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Differential experiences of the psychobiological sequelae of ecstasy use: quantitative and qualitative data from an internet study

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Abstract

Previous work provided preliminary evidence that different patterns of use among ecstasy users may impact on perceived side-effects. Participants recruited via an ecstasy-related bulletin board differed in their responses compared to those recruited via other means. The present investigation compares self-reports of psychobiological difficulties among ecstasy users recruited either via a bulletin board or by alternative methods. Qualitative data included reports of any negative or positive changes attributable to ecstasy use and reasons for cessation of use. An Internet-based design was utilized and 209 volunteers completed the study, 117 of whom were recruited via a bulletin board devoted to discussion of ecstasy. Psychobiological difficulties attributable to ecstasy use varied, with mood fluctuation the most common. Differences between the two groups in the extent to which these problems were reported was found. Bulletin board recruits were less likely to report anxiety or poor concentration, but more likely to report tremors/twitches. For the whole sample, lifetime use was associated more with psychobiologial problems, although this pattern was stronger and more pervasive for the non-bulletin board participants. Bulletin board recruits were more aware of possible negative psychological effects and were more likely to report adopting harm reduction strategies. From the qualitative data three negative consequences of use were identified, the most common of which was 'psychological problems'. In support of the quantitative findings the likelihood of reporting psychological problems increased with lifetime exposure to ecstasy in both recruitment conditions but interestingly this did not appear to impact on reasons for cessation of use. Participants also reported a number of effects that they regarded as beneficial. Future research should also take these aspects of use into account.

Key words

MDMA, ecstasy, 3,4-methyleldioxymethamphetamine, side-effects, neuroprotection

Introduction

It has become apparent in the last 20 years that the use of recreational drugs is not without cost, with a large body of research outlining the potential side-effects of a number of substances, including the popular dance drug 'ecstasy'. The sequelae associated with ecstasy use appear to range from medical/physiological to psychological and neuropsychological/cognitive difficulties. Research which has attempted to determine the side-effects of ecstasy/MDMA use has taken two forms. Laboratory-based animal studies have sought to provide an understanding of the pharmacological actions and consequences of controlled doses of MDMA (Hegadoren *et al.*, 1998; Colado *et al.*, 2001; Green *et al.*, 2003). Human volunteer studies have also been undertaken in an attempt to identify any potentially harmful side-effects of recreational ecstasy/MDMA use in real world settings (Fox *et al.*, 2000; Gouzoulis-Mayfrank *et al.*, 2000; Parrott *et al.*, 2000; Rodgers *et al.*, 2000; Fox *et al.*, 2001; Parrott *et al.*, 2001; Rodgers *et al.*, 2001; Rodgers *et al.*, 2003; McCardle *et al.*, 2004; Parrott, 2004). Both types of research have provided valuable information in rela-

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tion to the impact of the use of ecstasy at a number of levels. However, as this body of research has advanced it has become apparent that the use of recreational substances is a very complex phenomenon and that a range of factors need to be taken into account when trying to tease apart the actual impact of use, and that many of these factors are not easily replicable within laboratory settings.

There is now growing evidence that some ecstasy users will actively engage in 'harm-reduction' activities in an attempt to protect against any potentially damaging side-effects. Little focus has been given to date to the motivations for drug use with few researchers gathering information from users about what they believe to be the 'benefits' of use. Similarly although much work has been undertaken documenting and describing potential harmful effects from both empirical studies and self-report questionnaire data very little attention has been directed at asking users what they believe the negative consequences of use are, nor has much focus been given to gaining an understanding of the reasons why individuals decide to cease drug use. Gaining an understanding of the patterns of use, perceived advantages and disadvantages of use and reasons for quitting is critical to a clear and comprehensive understanding of the potential impact of ecstasy use.

Long-term negative consequences of use are not inevitable, with some users reporting few side-effects. What is unclear at the present time is which factors influence long-term outcomes. A clearer understanding of the potential risk factors and the possible protective factors is critical at this stage. Is it that there is a critical threshold of drug consumption beyond which users will begin to perceive negative side-effects (e.g. Parrott *et al.*, 2000; Parrott *et al.*, 2002; Scholey *et al.*, 2004) or that the neuroprotective factors described by users are indeed effective?

The findings of two previous investigations from our laboratory utilizing a web-based design suggested that the difficulties with memory performance among users of ecstasy and cannabis witnessed in objective, laboratory investigations are discernible to users in real-life settings and may be causing difficulties in day to day living (Rodgers *et al.*, 2001, 2003). What is more Rodgers *et al.* (2003) also provided preliminary evidence that different patterns of use within the same drug using population may have an impact on perceived outcome. We reported that participants recruited via an Internet bulletin board devoted to discussion of ecstasy (from the users' perspective) displayed a different pattern of responses from those recruited via other means. This bulletin board site provides a large amount of information about ecstasy, advice on possible techniques to protect oneself against harmful side-effects and discussion forums where extensive and well-informed discussions of these issues, as well as of individual users' experiences, take place. The kind of harm-reduction strategies commonly discussed include limiting drug intake, avoiding overheating or taking various dietary supplements. It was hypothesized that people recruited via this website might be more likely to be implementing possible neuroprotective strategies, and that this (either due to biased responding, or because the strategies actually made a difference) might impact on the levels of memory impairment they report. The potential importance of this finding is clear and these results clearly need to be followed up.

