

The Prevalence, Intensity, and Assessment of Craving for MDMA/Ecstasy in Recreational Users

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Abstract— This study evaluated the prevalence, intensity, and correlates of craving for MDMA/ecstasy among recreational users employing a new multi-item, self-report questionnaire reflecting experiences of desire, intention to use, and anticipated loss of control. Using a web-based data collection procedure, we recruited MDMA/ecstasy users ($n = 240$) to rate their agreement with eight craving statements immediately before and immediately following 90 seconds of exposure to either ecstasy-related or control stimuli. Participants then completed questionnaires to measure ecstasy refusal self-efficacy, passionate engagement in ecstasy use, substance use history, and demographic information. Fifty percent of participants indicated some level of agreement with at least two (out of eight) statements indicative of craving and 30% agreed at some level with six or more such statements. The questionnaire used to assess craving was internally consistent, unidimensional, and had excellent one-week test-retest reliability. Craving scores varied as a function of both cue exposure and frequency of ecstasy use, and were significantly associated with ecstasy-related attitudes. Recreational users of MDMA/ecstasy endorse some experiences indicative of craving for this drug, even though only a minority report intense craving following explicit cue exposure.

Keywords— assessment, craving, ecstasy, MDMA, prevalence

INTRODUCTION

MDMA (+/- 3, 4-methylenedioxymethamphetamine), also known as ecstasy, is taken by over 19 million people around the world (United Nations Office on Drugs and

Crime 2013), primarily for its short-term euphoric and energizing effects (Kirkpatrick et al. 2012). Although there is a growing literature on the acute subjective effects of ecstasy (e.g., Baylen & Rosenberg 2006), there is little empirical evidence regarding the prevalence and intensity with which craving, generally defined as the experience of an intense or compelling urge or desire to consume a substance (Pickens & Johanson 1992), is experienced by users of this drug. Those few studies that have assessed craving for ecstasy employed single-item rating scales, and found that participants reported greater desire on the days they were planning to use ecstasy compared to days when they were not planning to use and that craving declined sharply shortly after the drug had been consumed (Hopper et al. 2006; Huxter, Pirona & Morgan 2006).

The practical advantages of using single-item rating scales to study drug craving in naturalistic, laboratory,

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and clinical settings include suitability for rapid repeated assessment and ease of administration and scoring. However, because craving is composed of various subjective experiences (e.g., urges, strong desire, intention to consume, anticipated loss of control), and because craving may be experienced simultaneously as both pleasurable and unpleasant, users of this drug may have difficulty summarizing their experience of craving using a single numeral (Rosenberg 2009; Tiffany 1992).

Although multi-item questionnaires have been developed to assess urges and desire, intention to consume, and anticipated loss of control for other drugs of abuse (e.g., Kavanagh et al. 2013; Rosenberg 2009; Tiffany & Wray 2012), we could find no questionnaire to measure craving for MDMA/ecstasy. Therefore, using previously published craving questionnaires as a model, and based on subsequent pilot testing of 19 draft craving items, we developed an eight-item measure designed to assess one's experience of current craving for MDMA/ecstasy. We designed this study both to evaluate the psychometric properties of this multi-item ecstasy-specific craving questionnaire and to evaluate the prevalence with which specific aspects of craving were experienced by a community sample of recreational users. First, we tested the hypothesis that craving would vary as a function of exposure to ecstasy-related stimuli versus control stimuli. Second, we examined the frequency with which participants agreed and disagreed with each specific craving statement on the questionnaire. Third, we evaluated the factor structure, unidimensionality, internal consistency, and one-week test-retest reliability of the questionnaire.

We hypothesized that scores on the craving questionnaire would be associated with several ecstasy-related measures. Specifically, we hypothesized that the stronger users' craving for ecstasy, the less confident they would be that they could refuse to consume ecstasy across various contexts. Additionally, because desire for ecstasy could be related to both obsessive and compulsive use of the drug and to harmonious and well-integrated use of the drug, we hypothesized that craving scores would be associated with a measure of obsessive and harmonious passion for consuming ecstasy. Finally, because craving is often associated with increased frequency of drug consumption, we hypothesized that higher craving for ecstasy would be correlated with more frequent consumption of this drug.

