9.7	9.5
Ketamine	12.4	2.7	1
Ethyl chloride	10.8	6.5	4
Methadone	6.5	3.2	128
Anabolic steroids	1.6	0.5	-
GHB	1.1	0.5	-
Other drugs *	-	2.2	3.5

* Other drugs included hallucinogenic mushrooms, DMT, "Vitamin C" and datura

3.6 Ecstasy-related harms

3.6.1. Physical and psychological side-effects of ecstasy

Tables 4 and 5, respectively, display the physical and psychological side-effects of ecstasy experienced by subjects in the preceding six months (column 1) and the nature and duration of these side-effects among those who reported them (columns 2 to 6). Subjects reported a mean of 8 physical side-effects from ecstasy in the preceding six months (SD 3.8; range 0-17), the most common of which were muscle aches (reported by 75.1% of the sample); blurred vision (54.6%); hot and cold flushes (52.4%); dizziness (49.7%); profuse sweating (49.2%); numbness or tingling (48.6%); and weight loss (48.1%). Subjects also reported a mean of 5.2 psychological side-effects from ecstasy in the preceding six months, the most common of which were loss of energy (reported by 82.7% of the sample); irritability (78.4%); depression (62.7%); trouble sleeping (60%); confusion (54.1%); anxiety (49.2%) and paranoia (46.5%). Dependent subjects reported a significantly higher number of both physical (9.5 versus 6.9; t_{183}=4.76; p<.001) and psychological (6.2 versus 4.5; t_{183}=5.47; p<.001) side effects than nondependent subjects.

Three-quarters of the sample (77.3%) had noticed changes in these physical and/or psychological side-effects from ecstasy since they first began to take the drug. The most common changes reported were increases in severity or duration of side-effects, notably energy loss (38.9% of the sample); depression (35.1%); irritability (35.1%); anxiety or panic attacks (20.5%); paranoia (16.2%); muscle aches (13.5%); headaches (8.6%); palpitations (7.0%); vomiting (4.3%) and tremors (4.3%). On the other hand, a substantial minority of the sample (15.1%) reported that their side-effects were currently less intense than at the beginning of their use careers. Dependent subjects were significantly more likely to report increased depression than nondependent subjects (χ^2_1=9.9; p=.02); along with increased paranoia (χ^2_1=13.4; p<.001); increased irritability (χ^2_1=8.0; p<.005); and increased anxiety or panic attacks (χ^2_1=4.6; p=.03). These results indicate that dependent subjects were more likely than nondependent subjects to experience an increase in severity of the psychological side effects of ecstasy.

Table 4: Physical side effects of ecstasy (*N*=185)

SYMPTOM	Last 6 mths (%)	While intox'	While coming down	At other times	Length worst case (median)	Caused only by ecstasy (%)
Muscular aches	75.1	7.9	96.4	12.9	2 days	34.5
Blurred vision	54.6	96.0	25.7	4.0	1 hour	70.3
Hot / cold flushes	52.4	81.4	55.7	7.2	2 hours	47.4
Dizziness	49.7	71.7	50.0	18.5	20 mins	50.0
Profuse sweating	49.2	87.9	50.5	8.8	3 hours	39.6
Numbness/tingling	48.6	92.2	23.3	5.6	1 hour	63.3
Weight loss	48.1	95.5	95.5	80.9	60 days	23.6
Tremors/shakes	47.0	70.1	57.5	16.1	3 hours	43.7
Heart palpitations	46.5	90.7	37.2	11.6	30 mins	38.4
Stomach pains	44.9	68.7	59.0	9.6	2 hours	47.0
Headaches	44.9	21.7	88.0	10.8	8 hours	37.3
Inability to urinate	41.1	100.0	9.2	1.3	3 hours	85.5
Joint pains/stiffness	39.5	9.6	97.3	16.4	2 days	24.7
Shortness of breath	34.1	84.1	27.0	4.8	1 hour	34.9
Vomiting	33.5	95.2	21.0	3.2	3 mins	67.7
Teeth problems	31.9	23.7	84.7	42.4	3 days	39.0
Blackout/memory lapse	28.1	55.8	59.6	67.3	3 hours	25.0
Chest pains	20.5	57.9	52.6	21.1	1.25 hours	18.4
Fainting/pass out	6.5	75.0	33.3	8.3	3 mins	41.7
Fits/seizures	1.1	50.0	50.0	0	30 secs	50.0