In summary, whilst a significant amount of important work into the potential impact of the use of ecstasy has been undertaken there are still many unanswered questions, including a clearer understanding the use of *and impact of* neuroprotective strategies, the perceived benefits and negative aspects of drug use and the most common reasons for cessation of use.

Taking these issues into account the present investigation aims to use both quantitative and qualitative methods to compare self-reports of psychobiological difficulties among ecstasy users recruited via an ecstasy-related bulletin board site and those recruited by other means. In order to gain a clearer understanding of the pros and cons of drug use from the users' perspective, participants were invited to describe in their own words any negative or positive changes they had observed in themselves that they would attribute to their ecstasy use and if applicable their reasons for deciding to stop using ecstasy. The inclusion of this additional qualitative aspect is important because most questionnaire-based research to date has necessarily required participants to describe their experiences in terms of predefined categories (e.g. a list of symptoms). It may be that we can learn about other side-effects of MDMA use by gathering accounts from people in the best position to tell us about them: ecstasy users. Furthermore, most of the literature published to date addresses likely deleterious consequences of drug use, not those aspects that users see as positive. Asking people to describe positive sequelae may give further information on acute and chronic effects of MDMA use, and also insights into the cost–benefit analysis users must engage in when deciding to take the drug in full knowledge of its potential harmful effects.

A web-based methodology was adopted due to the significant advantages such techniques may confer when trying to reach a specialized population or address questions that people might be reticent to answer (e.g. pertaining to illegal drug use) using traditional research methods (e.g. Reips, 2000; Rodgers *et al.*, 2003), and to maximize the recruitment of individuals using the Internet-based bulletin board.

Methods

Materials

A website was created for the purposes of data acquisition. It was hosted on the University of Westminster web server, and could be accessed via a number of different addresses (e.g. www.drug research.org.uk).

Patterns of drug use and demographic characteristics

Drug use was assessed using a version of the UEL Recreational Drug Use Questionnaire (Parrott *et al.*, 2000) which asks respondents to estimate their level of use of ecstasy, amphetamines, cocaine, LSD, barbiturates/benzodiazepines, opiates, magic mushrooms, anabolic steroids, solvents, cannabis, alcohol and tobacco. This was slightly modified for World Wide Web (WWW) use with some drug descriptions amended to make it more suitable for an international sample. Also, in the original questionnaire, particip-

ants were required to write down estimates of their use of various substances whereas for the online version, they were simply required to select a typical frequency from a drop-down menu. For all questions regarding drugs, a 'prefer not to answer' option was also included. Participants also answered a number of demographic questions (age, sex, location, occupation and education) and questions relating to their participation (how they found out about the study, whether they were currently under the influence of any substance, and whether there was any reason their data should not be used in analyses).

Each participant was asked to indicate whether or not they had experienced any of a range of psychobiological problems while 'off-drug' that they attributed to their ecstasy use. The questions were based upon the literature on cognitive problems in ecstasy users, and covered memory problems, mood fluctuation, poor concentration, anxiety, depression, impulsivity, infections, tremor/twitches, weight loss, poor sleep and sexual problems. Each question required a binary yes/no response.

Finally, participants were asked about their knowledge of potential physical and psychological effects of ecstasy use, and to indicate whether they took any steps to try to prevent any harmful side-effect (e.g. drinking fluids, attempting to stay cool, restricting intake, taking vitamins etc.). In this section they were also asked to describe (by typing in a text box) any negative or positive changes they had observed in themselves that they would attribute to their ecstasy use and (if applicable) why they had stopped taking ecstasy.

A number of other elements were included in the questionnaire. Prospective memory (PM) was assessed using the Prospective Memory Questionnaire (PMQ; Hannon *et al.*, 1995). A series of items designed to assess executive function was also included, as were questions addressing the use of other drugs whilst on ecstasy and whilst coming down off ecstasy. In addition, participants were asked to report the circumstances in which they generally took ecstasy (e.g. at a club, alone etc.), their main activity whilst on the drug, whether they experienced feeling hot whilst taking ecstasy and their normal feelings/experiences when coming down off the drug. Analyses pertaining to these other elements of the questionnaire are reported in other work and responses to these items will not be discussed in the current paper (Parrott *et al.*, submitted).

All of these instruments were presented as interactive forms on a single web page. Different response formats (clicking on radio buttons or selecting options from a drop-down menu) were used as appropriate. If participants submitted an incomplete form (i.e. left one or more questions blank) they were automatically informed of this and requested to supply the missing data then resubmit the form.