METHOD

Measures

Ecstasy Craving Questionnaire-Current Craving (ECQ-CC). As the initial step in the development of the ECQ-CC, we modified statements appearing on questionnaires assessing craving for other substances; sought feedback on content and phrasing of those statements from

both experts in the field and regular ecstasy users; and created an initial pool of 19 items that reflected intense urges or desire for the drug, anticipated loss of control over consumption, intention to use the drug, expected outcomes of consumption, and desire to be in the social environment in which ecstasy is often consumed. We then used the Internet to administer the draft questionnaire to a pilot sample of 217 ecstasy users prior to and immediately following exposure to ecstasy-related or control stimuli. As part of a process of item reduction (Floyd & Widaman 1995), we conducted an unrotated principal components analysis, using only those 186 pilot participants who were exposed to ecstasy-related cues, and we deleted those six of the 19 items that cross-loaded highly on more than one component. In addition, because we wanted the questionnaire to focus on current craving, rather than more stable attitudes regarding ecstasy, we deleted those five items assessing outcome expectancies and preference for ecstasy-use environments.

The final questionnaire used in the present study contains eight items that reflect an intense urge or desire, anticipated loss of control, or an immediate intention to consume (see Table 1 for list of items). Participants were asked to use a seven-point Likert scale response format ("Completely disagree," "Moderately disagree," "Slightly disagree," "Neither agree nor disagree," "Slightly agree," "Moderately agree," "Completely agree") to rate their agreement with each statement. Ratings were later coded from -3 (Strongly disagree) to +3 (Strongly agree) for data analyses.

Ecstasy Refusal Self-Efficacy Questionnaire (ERSEQ). To test the degree to which lower self-confidence to refuse ecstasy was associated with greater craving to consume the drug, we modified the phrasing of items on the Drinking Refusal Self-Efficacy questionnaire (Young, Oei & Crook 1991) to assess participants' perceived self-efficacy to refuse to consume ecstasy in 25 specific situations. Participants in the present study were asked to rate how confident they were that they could refuse ecstasy in each of 25 situations on a scale from "0% No confidence, Cannot refuse" to "100% Extreme confidence, Certain can refuse" in increments of 10%. We calculated a total self-efficacy score by averaging across all 25 situations. Internal consistency reliability of total score in the present sample was .95.

Ecstasy-Harmonious and Obsessive Passion Scale (E-HOPS). To test the degree to which one's passionate engagement in ecstasy use was associated with craving for this drug, we modified the original 14 items of the Passion Scale (Vallerand et al. 2003), which was designed to assess passionate engagement with a variety of activities. We substituted the word "MDMA/ecstasy" in place of "this activity" in each of the original items, and participants were asked to rate each item on the E-HOPS using a seven-point scale ranging from "Do not agree at all" to

TABLE 1
Post-Cue Exposure Component Loadings, Means (Standard Deviations), and Frequency Counts for Each Item on the ECQ-CC (Ns Range = 163 to 169)

Items	Component 1	Item M(SD)	CD ^a	MD ^a	SD ^a	Neither ^a	SA ^a	MA ^a	CA ^a
			%	%	%	%	%	%	
1. I crave ecstasy right now	.90	-.33 (2.3)	29	13	7	7	18	10	17
2. I want ecstasy so bad I can almost feel it	.92	-.99 (2.2)	44	11	5	8	11	11	9
3. I have an urge to use ecstasy	.88	-.16 (2.3)	28	11	5	8	19	12	17
4. Nothing would be better than using ecstasy right now	.89	-.78 (2.3)	37	13	10	7	11	6	16
5. If I had the chance to use ecstasy now I think I would	.79	.36 (2.4)	24	7	7	8	14	9	32
6. The more I think about it, the more I want to use ecstasy	.87	-.07 (2.3)	26	11	8	5	20	11	19
7. If I started using ecstasy right now I would not stop until I had used up my whole supply	.77	-1.21 (2.3)	51	11	9	4	5	6	15
8. I would do almost anything to take some ecstasy now	.83	-1.59 (2.1)	58	10	6	9	4	4	10
Eigenvalue	5.86								
% of variance explained	73.20								
Cronbach's alpha	.95								

^aResponse options labeled: CD = "Completely Disagree"; MD = "Moderately Disagree"; SD = "Slightly Disagree"; Neither = "Neither Agree or Disagree"; SA = "Slightly Agree"; MA = "Moderately Agree"; CA = "Completely Agree."