Column 1 indicates the proportion of the sample reporting the side effect in the preceding six months. Columns 2-4 show, of those who reported the side effect, the proportion who experienced it at different times (while acutely intoxicated, while coming down and at other times). Column 5 displays the median length of the worst case in the preceding six months. Column 6 indicates the proportion of those experiencing the side effect who believed that it was solely caused by ecstasy, rather than a combination of factors, such as other drug use, the context in which the drug was used, and/or preexisting conditions.

Table 5: Psychological side effects of ecstasy (*N*=185)

SYMPTOM	Last 6 mths (%)	While intox'	While coming down	At other times	Length worst case (median)	Caused only by ecstasy (%)
Loss of energy	82.7	5.9	98.7	23.5	3 days	48.4
Irritability	78.4	2.1	97.9	26.9	2 days	46.9
Depression	62.7	2.6	93.1	36.2	3 days	47.4
Trouble sleeping	60.0	25.2	98.2	23.4	12 hours	43.2
Confusion	54.1	58.0	79.0	11.0	13 hours	53.0
Anxiety	49.2	57.1	75.8	23.1	12 hours	48.4
Paranoia	46.5	54.7	74.4	14.0	4 hours	37.2
Visual hallucinations	21.1	100.0	12.8	5.1	1 hour	51.3
Sound hallucinations	15.1	85.7	35.7	0	19.5 mins	46.4
Loss of sex urge	13.0	58.3	62.5	45.8	45 hours	37.5
Panic attacks	10.8	70.0	25.0	10.0	1 hour	50.0
Suicidal thoughts	10.8	0	95.0	45.0	5.5 hours	30.0
Flashbacks	10.3	0	21.1	89.5	5 mins	63.2
Violent behaviour	1.6	0	100	66.7	3 days	0
Suicide attempts	1.1	0	50.0	50.0	-	0

Column 1 indicates the proportion of the sample reporting the side effect in the preceding six months. Columns 2-4 show, of those who reported the side effect, the proportion who experienced it at different times (while acutely intoxicated, while coming down and at other times). Column 5 displays the median length of the worst case in the preceding six months. Column 6 indicates the proportion of those experiencing the side effect who believed that it was solely caused by ecstasy, rather than a combination of factors, such as other drug use, the context in which the drug was used, and/or preexisting conditions.

Multiple linear regressions were performed to determine which variables were independently associated with physical and psychological side effects. Variables entered into the models included age, gender, current dependence status, total number of drugs used in the preceding six months, and extent of recent amphetamine and cocaine use. Backwards elimination was used to select the most appropriate models. The final model predicting physical harms (Table 6) indicated that the strongest predictor was current dependence status, followed by age (being younger) and the extent of recent amphetamine use. This model was significant ($F_{3,181}$=15.4; p<.001), and predicted 18.9% of the variance. The final model predicting psychological harms (Table 7) indicated that the strongest predictor was current dependence status, followed by gender (being female) and extent of recent polydrug use. This model was significant ($F_{3,181}$=15.5; p<.001), and accounted for 19.1% of the variance.

Table 6: Multiple linear regression predicting number of physical side effects of ecstasy (N=185)

Variable	Coefficient	SE	T	Sig T
current dependence	2.2	.53	4.2	<.001
age	-.19	.05	-4.1	<.001
extent of recent amphetamine use	.03	.01	2.2	.03

Table 7: Multiple linear regression predicting number of psychological side effects of ecstasy (N=185)

Variable	Coefficient	SE	T	Sig T
current dependence	1.5	.32	4.7	<.001
gender	.82	.29	2.8	.006
extent of recent polydrug use	.20	.08	2.6	.01