Ethical approval for the study came via the University of Westminster, where data collection was based. Participants read a brief introduction to the study, outlining its nature and the kind of questions which would be asked, then those who wished to continue clicked on a button reading 'I understand the nature of the study and wish to continue' as an indicator of informed consent. It was emphasized that no information from which they could be personally identified would be requested at any stage, and that they were free to withdraw if they wished.

Procedure

Participants were recruited using a variety of methods. These included messages posted on the aforementioned ecstasy-related bulletin board, links from other online experiments, notices on web pages and announcements in our home institutions, and emails to personal contacts. Data arising from the bulletin board was treated separately so that we could identify participants recruited in that way.

Participants first saw an informed consent page. Via this page participants were informed that the study was designed to investigate everyday behaviour and recreational drug use. They were informed that the study aimed to look at the potential effects of using various drugs (such as tobacco, cannabis, ecstasy and so on). There was also a link to a statement on anonymity and confidentiality. This assured participants that individual respondents would be unidentifiable and that they could select 'prefer not to answer' options where appropriate.

Having entered the site, participants then saw a page bearing brief instructions, demographic items, the PMQ and drug use questionnaires, and questions about their participation. Having completed all the items, they then clicked on a button labelled 'Finished' at the bottom of the page. Participants who had not answered all the questions then saw a page indicating this, and asking them to return to the form and fill it out completely prior to resubmission. Those who had answered all the items saw a debriefing page. This thanked them, outlined the purpose of the study, provided links to several websites with information about drugs, and also a link to a web page where a summary of results would be posted on conclusion of the study. An email contact address was also provided for respondents who wished to give us feedback or ask questions.

Data screening and processing

WWW research has a number of potential attendant problems (e.g. Buchanan and Smith 1999; Buchanan 2000; Reips, 2000). These include multiple submissions of data by the same people, and the possibility of mischievous data entry. Accordingly, responses submitted by participants were screened and a number of inclusion criteria applied.

A common way of detecting multiple submissions is to log the respondent's IP address (the unique Internet address of their computer) and delete multiple responses from the same IP. We recorded all IP addresses of participants accessing the site, and those which duplicated previous addresses were automatically flagged in the data file (for ethical reasons IP addresses were not stored in the same file as information about drug use). It could be the case that more than one respondent may have used the same PC, but with no way of knowing this we therefore felt that it was appropriate to be cautious in our data screening and remove all multiple entries. This is a relatively conservative method that may lead to deletion of some valid data. However, to ensure independence of observations, it was felt that it is probably best to err on the side of caution and exclude all such submissions from analysis. Also flagged up were instances where participants indicated

they were under the influence of some substance or that there was some reason their data should not be used. Application of these criteria led to the exclusion of 240 of the initial 731 submissions. One possible reason for multiple submissions is the situation where the respondent clicks more than once on the submit button (perhaps through habit or impatience at a slow connection). These can be identified by the occurrence in the data file of identical sets of responses with very similar submission times, and controlled for by deleting all but the first such set. This led to exclusion of a further ten responses.

Fraudulent or mischievous data entry is harder to control for. One technique often employed is to use demographic information to screen out implausible responses (e.g. very young respondents claiming to have doctoral degrees). A number of respondents were excluded at this stage due to doubts about the integrity of their data: people on the 16–20 age group claiming to have postgraduate education or be retired; people claiming to have been recruited through a website on which we did not advertise; people claiming to be currently under the influence of drugs or alcohol; and one person who said they lived in Antarctica. Twelve respondents also indicated that their data should not be analysed, and were also excluded. A total of 417 participants thus remained.

Participants

The present analyses are based on those 209 people among the 417 respondents who had used ecstasy. Data from 209 individuals who had used ecstasy on at least one occasion was analysed. Of these 209 ecstasy users, 92 were recruited through non-bulletin recruitment strategies and 117 entered the study via a link from the bulletin board website. Demographic characteristics of the entire sample and sub-samples from the two recruitment conditions can be found in Table 1.

Table 1 indicates that there are demographic differences between the two groups. Those recruited via the bulletin board are more likely to be male, (73% of the bulletin board sample vs. 42% of the non-bulletin board sample), to be younger (modal age 16–20 vs 21–25), and more likely to be based in the USA (vs Europe). In summary then participants recruited via the bulletin board are most likely to be teenage, male Americans, and the non-bulletin board recruits are most likely to be female, Europeans in their early twenties.

Results

Ecstasy use

Among the entire sample, 27% had used ecstasy 1–9 times, 54% had used ecstasy 10–99 times and 19% had used ecstasy on more than 100 occasions. Of those recruited via the bulletin board 33% had used ecstasy 1–9 times, 50% had used ecstasy 10–99 times and 17% had used ecstasy on more than 100 occasions. Of those recruited via other means 21% had used ecstasy 1–9 times, 60% 10–99 times and 19% more than 100 times. When the lifetime level of ecstasy use is compared, there is no significant difference between the bulletin board group and participants recruited via other means (chi-square (df = 2, $n = 209$) = 0.402, $p = 0.134$). The bulletin board group are more 'recent' in the onset of their use of ecstasy, 30% of this group first used 0–1 years ago, 56% 1–5 years ago, and 14% 5+ years ago. For the non-bulletin board group, the corresponding figures are 10%, 53% and 37%. This difference is significant using chi-square (df = 2, $n = 208$) = 20.66, $p = 0.0000$.