"Completely agree," and responses were coded from 1 to 7. Based on previous research (e.g., Rousseau et al. 2002; Stoeber et al. 2011; Vallerand et al. 2003) that assigned each item to one of two subscales, we calculated two types of passionate engagement in ecstasy use: (1) Obsessive Passion and (2) Harmonious Passion. In the present sample, internal consistency reliability of the Ecstasy-Obsessive Passion subscale was .88 and of the Ecstasy-Harmonious Passion subscale was .73.

Demographic and Substance Use History Questionnaires. To provide background information on the sample and compare those assigned to each of the two cue exposure conditions, we administered the 10-item revision of the Drug Abuse Screening Test (DAST; Skinner 1982; Yudko, Lozhkina & Fouts 2007), the three-item Alcohol Use Disorders Identification Test-Consumption (AUDIT-C; Bush et al. 1998; Saunders et al. 1993), and two questionnaires designed to assess participant demographic characteristics and drug use history (see Table 2).

Procedure

Participants were recruited using online message postings, banner ads, and announcements (bluelight.ru, drugs-forum.com, erowid.org, facebook.com, hanover.edu, maps.org, pillreports.com) that directed participants to the web-based study site (hosted by surveygizmo.com). Potential participants were asked to participate only if they were at least 18 years old and no older than 65, read and understood English, had used ecstasy at least once every other week in the previous six months, and had used ecstasy at least 30 times in their lifetime.

Following presentation of the consent form, participants were asked to fill out the ECQ-CC. Then, based on month of birth, participants were assigned to one of two conditions: Cue Exposure (CE)-Ecstasy or Cue Exposure (CE)-Control. Those in the CE-Ecstasy condition viewed a 90-second video portraying 18 still photographic images, presented at the rate of five seconds per image, of ecstasy pills and of people holding and consuming ecstasy pills; the video also played electronic dance music. Those in the CE-Control condition viewed a 90-second video portraying 18 still photographic images, presented at the rate of five seconds per image, of various nuts and of people holding and consuming nuts; the video also played classical music. Both cue exposure videos are available by request to the corresponding author (AKD). Based on our hypothesis that exposure to ecstasy-related cues would impact craving, and to ensure that a large enough number of participants were exposed to the CE-Ecstasy condition to conduct psychometric analyses, including principal components analysis, approximately twice as many participants were assigned to the CE-Ecstasy condition as to the CE-Control condition.

Immediately following the video presentations, all participants were asked to fill out the ECQ-CC a second time. Following this, participants were administered the remaining measures outlined above presented in random order (except that the demographic and drug history questionnaires were always administered last). Following completion of the measures, participants were presented with a drug craving reduction script (Versland & Rosenberg 2007) to reduce craving (if any) they may have still been experiencing as a result of participating in the study. Finally,

TABLE 2
Demographic Characteristics, Ecstasy Use, Drug Use History, Drug-related Problems, and Alcohol Consumption by Condition

Characteristic	Control Group (<i>n</i> = 71) ^a	Ecstasy-Stimuli Group (<i>n</i> = 169) ^a
	<i>M</i> (<i>SD</i>) or %	<i>M</i> (<i>SD</i>) or %
Age	23 (6.1)	25 (8.0)
Gender		
Female	21	20
Male	79	80
Sexual Orientation		
Heterosexual	79	77
Homosexual/Bisexual	18	22
Other	3	1
Ethnicity		
White/Caucasian	79	79
Hispanic/Latino/a	10	7
Other (Asian, African, Native)	11	15
Country of Residence		
United States	59	60
Non-US English-Speaking Countries	29	22
Non-US Other	11	18
Education Level		
Some High School or HS Degree	53	53
Associates or Bachelor's Degree	39	40
Master's or Doctorate Degree	8	7
Relationship Status		
Single	69	62
Married/Partnered	27	33
Other	4	5
Frequency of ecstasy use		
Two times per month	41	31
Three times per month	20	25
Four times per month/Weekly	24	20
Five times per month or more	16	24
Number of times used—lifetime		
31–60	31	41
61–99	20	20
100+	49	39
Typical consumption environment		
Home	25	22
Rave/Club/Festival	60	54
Other (e.g., Outdoors, Party)	15	24
Last time consumed ecstasy		
More than two weeks ago	7	9
More than one week ago	17	16
6 to 7 days ago	10	9
4 to 5 days ago	12	16
2 to 3 days ago	25	22
Yesterday	17	16
Earlier today	6	4
Currently intoxicated	6	7
Average number of pills consumed per occasion	3.1 (1.9)	3.6 (3.0)
Drug-Use-Related Problems		
DAST-10	4.9 (2.0)	5.5 (2.3)
Level of Alcohol Consumption		
AUDIT-C	4.7 (2.5)	5.0 (2.3)

