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Ecstasy Use and Suicidal Behavior Among Adolescents: Findings from a National Survey

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Abstract

This study examines the relationship between ecstasy use and suicidal behaviors among adolescents in the United States. Data from the adolescent subsample (ages 12–17, N=19,301) of the 2000 NHSDA were used in the analyses. Information on adolescent substance use, suicidal behaviors and related socio-demographic, family and individual factors was obtained in the survey. The rate of past year suicide attempt among adolescents with lifetime ecstasy use was almost double that of adolescents who had used other drugs only, and nine times that of adolescents with no history of illicit drug use. In multinomial logistic regression analyses, controlling for related factors, the effect of ecstasy use remained significant. Adolescent ecstasy users may require enhanced suicide prevention and intervention efforts.

1. INTRODUCTION

Suicide is the third leading cause of death for young people 10–24 years of age (CDC, 2010) in the United States. Each year, approximately 149,000 youth between the ages of 10 and 24 receive medical care for self-inflicted injuries (CDC, 2007). Suicidality affects all youth, but some subgroups are at a higher risk than others. Studies have shown that adolescents who are substance abusers are more likely than others to attempt suicide (Borowsky et al., 2001; Brent et al., 1993; Wu et al., 2004). Although abuse of alcohol, cocaine, and inhalants are known to be risk factors for suicide attempt (Sakai et al., 2004; Vega et al., 2000; Wu et al., 2004), little is known about the contribution of other specific drugs of abuse, such as MDMA (3,4 methylenedioxymethamphetamine; popularly known as ecstasy) to suicidal behaviors among youth.

MDMA is an indirect serotonergic agonist which causes flooding of the serotonin system, usually leading to temporary positive changes in mood. Clinical research has found that, in young adults, MDMA's metabolites may remain detectable in blood plasma up to 146 hours (about six days) after ingestion of a high dose, while a low dose will become undetectable after 47 hours (i.e., about two days) (Kolbrich et al., 2008). Aftereffects associated with ecstasy use include lethargy, anorexia, decreased motivation, sleepiness, depression, and fatigue. (Ajalo et al., 1998; Gabbard, 2001; Holmes et al., 1999; Hoshi et al., 2006; Huxster et al., 2006; Travers and Lyvers, 2005). Youth ecstasy use typically takes place on weekends at rave-style parties (Bahora et al., 2009; Hopfer et al., 2006; Hopper et al., 2006), and 'Suicide Tuesday' is a term that is sometimes used to describe the negative aftereffects that

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users may experience following an episode of ecstasy use (Bahora et al., 2009). With regular use, ecstasy may damage serotonin neurons, causing a decrease in serotonin production (Karlsen et al., 2008). Serotonin deprivation resulting from this process may lead to increases in depressive symptoms, impulsivity (Butler and Montgomery, 2004), aggression (Milani et al., 2005) and poor judgment (Morgan et al., 2006). Some of these changes may not be reversible even with prolonged abstinence (Morgan et al., 2002).

Few studies have examined the relationship between ecstasy use and suicidality in detail. One 10-year clinical retrospective study did examine the relationship between suicidality and ecstasy use among 178 adolescent psychiatric inpatients (Shoval et al., 2006), and found ecstasy use to be significantly associated with subsequent suicide attempt. Studies using large-scale epidemiological survey data to examine this relationship are called for. The current study, which focuses on the relationship between ecstasy use and suicidal behavior, and is based on a nationally representative sample of U.S. adolescents ages 12 to 17, will help to fill this research gap.