Self-reported off-drug problems attributed to MDMA

Existence of self-reported cognitive problems attributed to MDMA use was examined for the 209 ecstasy users in the sample on the basis of their yes/no answers to whether they had experienced any of a list of off-drug psychobiological problems that they attributed to their use of MDMA. As indicated in Table 2 (left side), there was considerable variance in the extent to which each such problem was reported, with frequencies ranging from only 9.7% for infections to 59.7% for mood fluctuation. There were also differences between the two recruitment groups in the extent to which these problems were reported (Table 2, right side, chi-square analyses). Participants recruited via the bulletin board were

Table 1 Demographic characterisitcs of participants

	Whole sample $n = 209$	Non-bulletin board $n = 92$	Bulletin board $n = 117$
Gender	M:F *124*:85 (60% vs 40%)	M:F *39*:53 (42% vs 58%)	M:F *85*:32 (73% vs 27%)
Modal age	16–20 years ($n = 77$, 37%)	21–25 years ($n = 41$, 47%)	16–20 years ($n = 59$, 50%)
Modal location	Europe ($n = 105$, 50%)	Europe ($n = 69$, 75%)	USA ($n = 46$, 40%)
Modal education	Beyond High School ($n = 69$, 33%)	Beyond High School ($n = 26$, 28%)	Beyond High School ($n = 43$, 37%)
Modal occupation	Student ($n = 105$, 50%)	Student ($n = 51$, 55%)	Student ($n = 54$, 46%)

Table 2 Proportion of MDMA users indicating off-drug problems they attributed to their ecstasy use

Problem	Whole sample	Non-bulletin board	Bulletin board	Chi-square	(df, n)
Memory problems	39.3%	40.0%	38.8%	0.03	1, 206
Mood fluctuation	59.7%	63.3%	56.9%	0.84	1, 206
Poor concentration	43.5%	51.6%	37.1%	4.41*	1, 207
Anxiety	42.0%	52.2%	34.2%	6.69**	1, 207
Depression	49.5%	52.2%	47.4%	0.47	1, 206
Impulsivity	26.2%	32.2%	21.6%	2.98	1, 206
Infections	9.7%	8.9%	10.3%	0.12	1, 206
Tremor/twitches	25.2%	17.8%	31.0%	4.72*	1, 206
Weight loss	35.7%	34.4%	36.8%	0.12	1, 207
Poor sleep	40.8%	36.7%	44.0%	1.12	1, 206
Sexual problems	11.7%	11.1%	12.1%	0.05	1, 206

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

significantly less likely to report anxiety or poor concentration, but significantly more likely to report tremors/twitches.

Parrott *et al.* (2002) showed that people with a higher lifetime level of ecstasy use were more likely to report these psychobiological problems. The same pattern was evident in the current data. For the whole sample, level of MDMA use was significantly, positively associated with frequency of reporting a number of these problems (Table 3).

When the sub-samples of individuals recruited via the bulletin board and by other means are analysed independently, this pattern becomes stronger for the non-bulletin board participants. Some trends remain, but become markedly weaker for those participants recruited through the bulletin board. Indeed, among the bulletin board participants, only memory problems are significantly associated with level of MDMA use (weight loss and poor sleep approach significance, with p values of 0.057 and 0.098 respectively).

The positive and negative aspects of 'ecstasy' use and reasons for cessation of use

Text answers to at least one of the open-ended questions were submitted by 160 people, of whom 157 indicated they had used ecstasy. The percentages reported below are based on these 157 individuals only. The written comments were coded by a rater blind to the drug use scores of participants and naive to the questions on psychobiological problems attributed to ecstasy. Content analysis, using both manifest and latent coding and categorizing techniques, led to identification of a number of categories of comment (each of these is comprised of a number of subcategories, reported by much smaller numbers of people).

Negative effects of ecstasy use Three broad themes emerged in relation to negative effects of ecstasy use. Interestingly the most frequently cited theme was 'psychological problems' reported by 31.8% of the sample. Comments here included, 'After doing E one night, I find it hard not to think about doing it really soon again. But I can't, I know that's bad for me. The problem is you want more', 'In general for about a week up to month afterwards can make me irritable or unable to concentrate or remember as well but after that period of time I feel normal again', 'low concentration span – depression – anxiety about stupid things – paranoia', 'being mildly depressed, being anxious, irritable and impulsive – not at ease', 'For a week or so I became quite depressed. I wanted to be happy, but thought what's the point? I thought too much about life and my problems', 'After taking MDMA . . . I suffered severe depression and acute panic attacks for several weeks'.