(Continued)

TABLE 2
(Continued)

Characteristic	Control Group (<i>n</i> = 71) ^a	Ecstasy-Stimuli Group (<i>n</i> = 169) ^a
	<i>M</i> (<i>SD</i>) or %	<i>M</i> (<i>SD</i>) or %
Drug Use History (past three months)		
Cannabis	90	85
Hallucinogens	50	60
Amphetamines	49	49
Cocaine	39	51
Benzodiazepines	36	35
Prescription Opiates	33	41
Inhalants	17	17
Spice/K2	9	17
Sedatives	6	12
Heroin	3	8
Other ^b	62	59

Note. There were no statistically significant differences between the conditions on any of the variables listed in this table; however, we could not conduct a chi-square for those two categorical variables (Relationship status; Last time consumed ecstasy) that had cells with expected frequencies less than 5.

^aNumbers of participants by condition could vary if participants declined to answer questions or exited the site prior to completing all measures.

^bTypes of "other drugs" varied considerably and included research chemicals, mephedrone, ketamine, GHB, MDPV, steroids, DMT, amyl nitrate, prescription stimulants, OTC cold medicines, salvia, ayahuasca, and ibogaine.

the program informed each participant if he or she had won one of the four \$50 gift cards to an online retailer, and the winners were presented with this prize before exiting the site. All study procedures were approved by the Bowling Green State University Institutional Review Board.

Participant Characteristics

During the data collection period, from May through September 2012, 1800 people clicked the link presented on the recruitment websites. Of these individuals, 943 proceeded to the consent document, but did not consent to participate. The remaining 857 consented to participate and answered eligibility questions about their age and ecstasy use history. Of these, 316 were disqualified from further participation by the online software program for not meeting age or ecstasy use inclusion criteria. Of the 541 participants who were eligible to proceed, 240 completed all measures and demographic information. Of this final sample, 169 participants were assigned to the CE-Ecstasy condition and 71 were assigned to the CE-Control condition. Both samples were comprised of primarily Caucasian men, which is consistent with the ethnic and gender composition of ecstasy users reported in previous investigations (e.g., Wu et al. 2009). There were no differences on demographic or drug history variables by cue exposure condition and, in addition to taking ecstasy, participants reported having used a variety of other substances over the previous three months (see Table 2).

RESULTS

Impact of Cue Exposure on Craving for Ecstasy

First, we evaluated whether exposure to ecstasy-related cues had an impact on craving scores. To test this hypothesis, we conducted a 2 (time: pre; post) x 2 (cue exposure condition: ecstasy stimuli; control stimuli) mixed model analysis of variance (ANOVA), which yielded a significant interaction effect, $F(1, 238) = 14.71$, $p < .001$, partial eta squared = .06. The cell means reveal that average ECQ-CC scores did not differ significantly prior to cue exposure, $M_{\text{ecstasy stimuli}} = -.91$ ($SD = 1.6$); $M_{\text{control stimuli}} = -1.07$ ($SD = 1.5$), but those who were shown the ecstasy-related stimuli had significantly higher scores following cue exposure, $M = -.59$ ($SD = 1.9$), than did those who were shown the control stimuli, $M = -1.22$ ($SD = 1.7$). Because we wanted to evaluate craving following exposure to ecstasy-related cues, and because the ANOVA showed that exposure to the ecstasy-related stimuli led to significantly greater craving compared to the control stimuli, we used data from only those 169 participants in the CE-Ecstasy condition in the remaining analyses.