3.6.2 Other ecstasy-related harms

Half the sample (50.8%) had experienced occupational problems as a result of their ecstasy use. Problems included sick leave or not attending classes (28.7%); feeling unmotivated (23.4%); trouble concentrating (18.1%); reduced work performance (17%); being sacked, quitting a job or being unable to find work (11.7%) and dropping out of school (1.1%). Dependent subjects were significantly more likely to report occupational problems than nondependent subjects (67.6% versus 36.9%; χ^2_1=16.7; p<.001). Half the sample (49.7%) had experienced relationship or social problems related to ecstasy, two-thirds (64.1%) of which were relatively minor, such as arguments. Smaller proportions reported mistrust or anxiety (15.2%), the ending of a relationship (15.2%), being forced to leave home (3.3%), and violence (2.2%). Dependent subjects were significantly more likely to report relationship problems than nondependent subjects (68.9% versus 36.9%; χ^2_1=18.2; p<.001).

Half the sample (49.2%) had experienced financial problems related to ecstasy use, half (45.1%) of which were relatively minor, with subjects reporting that their expenditure on drugs left them with no money for other recreation or luxuries. However, a quarter of those who had financial problems (27.5%) had been in debt due to their drug use, and a further quarter (27.5%) had been unable to pay their rent or buy food. Dependent subjects were significantly more likely to report financial problems than nondependent subjects (67.6% versus 36.9%; χ^2_1=13.9; p<.001). Only seven subjects (3.8%) had legal problems related to ecstasy. Of these, five subjects had been cautioned by police, and two subjects had been arrested. A minority of the sample (3.2%) reported a complete loss of interest in non-drug related activities. Subjects felt that they had such a good time while they were intoxicated on ecstasy that other activities were seen as meaningless or worthless.

An index of total ecstasy-related harms experienced in the preceding six months was calculated by adding the number of different harms reported (physical, psychological, occupational, financial, relationship and legal). Mean number of harms experienced by the sample as a whole was 14.7 (SD 6.1; range 1-28). Currently dependent subjects had experienced a significantly greater number of harms than nondependent subjects (17.5 versus 12.2; t_{183}=-6.65; p<.001). Multiple linear regressions were performed to determine which variables were independently associated with extent of ecstasy-related harm. Variables entered into the model included age, gender, current dependence status, total number of drugs used in the preceding six months, and extent of recent amphetamine and cocaine use. Backwards elimination was used to select the most appropriate models. The final model (Table 8) indicated that dependence status and age (being younger) independently predicted extent of harm. This model was significant ($F_{2,182}$=37.5; p<.001), and accounted for 28.4% of the variance.

Table 8: Multiple linear regression predicting extent of ecstasy-related harm (*N*=185)

Variable	Coefficient	SE	T	Sig T
current dependence	.89	.15	6.2	<.001
age	-.08	.01	-5.8	<.001

3.7 Perception of Risks

Subjects were asked to rank on an 11-point scale how "hard" or "risky" an illicit drug they considered ecstasy to be *in general* (with the point '0' anchored by cannabis and '10' anchored by heroin). Mean risk score was 5.1 (SD 1.7; range 0-10), indicating that subjects considered ecstasy to fall approximately half-way between cannabis and heroin in terms of possible associated risks. Similarly, when asked to name the three main risks of ecstasy use for *users in general*, all subjects were able to nominate three, and no subjects chose the option, "no risks". The main risks of ecstasy use were considered to be emotional problems (such as depression or paranoia; nominated by 47% of the sample), impurities/cutting agents (42.2%), long term physical problems (such as being run down and susceptible to infection; 29.7%), short term physical problems (such as dehydration or overheating; 29.7%), financial problems (25.9%), the unknown long term effects (23.8%), dependence (21.1%), a toxic reaction (conceived as needing emergency medical treatment; 16.2%), legal problems (14.6%), cognitive problems (11.4%) and death (10.8%).