'Social problems' were identified by 12.1% of respondents, including, 'Social situations are more intense and anxiety builds up', 'getting too extrovert – getting too intimate with people', 'Being impulsive: saying things I don't really mean: having sex with people I don't really fancy: not realizing when to stop (physically)'.

The third theme to emerge in relation to negative aspects of use was 'physical problems' reported by 10.2% of participants. The physical difficulties identified included 'extreme weight loss, tiredness the day after MDMA intake', 'Approximately for a week after taking ecstasy I feel drained, slightly withdrawn', 'Eye twitching when off drug – grinded teeth', 'When I take ecstasy I don't get hot, I get extremely cold', 'My sex-drive seems decreased for a few days after taking ecstasy'.

Chi-square analyses indicate that only one negative theme is significantly associated with ecstasy use (psychological problems). In the 1–9 (light user) category, only 14.3% of the respondents reported psychological problems. However, for the 10–99 and 100+ groups, many more (38.1 and 38.7% respectively) reported problems. (Chi-square ($df = 2$, $n = 157$) $= 8.15$, $p = 0.017$). Recruitment groups (Bulletin board vs non-bulletin board) did not differ in their reporting of this theme. (Chi-square ($df = 1$, $n = 155$) $= 0.45$, $p = 0.50$).

Positive effects of ecstasy use Six themes emerged in relation to positive aspects of ecstasy use. The most frequently cited positive theme was 'a changed outlook on life' reported by over one third of the sample (38.2%). This theme included comments such

Table 3 Proportion of MDMA users indicating off-drug problems they attributed to their ecstasy use in relation to level of use

		MDMA use				
Sample	Problem	1–9	10–99	100+	Chi-square	(df, N)
Whole sample						
	Memory problems	18.5%	41.6%	61.5%	18.11***	2, 206
	Mood fluctuation	37.0%	66.5%	71.8%	16.00***	2, 206
	Poor concentration	23.6%	47.8%	59.0%	13.48***	2, 207
	Anxiety	29.6%	47.4%	43.6%	4.78	2, 207
	Depression	29.6%	57.5%	53.8%	11.73**	2, 206
	Impulsivity	11.1%	31.0%	33.3%	8.71*	2, 206
	Infections	3.7%	12.4%	10.3%	3.16	2, 206
	Tremor/twitches	14.8%	28.3%	30.8%	4.31	2, 206
	Weight loss	13.0%	41.2%	51.3%	17.79***	2, 207
	Poor sleep	24.1%	42.1%	60.5%	12.46**	2, 206
	Sexual problems	3.7%	10.6%	25.6%	10.45**	2,206
Non-bulletin board						
	Memory problems	10.3%	53.3%	56.3%	15.72***	2, 90
	Mood fluctuation	27.6%	80.0%	81.3%	23.55***	2, 90
	Poor concentration	20.0%	62.2%	81.3%	19.66***	2, 91
	Anxiety	20.7%	71.1%	56.3%	18.10***	2, 90
	Depression	24.1%	64.4%	68.8%	13.61**	2, 90
	Impulsivity	13.8%	42.2%	37.5%	6.77*	2, 90
	Infections	0.0%	11.1%	18.8%	7.16*[a]	2, 90
	Tremor / twitches	3.4%	24..4%	25.0%	7.49*[a]	2, 90
	Weight loss	3.4%	51.1%	43.8%	18.49***	2, 90
	Poor sleep	20.7%	37.8%	62.5%	7.81*	2, 90
	Sexual problems	0.0%	11.1%	31.3%	10.20**	2, 90
Bulletin Board						
	Memory problems	28.0%	33.8%	65.2%	8.70*	2, 116
	Mood fluctuation	48.0%	57.4%	65.2%	1.46	2, 116
	Poor concentration	28.0%	38.2%	43.5%	1.33	2, 116
	Anxiety	40.0%	31.9%	34.8%	0.54	2, 117
	Depression	36.0%	52.9%	43.5%	2.28	2, 116
	Impulsivity	8.0%	23.5%	30.4%	4.51[a]	2, 116
	Infections	8.0%	13.2%	4.3%	1.84[a]	2, 116
	Tremor/twitches	28.0%	30.9%	34.8%	0.26	2, 116
	Weight loss	24.0%	34.8%	56.5%	5.73	2, 117
	Poor sleep	28.0%	44.9%	59.1%	4.66	2, 116
	Sexual problems	8.0%	10.3%	21.7%	2.34[a]	2, 116

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

[a]likelihood ratio reported instead of chi-square due to expected count <5 in one or more cells.

as, ‘different outlook on life, more of an understanding of others, can see beauty in everything. Don’t worry about things as much’, ‘Became more open minded, happy, friendly, positive about life, creative’, ‘YES! I’m a more open person and I have coped better with how I see myself in the world. I also think ecstasy has shown me that I can be happy in any situation’, ‘Taking MDMA opened my outlook on life. It allowed me to see things in a more positive outlook and get out of the self-centered depression I was in’, ‘See the world in a whole new light. I believe it to be a new dawn in my life’, ‘Life-affirming’.