The negative mean ECQ-CC score for participants exposed to ecstasy-related cues, $M = -.59$ ($SD = 1.9$), indicated that they disagreed, on average, with the statements reflecting craving. Nonetheless, frequency counts of agreement for each of the eight items revealed that 50% of participants agreed at some level with at least two items

and over 30% agreed at some level with six or more of the eight craving items. Table 1 (right side) shows that the three statements with which the largest proportions of participants agreed were: (1) If I had the chance to use ecstasy now I think I would (55% agreed at some level); (2) The more I think about it, the more I want to use ecstasy (50% agreed at some level); and (3) I have an urge to use ecstasy (48% agreed at some level).

Reliability and Unidimensionality of the ECQ-CC

Next, we conducted a Principal Components Analysis of the ECQ-CC. As Table 1 (column two) indicates, this analysis yielded only one component, with an eigenvalue of 5.86, which accounted for 73% of the variance in ECQ-CC scores. Item loadings ranged from .77 to .92. The internal consistency reliability of the ECQ-CC was excellent (Cronbach's $\alpha = .95$). Although the mean inter-item correlation ($r = .69$) was outside the range ($r = 0.15$ to 0.50) suggested by Clark and Watson (1995) as indicative of scale unidimensionality, one might expect stronger inter-correlations among drug-specific craving statements than among statements reflecting broader psychological constructs (e.g., personality traits). As an evaluation of test-retest reliability of the ECQ-CC, we recruited a separate sample of 20 ecstasy users enrolled at a large Midwestern university to complete the ECQ-CC (but not the ecstasy-attitude questionnaires) following exposure to the ecstasy-related stimuli on two occasions approximately one week apart. The Intraclass Correlation Coefficient (ICC agreement = .95) suggests that the scale has excellent short-term test-retest reliability.

Associations of Post-Cue Exposure Craving with Ecstasy-Related Attitudes and Frequency of Use

First, we predicted that increased craving would be associated with lower confidence in one's ability to refuse ecstasy across various circumstances. The significant negative coefficient, $r(167) = -.59$, $p < .001$, reveals that the less confident participants were that they could refuse ecstasy, the higher their craving scores. Second, we predicted there would be a moderate-to-high positive correlation between obsessive passion and craving, and a lower though still significant correlation between harmonious passion and craving. As expected, craving was significantly associated with scores on the Obsessive Passion subscale, $r(167) = 0.64$, $p < .01$, and with scores on the Harmonious Passion subscale, $r(167) = .38$, $p < .01$. Further, a dependent r comparison (Steiger 1980) revealed that the two coefficients were significantly different, $z = 3.70$, $p < .001$.

Finally, we conducted a one-way ANOVA to test whether scores on the post-cue exposure ECQ-CC varied as a function of the level of ecstasy use frequency, $M_{\text{Two times/Month}} = -1.11$ (1.8), $M_{\text{Three times/Month}} = -0.79$ (1.8), $M_{\text{Four times/Month}} = -0.31$ (2.0), $M_{\text{Five+ times/Month}} =$

0.08 (2.1). There was a significant main effect for ecstasy use frequency, $F(3,165) = 3.39$, $p < .01$. Examination of post-hoc tests using the Tukey statistic revealed that the mean craving for those who used Two times/Month was significantly different from mean craving for those who used Five+ times/Month, but no other mean pairs differed significantly.

DISCUSSION

Despite the growing literature on the acute subjective effects of ecstasy, there is little empirical evidence regarding the prevalence, intensity and means of assessing craving for this drug. Therefore, we developed an eight-item measure designed to assess multiple facets of craving for ecstasy and recruited a sample of 240 ecstasy users using the Internet to complete the craving questionnaire prior to and immediately following exposure to ecstasy-related or control stimuli, and to complete measures of self-efficacy to refuse ecstasy, passionate engagement in ecstasy use, and drug/alcohol history. In support of its construct validity, craving scores on the ECQ-CC varied as a function of cue exposure. Further analyses using only those participants who were exposed to the drug cues revealed that the ECQ-CC is a unidimensional instrument with excellent internal consistency reliability and excellent one-week test-retest reliability. Associations of craving scores with ecstasy-related attitudes and frequency of use supported the convergent and criterion validity of the questionnaire.