Despite this impressive knowledge of possible risks, when asked how safe they thought it was to use ecstasy *for them personally*, very few subjects indicated that they considered it "quite risky" (4.3% of the sample) or "very risky" (0.5%). Most subjects considered their use of ecstasy to be "quite safe" (37.3%) or "moderately safe" (31.4%), or "very safe" (26.5%). There was no difference in perception of either personal or general risks between dependent and nondependent subjects. Further, dependent subjects were no more likely than nondependent subjects to nominate dependence as a main risk associated with ecstasy use.

3.8 Moderating ecstasy use

Just over half (55.1%) of the sample had attempted to reduce their use of ecstasy at some time, 85.3% of whom had done so in the preceding twelve months. Among those who had attempted to cut down or quit, the main reasons for doing so were financial reasons (64.7% of those who had tried to cut down), physical health effects or risks (50%), psychological effects or risks (34.3%), occupational problems (32.4%), relationship problems (23.5%) and to improve quality of life (13.7%). Dependent subjects were significantly more likely than nondependent subjects to have attempted to

moderate their use in the preceding twelve months (63.5% versus 36.0%; χ^2_1=13.5; *p*<.001).

In addition, 16.2% of the sample felt that they had needed help for an ecstasy problem in the past, and 7.6% (*n*=14) reported a current problem with ecstasy. Those who perceived that they had a current problem wanted to either quit completely (*n*=2) or cut down significantly (*n*=12). The most common reasons cited were financial problems (*n*=7), psychological problems (*n*=7), physical health problems (*n*=5), relationship problems (*n*=5), occupational problems (*n*=5), feeling addicted (*n*=5) and to improve quality of life (*n*=3). Dependent subjects were significantly more likely than nondependent subjects to perceive a current problem with ecstasy (13.5% versus 3.6%; χ^2_1=6.2; *p*<.05), although this result should be interpreted cautiously due to small subject numbers. Although few subjects perceived a current problem with ecstasy, almost one-third of the sample (31.4%) wanted to cut down on the drug, and a further 3.2% wanted to stop using. Dependent subjects were significantly more likely than nondependent subjects to want to cut down (41.9% versus 23.4%; χ^2_1=7.1; *p*<.01) or quit (6.8% versus 0.9%; χ^2_1=4.9; *p*<.05).

3.9 Criminal behaviour

Over one-third of this sample (38.9%) had not committed any crime in the preceding month. One half (49.6%) had sold drugs for profit in the preceding month, 44.4% of whom had done so less than once a week. One-third (38.9%) of those who had dealt drugs had done so more than once a week. One quarter of the sample (25.9%) had engaged in property crime in the preceding month, the majority of whom (68.8%) did so less than once a week. Only 10.4% of those who had committed property crime reported that they did so more than once a week in the preceding month. Eight subjects (4.3%) had committed fraud in the preceding month, seven of whom had done so less than once a week. Four subjects (2.2%) had committed violent crime in the preceding month. One of these subjects dealt in arms on a daily basis. Median OTI crime score was 1. Dependent subjects had significantly higher crime scores than nondependent subjects (median 2 versus 0; *U*=1670.0; *p*<.0001), indicating a higher degree of criminal involvement.

3.10 HIV risk-taking behaviour

3.10.1 Injecting behaviour

The majority of this sample (90.3%) had not injected any drugs in the preceding month. Of those that had (*n*=18), one-third (*n*=6) had done so once a week or less frequently, and one-half (*n*=9) had done so more than once a week. The remainder (*n*=3) had injected drugs once a day or more often in the preceding month. The majority of current injectors had neither used a needle after another person (*n*=16), nor lent a used needle to another person (*n*=15). Of the three subjects that re-used needles, only one always used bleach to clean them prior to re-using.