A study that aims to test whether ecstasy use independently contributes to suicidal behaviors should take potentially shared risk factors, such as socio-demographic, parental/family, and individual-level factors, into account. Previous studies have found that Asian or White race/ethnicity (Bae et al., 2005) and female gender (Roy and Janal, 2006; Weissman et al., 1999) are associated with youth suicide attempt. Parental/familial and individual factors that have been found to be associated with adolescent suicidal behaviors include residential instability (Brent et al., 1994), being from a single parent family (Wichstrom, 2000), not feeling able to discuss serious problems with one's parents (Borowsky et al., 2001), and having conduct disorder (Darke et al., 2003) or an anxiety disorder (Sareen et al., 2005). Many of these factors have also been found to be related to use of ecstasy (Huizink et al., 2006; Lieb et al., 2002; Martins and Alexandre, 2009; Martins et al., 2007; Yacoubian, 2003; Zimmermann et al., 2005).

Using data from a nationally representative sample of adolescents, this study examines (1) the relationship of ecstasy use with suicidal ideation and attempt among adolescents ages 12–17; and (2) whether the observed association can be explained by those socio-demographic, parental/family, and individual-level factors that are associated with both ecstasy use and suicidality. The findings from this study will help improve understanding of the relationship between use of ecstasy and suicidal behavior. The clinical and public health implications of the findings are also explored.

2. METHODS

2.1. Sample and Data

The adolescent (ages 12–17) subsample (N=19,430) of the 2000 National Household Survey on Drug Abuse (NHSDA) was selected for use in our analyses. The target population for the 2000 NHSDA is defined as the civilian, non-institutionalized population of the United States who are 12 years of age and older (SAMHSA, 2001). The weighted adolescent subsample is a representative sample of non-institutionalized adolescents ages 12–17 in the United States. Within this adolescent subsample, a small number of respondents (N=129) did not provide information on suicidal behaviors, and, therefore, were not included in our analyses. Thus, the actual sample size for the current study was 19,301.

Trained interviewers interviewed respondents in their homes in person, using a computer-assisted personal interview. Survey sections focusing on substance use and other sensitive topics were administered using an audio computer-assisted self-interview, in order to provide the respondent with a highly private and confidential means of responding to

questions and to increase the level of honest reporting. Weighted response rates for household screening and for interviewing were 92.8% and 73.9%, respectively. Further details on the study's sampling design, study procedures are available elsewhere (SAMHSA, 2001).

This study's secondary data analyses were conducted in full compliance with the Institutional Review Board of the New York State Psychiatric Institute.

2.2. Measures

2.2.1. Suicidal Behaviors—The suicidal behavior outcome variable had three categories, all referring to behaviors in the past year: no suicidal behaviors; ideation only; and suicide attempt. Suicidal ideation was defined as responding affirmatively to the question: “During the past 12 months, has there been a time when you thought seriously about killing yourself? Suicide attempt was defined as a positive response to the question: “In the past 12 months, have you tried to kill yourself?”

2.2.2. Ecstasy and Other Drug use—Adolescents were asked about their lifetime use of ecstasy, and of other drugs including marijuana, cocaine, crack, inhalants, hallucinogens, heroin, stimulants, sedatives, tranquilizers, analgesics and any psychotherapeutic drugs used nonmedically.

A three-category drug use variable was created by combining information from the lifetime ecstasy use variable with information from the drug use summary variable provided in the dataset, “Any illicit drug – ever used”. The created three-category variable was used to divide the adolescents into three groups for the purposes of the analyses: (1) No illicit drug use, (2) Used other drugs only, and (3) Used ecstasy.

2.2.3. Socio-Demographic Factors—Demographic measures such as respondent age, gender, and race/ethnicity were included in the NHSDA interview. The main race/ethnicity variable had four categories: Non-Hispanic White, African American, Hispanic, and “Other.” The annual household income levels of the adolescents' families were classified into the following four categories based on adolescents' estimates: \$0–19,999, \$20,000–\$39,999, \$40,000–\$74,999, and \$75,000 or above.

2.2.4. Family, Parental, and Individual Factors

Residential instability: This was defined as having moved three or more times in the past five years.

Child not living with both parents: This was based on youths' reports regarding family structure.

Able to talk with parents about serious problems: Respondents disagreeing with the statement “There is no one I can talk to about serious problems”, and reporting that they could talk to their mother, father, or guardian about such problems, were coded affirmatively on this measure.