‘Understanding of self’ was the second most frequently cited positive aspect of use reported by 31.2% of the sample and including such comments as, ‘I have become more aware of myself and my relationship to others - in a positive way, as a direct result of self reflective thought through the use of ecstasy’, ‘in touch with myself and understand my life etc’, ‘Yes, it has helped me shape

the person I am today. It gave me powerful insight on my life and helped me properly analyse my problems', 'far more introspective. I can happily look at my life and analyse both negative and positive things in it. E opened the door to this'.

'Improved relationships' was reported as a positive aspect of use by 25.5% of respondents including comments such as, 'form bonds more quickly with new people I meet while on ecstasy, more affectionate with these people generally even when not on drug', 'I've been able to talk to my partner about difficult topics, and vice-versa. Opening up to friends. Generally closer relationships', 'Enhanced relationships with loved ones'.

This was followed by 'increased sociability' (17.8%) comments included, 'increased sociability, maybe due to the social 'scene', 'I've become more open, social, friendly, caring, and interested in other people', 'I believe that ecstasy has helped make me a more outgoing person. I used to be very shy person, but once I found ecstasy I became much more outgoing and social'.

'Improved psychological functioning' was cited by 8.9% of respondents comments included were 'MDMA has done so much for me psychologically and creatively', 'Improved mood for days afterwards, general increase in positive thinking', 'Accepting problems that come my way. More relaxed', 'less stress and worry'.

Finally 'healthiness' cited by 7.0% and including comments such as 'When I first rolled [took ecstasy], I was 30 pounds overweight, bored, substantially depressed. While on ecstasy, I made the decision to become active and lose weight. I began working out slowly, eventually getting to my current point of running 6 miles a day. I would never have gotten to this point without having taken MDMA, so overall, I would have to say that MDMA has greatly IMPROVED my physical health', 'I am happier in life as I now live a more active life, going out and meeting people, doing more sports, etc. – I am also eating a more balanced and healthy diet'.

Chi–square analyses indicate that 'increased sociability' was significantly associated with ecstasy use. This theme was reported by 9.5% of 1–9 category users, 16.7% of 10 -99 category users and 32.3% of the 100+ category. (Chi-square ($df = 2$, $n = 157$) = 6.46, $p = 0.04$). Recruitment group (bulletin board vs non-bulletin board) did not differ in reporting of this theme. (Chi-square ($df = 1$, $n = 155$) = 0.004, $p = 0.95$).

Cessation of use

Only a small number of individuals responded to the question about why they had stopped using ecstasy or cut their intake. This indicates that the majority of people in our sample are still 'actively engaged' drug users. For those individuals with the sample who had stopped using ecstasy two broad explanations emerged. The most frequently cited reason for cessation of use was 'moving on' cited by 15.9% and including comments such as, 'because I realised that reality is nice and I wanted to get on with my life. My first goal at that time was to finish high school and I did', 'Because I've got a responsible job now that I don't want to ruin by taking drugs and I've worked it out of my system and genuinely hardly ever want to do it anymore', 'Change in circumstances, less clubbing, increased responsibility at work (Monday mornings)'.

This was closely followed by 'negative effects' identified by 14.0%, examples of which include, 'I noticed that in the past few months, my come downs were affecting me in a big way, and that I was feeling upset, confused, depressed etc,. a lot more than usual and so I was talking to my friends about these and they had started to get worried', 'Memory loss, mood swings, generally decided not for me anymore', 'Afraid that I had permanently caused some damage. Emotional problems. Depression'.

There was no association between level of use and cessation of ecstasy use due to negative effects. However, ecstasy use was associated with cessation for reasons of 'moving on' – 2.4% (1–9 use), 17.9% (10–99 use) and 29.0% (100+ use) respectively (Chi-square ($df = 2$, $n = 157$) = 9.97, $p = 0.007$). People in the bulletin board group were significantly less likely to report cessation due to 'moving on' (perhaps due to their continued immersion in drug culture), 9.3% in the bulletin board recruitment group compared to 22.1% in the non-bulletin board group. (Chi-square ($df = 1$, $n = 155$) = 5.00, $p = 0.025$). There was no difference between the recruitment groups in cessation due to negative effects (Chi-square ($df = 1$, $n = 155$) = 1.19, $p = 0.28$).

Neuroprotective strategies

It was speculated by Rodgers *et al.* (2003) that one reason the bulletin board group might display different patterns of results was due to knowledge of possible neuroprotective strategies. There is evidence from the current study that once again the bulletin board group differs from the rest of the sample in terms of the effects they report.

When the lifetime level of ecstasy use is compared, there is no significant difference between the bulletin board group and ecstasy using participants recruited via other means. Thus any differences detected between the two recruitment groups are not attributable to different levels of lifetime use.