3.10.2 Sexual behaviour

Mean HRBS Sexual Behaviour subscale score was 4.5 (SD 3.5; range 0-16). On average, dependent subjects had significantly higher HRBS Sexual Behaviour scores than nondependent subjects (5.5 versus 3.8; t_{183}=-3.22; p=.002), indicating a higher degree of sexual risk-taking. The majority of this sample (85.3%) identified as heterosexual, with smaller proportions identifying as bisexual (7.1%), gay male (6.0%) and lesbian (1.6%). Over one-half of the sample (52.4%) were currently in a steady relationship, and the median length of these relationships was 9 months (range: 2 weeks - 13 years). In the preceding month, 19.5% had not engaged in penetrative sexual activity, while 54.1% had sex with one person in that time, 14.6% with two people, 8.6% with between three and five people, 2.2% with between 6 and 10 people and one subject with more than 10 people. One quarter (25.5%) of those who had engaged in sexual activity had done so with casual partner(s) only, while 57.0% had sex with regular partner(s) only. Of those that had sex with casual partners, just over one-half (57.8%) had always used condoms, while 23.5% had done so rarely or never. Two-thirds (62.2%) of those who had sex with regular partners never used condoms, while 30.6% did so often or every time. Only one subject had been paid for sex in the preceding month, and had always used condoms when doing so. These figures suggest that this sample was more likely to engage in unprotected sex with regular partners than casual partners. Only a minority of those who had engaged in penetrative sex had anal sex in the preceding month (15.4%; n=23). In the preceding six months, only 8.6% of the sample had not engaged in sexual activity, and of those that had, median number of partners was 2 (range 1-70).

3.10.3 The effects of ecstasy on sexual behaviour

One half of this sample (50.3%) had sex while acutely intoxicated on ecstasy in the preceding six months, and the majority of these (75.3%) had done so more than once. Not surprisingly, dependent subjects had sex while intoxicated significantly more often than nondependent subjects (χ^2_5=26.9; p<.0001). One-fifth (21.5%) of those who had sex while using ecstasy had done so with casual partners only; while 58.1% had done so with regular partners only. Less than half (46.2%) of those who had sex with casual partners while using ecstasy had always used condoms, while 28.2% had never or only rarely done so. Dependent subjects used condoms significantly less often with casual partners while intoxicated than nondependent subjects (χ^2_5=10.5; p=.05). Over two-thirds (68.5%) of those who had sex with regular partners while using ecstasy had never used condoms, and 21.9% had always or often done so. While intoxicated, dependent subjects used condoms less often with regular partners than nondependent subjects (χ^2_5=11.2; p=.05). These figures suggest that the sample as a whole was more likely to engage in sexual activity with regular partners while intoxicated than casual partners, and were less likely to use condoms with their regular partners than casual partners. However, given the short-term and transient nature of many "steady relationships", these figures are still cause for concern. Moreover, dependent subjects were having sex while intoxicated more often than nondependent subjects, and were less likely to use condoms at this time, regardless of whether the partner was regular or casual.

Most of those who had sex while intoxicated in the preceding six months reported that sex was improved through the use of ecstasy (72%), while smaller proportions reported that sex was worse (6.5%) or that the effects were unpredictable (19.4%). Other reported effects of ecstasy on sex were that subjects felt more loving, intimate and communicative (69.9% of those who had sex while intoxicated); less inhibited (68.8%); or that it inhibited arousal and/or orgasm (49.5%). It is interesting to note that the latter was not necessarily perceived as aversive, and was often expressed in terms of comments such as, "You can go forever".

3.11 Social functioning

Over two-thirds of this sample (68.6%) had been employed for all of the preceding six months, while a further 14.1% had been unemployed for only a minority of that time. A small proportion of the sample (7.6%) had been unemployed for all of the preceding six months, while the remainder (9.7%) had been unemployed half to most of the preceding six months. Three-quarters (76.2%) reported that they had four or more close friends that they felt they could trust, and only one subject reported that they had no such friends. Most subjects (77.3%) reported that they saw their friends often or very often, suggesting that most of this sample had fairly well developed social networks to support them in times of crisis. Most subjects (83.8%) reported that half to all of the people they spent time with currently used ecstasy. Of those in a steady relationship (52.4%), most (83%) reported that their partners currently used ecstasy, while only 6% reported that their regular partners currently injected drugs. There were no differences between dependent and nondependent subjects in any social functioning measures.