Psychopathology: Measures of psychopathology, including anxiety disorders, and conduct disorder, were adapted from the Diagnostic Interview Schedule for Children (DISC) Predictive Scales (DPS 4) (Lucas et al., 2001) (a screening measure derived from the National Institute of Mental Health's DISC Version IV)(Shaffer et al., 2000). The DPS instrument includes only those DISC items that are most highly predictive of DSM-IV (American Psychiatric Association, 1994) diagnoses. The recall period used for all of the

psychopathology symptom items was the past year. Psychometric data on the DPS are reported elsewhere (Lucas et al., 2001). The DPS items were used to detect psychopathological symptom clusters. A symptom cluster is a group of symptoms derived from the DSM-IV criteria for a particular disorder, not including criteria related to impairment or symptom duration. The cutoff points used for the symptom clusters were selected based on previous methodological research (Chen et al., 2005).

The number of positive anxiety symptom clusters found, including: social phobia, separation anxiety disorder, agoraphobia, panic disorder, generalized anxiety disorder, specific phobia, and obsessive compulsive disorder, was used in the analyses as a measure of level of anxiety problems. For conduct problems, a dichotomous measure indicating the presence of the conduct disorder symptom cluster was used.

2.3. Data Analysis

Initially, bivariate analyses were used to assess the associations between the suicidal behavior categories and use of ecstasy and other drugs. Then the associations between the suicidal behaviors and the other individual- and family-level risk factors were examined. To detect group differences, chi-square tests were used for categorical variables, while the ANOVA procedure was used for continuous variables. Bonferroni correction was used to adjust the significance levels, $\alpha = 0.05/3 = 0.017$, for multiple pair-wise comparisons between suicidal behavior groups. All tests were two-tailed. Similar analyses were conducted to examine the relationships between the three-category drug use variable and each of the remaining risk factors.

Multinomial logistic regression analysis was then applied to the three-category suicidal behavior outcome variable. The regression analyses were conducted hierarchically in two steps. In step one, in addition to our main predictor of interest, i.e., ecstasy and other drug use, the major socio-demographic factors were included in the model. In the second step, those other variables that had been found, in the bivariate analyses, to be significantly associated with both suicidal behavior and ecstasy use were added in. All analyses were weighted and were conducted using SUDAAN Version 8.0 (Research Triangle Institute, 2001), to take into account the complex sampling design of the national survey data.

3. RESULTS

Among the 19,301 adolescents, 48% were girls, 66% were Whites, 14% were African Americans and 14% were Hispanics. About one third were 12–13 years old, one third were 14–15, and the remaining third were 16–17 years old. In terms of suicidal behaviors, about 4.6% of the sample reported having attempted suicide in the year prior to the interview, while about 8.1% reported suicidal ideation only. About 2.6% had ever used ecstasy, while 24.3% had used only drugs other than ecstasy.

3.1. Bivariate Analysis

Table 1 shows the results of the bivariate analyses of the relationships between suicidal behaviors and ecstasy use, and between suicidal behaviors and the other risk factors. The ecstasy and other drug use variable was found to be significantly associated with the suicidal behavior variable. Among adolescents who had used ecstasy, more than 19% had attempted suicide in the year prior to the interview. This rate of suicide attempt was almost twice as high as that of the adolescents who had used other drugs only and nine times that of the non-drug users. With regard to the proportions having suicidal ideation alone, on the other hand, the ecstasy users were very similar to those with other drug use only, with these two groups' rates of suicidal ideation being about double that of the non-drug users.

The results of the bivariate analyses of the associations between suicidal behaviors and other possible risk factors indicate that suicidal behaviors are associated with older age, female gender, the “other” racial/ethnic category, low family income, residential instability, not living with both parents, and feeling unable to talk with one’s parents about serious problems. Also, adolescents with anxiety and/or conduct problems were more likely to report suicidal behaviors. A similar set of analyses was conducted to examine ecstasy and other drug use in relation to the same set of risk factors. Except for gender, all of these risk factors were found to be significantly associated with the ecstasy and other drug use variable (results not shown).