Knowledge of potential physical effects of ecstasy use did not differ (chi-square ($df = 1$, 207) = 0.06, $p = 0.81$), with all but two participants in each group reporting awareness of these. However in the bulletin board group there was slightly more awareness of possible psychological effects (113 from 116 respondents who answered the question, compared with 81 from 89 in the non bulletin-board condition; chi-square ($df = 1$, $n = 205$) = 4.07, $p = 0.044$).

While the majority of participants were aware of possible harmful side-effects of ecstasy use, there were clear differences between the groups in terms of whether they reported trying to counteract these side-effects. For both physical (chi-square ($df = 1$, $n = 206$) = 12.15, $p < 0.0005$) and psychological (chi-square ($df = 1$, $n = 208$) = 24.91, $p < 0.0005$) side-effects, participants recruited through the bulletin board were significantly more likely to report adopting preventative strategies.

Discussion

In this study we aimed to compare reports of difficulties experienced among ecstasy users recruited via an ecstasy-related bulletin

board site and those recruited by other means using a self-report questionnaire which addressed a range of psychobiological problems attributed specifically to ecstasy use. This related to a hypothesis from an earlier study, where individuals recruited via an ecstasy bulletin board differed in their reporting of psychobiological difficulties from those recruited via other means (Rodgers *et al.*, 2003). We were keen to determine whether there was a differential impact of recruitment groups and lifetime exposure to ecstasy in relation to the reporting of difficulties. In order to provide a richer picture of the lives of ecstasy users we also requested that participants provided us with some insight into their experiences in their own words. In order to provide some focus here we targeted three key questions, what are the negative effects of use, the positive effects of use and reasons for cessation of use? Finally, we wondered whether individuals who visited the bulletin board site, which provides information regarding so-called harm-reduction strategies, might be more likely to be implementing possible neuroprotective strategies.

When asked to report on psychobiological difficulties specifically attributable to ecstasy use, these overall findings were broadly similar to those from our previous study (Parrott *et al.*, 2002). Mood fluctuation was the most commonly reported problem while infections were the least frequently reported, whereas depression, memory problems, and many other psychobiological deficits, were again frequently described (Table 2). However, we also noted some differences between the two recruitment groups in the extent to which problems were being reported (Table 3), supporting our previous observations (Rodgers *et al.*, 2003). In particular, those participants recruited via the bulletin board were significantly less likely to report anxiety or poor concentration, but significantly more likely to report tremors/twitches. One of our concerns previously was that individuals recruited via an ecstasy-related bulletin board may be more likely to under report any adverse side-effects, but this did not generally occur (namely, tics and twitches, see above). However whereas the non-bulletin board participants showed a significant 'frequency of use' effect across all problem areas, among the bulletin board participants, only memory problems were significantly associated with level of MDMA use. Although the bulletin board recruits showed the same general trends the lifetime use trends were less steep. The reason for this is not clear. It could be that those individuals recruited via the bulletin board site were more immersed in the drug culture, and so more knowledgeable about the adverse effects of MDMA. This is certainly supported by the finding that the bulletin board group were more recent in terms of the onset of their ecstasy use than the non-bulletin board recruits. This in turn might explain why comparatively more of the light/novice users reported psychobiological problems.

Access to the bulletin boards also provides extensive information regarding supposed 'neuroprotective strategies'. Hence our findings that the participants recruited via the bulletin board, were more aware of possible negative psychological effects of MDMA, and were significantly more likely to report adopting harm-reduction strategies. This may have led to the slightly lower rates of problem being reported by heavy users at the bulletin board site (compared to non-bulletin board sites). These possible explanations are obviously only very tentative. Nevertheless consuming certain substances in order to prepare the body for ecstasy ingestion, known as pre- and post-loading is strongly advocated by user groups. The use of a wide range of substances is suggested including those purported to be neuroprotective, e.g. the serotonin precursor 5HTP, vitamin C and alpha-lipoic acid and those utilized to enhance the high by minimizing acute side-effects, such as jaw clenching (magnesium) and stomach upsets (antacids), through to grapefruit juice which it is purported inhibits CYP3A4, an enzyme that aids in metabolism – by inhibiting CYP3A4 more MDMA is made available. The presumed benefits of the range of neuroprotective strategies advocated among the ecstasy using community as yet have not been subject to empirical investigation.