3.12 Predicting current dependence status

Multiple logistic regressions were conducted to determine which variables were independently associated with current dependence status. Backwards elimination was used to remove variables which were not significantly predictive of dependence status as indicated by the Wald chi-square. The final model was significant (χ^2_4=69.3; p<.001), with a -2 log likelihood of 177.8 and a goodness of fit of 176.7. It correctly classified 76.6% of the sample as dependent or not dependent. Table 9 indicates that the variables independently associated with current dependence status were more frequent use of the drug, using a greater quantity per use occasion, a longer duration of use and age (being younger).

Table 9: Results of logistic regression predicting current dependence on ecstasy (N=185)

Variable	Beta	Odds Ratio	S.E. (Beta)	95% C.I.
Frequency of ecstasy use	.09	1.1	.02	[1.05 - 1.15]
Quantity of ecstasy used	.32	1.4	.10	[1.13 - 1.69]

Duration of use	.20	1.2	.10	[1.02 - 1.51]
Age	-.09	.91	.05	[0.84 - 1.00]

4.0 DISCUSSION

Just under half (48%) of this sample met criteria for a lifetime diagnosis of dependence on ecstasy, as assessed by the World Health Organisation operationalisation of the drug dependence syndrome. Moreover, the majority of these dependence diagnoses were current, suggesting that a substantial minority of current ecstasy users may also qualify for such a diagnosis. Those who were currently dependent experienced more adverse consequences than those who were not. These included a wider range of physical and psychological side effects, higher prevalence of financial, relationship and social problems, a wider range of other drug use, more anxieties about their drug-taking, higher levels of HIV-risk taking and criminal behaviour, and a stronger desire to moderate their ecstasy use to overcome or reduce problems, when compared to nondependent subjects. Thirdly, although the sample were engaging in high levels of polydrug use, multivariate analyses indicated that use of other drugs, and particularly use of other stimulants, could not account for these ecstasy-related harms. All multiple regressions performed indicated that current ecstasy dependence status was the strongest independent predictor of the various outcome measures. Thus, not only did subjects meet criteria for dependence on ecstasy, those who did reported significantly greater levels of consequent harm.

These results support the existence of "ecstasy dependence", but structural analyses of the DSM dependence criteria indicated that two dimensions underlay the criteria, rather than one. These results are inconsistent with the hypothesis that the drug dependence syndrome is unidimensional. Therefore, if ecstasy dependence exists, it differs from that produced by other drugs such as alcohol and the opiates. It is important to note that this finding is not confined to ecstasy dependence symptoms, as recent evidence has also failed to support the unidimensionality of the cannabis dependence syndrome (Didcott *et al.*, 1997; Swift *et al.,* 1997). It is surprising, however, since recent research has shown that the dependence syndrome is applicable to amphetamine (Topp & Darke, 1997), of which ecstasy is a related compound.

It is more surprising that subjects who used ecstasy as infrequently as once a fortnight were classified as dependent by DSM criteria. This was unexpected, and quite different to other drug classes, including alcohol (O'Brien, 1996), nicotine (Stolerman & Jarvis, 1995), opiates (Hall, Darke, Ross & Wodak, 1993), cannabis (Swift *et al.,* 1997) and amphetamine (Topp and Mattick, 1997a), where use on between three and seven days per week is the norm among dependent users. It may be the case that the dependence criteria are too liberal when applied to ecstasy, and that the present results indicate that relatively infrequent use of ecstasy is associated with a high prevalence of problems. Whether this should be considered "dependence" is a matter of debate.