The two previously published investigations (Hopper et al. 2006; Huxter et al. 2006) of craving for ecstasy used single-item measures to assess craving experienced in the natural environment. Hopper et al. (2006) found that participants reported an increase in craving on ecstasy-use nights, which could have been both an antecedent that set the occasion for consumption and an outcome of anticipated use. In the present study, cue exposure comprised of photos of ecstasy and electronic dance music also resulted in significant changes in reported craving. That craving for ecstasy is associated with both anticipation of consuming ecstasy and exposure to ecstasy-related cues suggests that researchers and clinicians may use either to induce or enhance craving as part of assessment or therapy. Clinicians could also use the ECQ-CC to identify whether specific paraphernalia, emotional states, and physical locations are associated with their clients' experiences of craving, and could then employ these as stimuli in cue exposure therapy.

Similar to Hopper et al. (2006), most of our participants did not report high levels of craving for ecstasy, as evidenced by the negative mean craving score even after drug-related cue exposure. There are several possible reasons for this finding. First, users of ecstasy may not experience intense craving for this drug, especially

when they are not actively planning to consume ecstasy. Second, because ecstasy may contain adulterants, and users do not always know what drugs they are consuming when they take “ecstasy,” any craving they might experience could also reflect a desire for a combination of subjective experiences that are not easily interpreted by the drug user. Additionally, some adulterants (e.g., amphetamines) might be more physiologically addictive and craving for the adulterated drug might be stronger than the craving for MDMA alone. We also recognize that the specific photos and music used in this study may have elicited only limited reactivity, and other forms of cue exposure (e.g., script instructing participants to imagine preparing to use ecstasy) might have elicited more pronounced craving. Nonetheless, frequency counts for six of the eight statements revealed that one-third to one-half of the recreational users in our sample agreed with statements indicative of craving.

The results outlined above are tempered by several limitations. First, we employed a between-subjects design and assumed that randomization resulted in equivalent groups on whatever psychological characteristics might have influenced reactivity to the two exposure conditions. Although a within-subjects design would have obviated such differences, it involves other limitations, such as contrast or carry-over effects.

Second, although the survey software was programmed to remind participants to use their speakers, allow time for the video to load completely in their web-browser, and confirm that they had watched the video, some may have been distracted when watching and listening to the cue exposure stimuli and when responding to the questionnaires. In addition, ecstasy users who access and participate in studies conducted on the Internet may differ in their use and experience of craving compared to ecstasy users who

do not use the Internet or do not visit the specific sites that posted the study link.

Third, the ECQ-CC asked about various components of craving (e.g., urges, strong desire, intention to consume, anticipated loss of control), but we decided to eliminate items that assessed specific outcomes of consumption (e.g., increased energy, sensory changes, transcendence of current reality, feeling closer to others) that one might desire. Another limitation of the ECQ-CC (or any other multi-item questionnaire of ecstasy craving) is that it may measure craving for certain outcomes, such as increased energy or sensory changes, better than it measures craving for other outcomes, such as social connection or transcendence of reality.

These limitations notwithstanding, this method of recruitment and participation has several advantages. For example, we were able to recruit participants from multiple geographic areas, which could have yielded a more representative sample of ecstasy users. In addition, web-based recruitment and data collection could increase a participant’s feeling of anonymity, thereby decreasing the chance that they would decline to participate for fear of reporting use of an illicit substance, misrepresent their drug history, or under-report their experience of current craving.

In light of the disadvantages of single-item ratings, and the psychometric properties of the ECQ-CC, this questionnaire could be employed to study both the base rates and specific aspects of craving endorsed by problematic as well as recreational users of this drug. In addition, the association of craving with harmonious passion to use ecstasy suggests that craving is not experienced only as aversive or ego-dystonic. Therefore, we also recommend further research using the ECQ-CC to evaluate the association of craving for ecstasy with use of the drug to achieve pleasurable states of altered consciousness.

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