With reference to the emergent themes provided by the participants about the positive and negative effects of ecstasy use, and reasons for cessation of use, three negative themes were identified. By far the most common negative theme was 'psychological problems'. The likelihood of reporting this theme increased with lifetime exposure to ecstasy. Furthermore, this was found under both recruitment conditions. However interestingly there was no association between level of use and cessation of ecstasy use due to negative effects. So although the likelihood of reporting negative effects increased with cumulative lifetime exposure this did not appear to impact on the reasons cited for cessation of use. Lifetime ecstasy use was associated with cessation for reasons of 'moving on'. The positive effects of ecstasy use were more diverse, with six themes identified. The most common theme was that ecstasy use conferred a changed outlook on life. Other themes included 'understanding of self', 'increased sociability', 'improved relationships' and 'improved psychological functioning'. Increased sociability was positively associated with increased lifetime exposure. It is interesting to note that the themes identified here mirror closely the purported therapeutic benefits of MDMA. Clearly what we are unable to determine on the basis of this data is whether these positive effects are a form of enhancement of experience or normalization of function for the individual, in other words does the use of ecstasy provide an experience that is beyond the routine or does it confer the capacity for the individual to achieve normative levels of functioning and as such is being utilized by some individuals as a form of self-medication? It is likely that both phenomena exist; a richer understanding of these perceived benefits is clearly required in order to develop appropriate models of use.

Taking into account the data from the psychobiological difficulties questionnaire it is striking that high levels of problems attributed to ecstasy use are reported by users and yet individuals continue to use the drug. It is important to attempt to ascertain why this might be the case and to try to understand users' motivations. A more detailed examination of the responses to the open-ended questions may provide us with some insight into users' perceptions of the benefits of use outweighing the costs.

At a qualitative level, it is worth noting the tone and language of respondents' written comments, as well as their factual content. Analysis of responses to the open-ended questions based on word emphasis, length of responses, number of reported effects and overall strength of response (rated by five independent raters)

were recorded. Interpretation of this data indicates that there is evidence to suggest that many users regard the benefits of use as outweighing any potential negative side effects. Reporting of the positive effects of use were given far greater emphasis, for example 'enormous euphoria and really intense great conversations', 'can see the beauty in everything', 'see the world in a whole new light. I believe it to be the dawn in my life', 'a window into the world of feeling instant happiness/love etc, a higher mood level'; whereas the negative effects were reported in a much more succinct manner. In addition only 13 respondents showed any level of regret when reporting the negative effects.

The present investigation is limited in a number of ways and these factors need to be taken into account when interpreting the findings reported. First the sample mainly consists of students who it is likely will be of above average intelligence and well educated. It would be important to determine whether the same findings apply to a wider population of ecstasy users. Furthermore there are known demographic differences between the bulletin board and non-bulletin board samples, e.g. age, gender and location, which may have influenced the results. Indeed some research indicates that there may be gender differences in both the subjective effects of and vulnerability to the neurotoxicity of ecstasy use. Liechti *et al.* (2001) describe women reporting a more intense subjective experience and more *acute* adverse reactions whilst 'on-drug'. Verheyden *et al.*, (2002) found women users reporting higher levels of depression midweek following a dose of MDMA compared to male users and male and female non-users. These findings relating to potential gender differences have not been replicated in all studies however (Rodgers *et al.*, 2003). In addition there may be other differences between the two groups that we are not aware of (given the different recruitment strategies used to enlist the participants) which could be affecting their responses. It would be useful for future research to try to identify such differences so that they can be controlled for in the evaluation of ecstasy-related effects. From a methodological point of view further limitations must be considered. The reliability and validity of the verbal reports provided by users could be explored further in future studies based on a more comprehensive qualitative design. The results here have provided preliminary evidence that this is a useful and fruitful methodology to employ to gain a greater understanding of users' views and motivations and further more detailed research should now be undertaken to explore these themes in more depth. It could be the case that the use of closed questions (relating to mood, health concerns etc.) may have influenced participants' responses to the more open-ended questions. However if this is the case then it is difficult to see how this would impact more significantly upon one group than another. It is also important to acknowledge that most ecstasy users are in fact poly-drug users and some of our findings may relate to the impact of the use of other drugs. While in this instance we have asked about problems people believe arise specifically from their ecstasy use, it is possible that other (combinations) of substances have psychobiological sequelae independently or interactively with MDMA. This is beyond the scope of the present investigation given that the the dependent variables here are explicitly linked to ecstasy use but should be borne in mind for future research. We asked participants to indicate that their date was suitable for inclusion in the study, i.e. that they were not intoxicated at the time of completion, and we also asked them to indicate the time since their last use of ecstasy e.g. whether they had used ecstasy in the last month, the last year or more than a year ago. However our current data set does not allow us to identify people who had used ecstasy in the last few days and might be experiencing a midweek low which could be influencing their responses. This information is perhaps something that future researchers may wish to consider incorporating.

In summary, a wide variety of psychobiological problems are associated with the recreational use of ecstasy, with mood fluctuation being the most common. However the nature and extent of these problems appears to differ across different sub-groups of users and this may reflect differential knowledge of the impact of ecstasy and/or the impact of neuroprotective or harm-reduction strategies. It would however be premature to assume that the relationship identified here, i.e. that those recruited via an ecstasy-related bulletin board are less likely to report the presence of psychobiological problems attributable to ecstasy use and are more likely to use harm reduction strategies implies that these strategies are effective. Further work is needed to determine what the impact of such use is.

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