The "drug dependence syndrome" attempted to redefine dependence in terms of continued use of a drug despite adverse consequences (Edwards *et al.*, 1984), and there is no doubt that this sample of current ecstasy users engaged in repeated use of the drug in the face of substantial harm. It is nonetheless difficult to conceptualise dependence on a drug from which users can abstain from 10 to 14 days without undue psychological distress. Moreover, such caution is reflected in the attitudes of ecstasy

users themselves. One example of this is the low SDS scores of the sample compared to those of dependent amphetamine (Topp & Mattick, 1997b) and heroin (Darke & Hall, 1996) users. Although the present sample reported significant levels of ecstasy-related harm, the majority did not equate this with "having a problem" with the drug. They were confident that they could go without it and that giving up would not be difficult. Further, dependent subjects did not perceive the drug as any riskier than nondependent subjects, and this appeared to be related to the fact that very few used on more than two days per week. The notion seemed to be, "How can I be addicted to a drug that I don't use on most days?" An analogous pattern of drug use is "binge drinking", in which individuals do not use alcohol on a majority of days, yet still report substantial alcohol-related harm. Hall, Hunter and Spargo (1993; Hunter, Hall & Spargo, 1992) found that among indigenous Australians living in remote areas, many drank as infrequently as less than monthly, yet reported a high prevalence of alcohol-related harm. Again, whether this should be considered alcohol dependence is a matter of debate.

Another relevant factor is the young age of the sample when compared to samples of Sydney amphetamine users (eg. Hando, Topp & Hall, 1997; Topp & Darke, 1997), who tend to be in their mid-20s, and Sydney heroin users (Darke & Hall, 1995; Hall, Darke, Ross & Wodak, 1993), who are about 30. Age was a significant predictor of two of the three measures of ecstasy-related harm (physical side-effects and extent of total harm). In both cases, being younger was independently associated with greater harm. Further, multivariate analyses showed that younger age made an independent contribution to current dependence status, over and above that made by ecstasy use variables including quantity, frequency and duration. The upper confidence interval for this predictor did cover chance, but recent research has indicated that at the same intensity of cannabis use, adolescent users are more likely to be dependent than adults (Chen, Kandel & Davies, 1997). It was speculated that adolescents may be more vulnerable than adults to the social and psychological consequences of cannabis use. It is possible that these findings may extend to ecstasy and to young adults. That is, younger ecstasy users may be more vulnerable, not only to dependence per se, but also to the range of harms associated with dependence.

Our impression throughout the interviews was that the younger users were more likely to be "out of control" with ecstasy. Drug use was all-consuming and their sense of identity revolved around drug-taking and the related "scene". The reasons for this relate to the nature of adolescence, the time when self-identity develops (Erikson, 1967). Greenberg (1992) noted that adolescents tend to feel that they are immortal, that there will be little consequence to their risk-taking, and that they need not deal with problems now because there will be many opportunities to do so in the future. On the other hand, adults generally acknowledge their limitations. Moreover, Stewart and Brown (1995) pointed out that younger drug users are less likely to be employed or in committed relationships than older users, which perhaps makes dependence more of an "option" for them. In other words, the fewer commitments a user has, the more opportunity ecstasy may have to become central. The contiguity between the relatively short heaviest use episodes and diagnoses suggests that dependence on ecstasy is constrained by environmental influences and social norms. Perhaps, as with other drugs, users tend to arrive at a given level of maturity or a certain situation in life, and priorities other than drug use begin to take precedence (Chen & Kandel, 1995). Further,

when an ecstasy user arrives at that point, the drug may be easier to go without than other drugs such as heroin or alcohol, but until the user makes that decision, consideration of abstention is laughable.

When discussing the caveats placed upon the possibility that ecstasy dependence exists, there can be no doubt that conceptions of "dependence" have been influenced by the heavy, daily use of drugs observed in heroin- and alcohol-dependent people. Further research will need to clarify whether ecstasy is a unique case in which dependence is possible with use at a level of once per fortnight, or if it is the case that our conceptions of dependence, derived from alcohol and the opiates, do not fit this class of drug. Recent research from a number of countries has described dependent amphetamine users and the harms they report (eg. Greenblatt & Gfroerer, 1995; Hall, Hando, Darke & Ross 1996; Kaplan, Husch & Bieleman, 1994; Klee, 1992; Klee & Morris, 1994). A sensible place to begin examining ecstasy dependence would be to compare regular amphetamine and ecstasy users. An understanding of the patterns and correlates of weekly or more frequent ecstasy use, and how these relate to analogous amphetamine use, may help to elucidate the nature of dependence on ecstasy.

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