3.2. Multinomial Logistic Regression

The results of the multinomial logistic regression analyses are shown in Table 2. As expected, the associations between the drug use categories and suicide attempt emerged as much stronger than those with suicidal ideation alone. The Model 1 results indicate that the association between suicidal ideation and other drug use only is essentially identical to that between suicidal ideation and ecstasy use (the Adjusted Odds Ratios (AORs) are 2.9 and 2.8 respectively); however, the magnitude of the association between suicide attempt and ecstasy use is strikingly higher than that between suicide attempt and other drug use only (with AORs of 13.2 and 6.2, respectively). In other words, while adolescents using only drugs other than ecstasy were about 6 times as likely to attempt suicide as non-drug users, adolescents using ecstasy were about 13 times as likely to attempt suicide compared to the non-drug users. Table 2 also shows that in Model 2, after the other family and individual factors were controlled for, the associations between the drug use categories and the suicidal behaviors remained significant, but were somewhat reduced in magnitude, indicating that the relationship between the two variables can be partially explained by these factors. However, the relationship between suicide attempt and ecstasy use remained stronger than that between suicide attempt and other drug use only (with AORs of 5.5 and 3.5 respectively). This difference was statistically significant at $p = .0121$. Among the other risk factors, being 14–15 years old, being female, not feeling able to talk to one’s parents about serious problems, anxiety problems, and conduct problems, were all found to significantly contribute to the likelihoods both of suicidal ideation alone, and of suicide attempt. Residential instability, on the other hand, was found to contribute only to suicide attempt.

4. DISCUSSION

This study examined the relationship between ecstasy use and suicidal behaviors. One strength of this study is its use of data from a nationally representative sample of community-dwelling youth. Another strength is that it controlled for the impact of demographic, family, and individual factors that are associated both with ecstasy use and with suicidality, in examining the impact of ecstasy use on suicidal behaviors, and compared the impact of ecstasy use with that of use of other illicit drugs only.

The results of the study indicate that ecstasy use is strongly associated with suicide attempt. Rates of suicide attempt were found to be considerably higher among adolescents with a history of ecstasy use than among either non-drug users, or users of other drugs only. This finding held even after controlling for the impact of factors such as age, gender, parent-child communication, and anxiety and conduct problems.

There are several possible explanations for the observed association between ecstasy use and suicide attempt. With regard to the effects of ecstasy use on behavior, the drop in serotonin levels that tends to occur a few days after an episode of ecstasy use, with its attendant increase in depressive symptoms, may temporarily increase users’ vulnerability to suicidal behaviors. With continued, regular use of ecstasy, users’ general vulnerability to depressive

symptoms may also increase (Keyes et al., 2008), thus increasing their overall risk for suicidal behavior. Impulsivity, too, may increase as a result of ecstasy use (Butler and Montgomery, 2004; Morgan et al., 2006; Wan et al., 2009), thus increasing the risk that an individual will act on suicidal thoughts (Carballo et al., 2006; Zalsman et al., 2008). Studies have also found, however, that prior to initiating ecstasy use, many users already have a history of depression or behavioral problems (Falck et al., 2006; Guillot, 2007; Lieb et al., 2002; Martins et al., 2006), or a genetic predisposition to psychiatric illness (Karlsen et al., 2008). Further, more targeted, research is needed to test specific pathways.

4.1. Limitations

The study dataset was a cross-sectional one, meaning that we could not ascertain whether the subjects' suicide attempts preceded or followed their first use of ecstasy. No causal inferences can be made on the basis of our results. Also, it has been observed that ecstasy users tend to be especially heavy users of drugs in general (Keyes et al., 2008). Thus, the observed association between ecstasy use and suicide attempt may be an indirect one, where other specific drugs play an important role. Although this study's analyses did divide the sample into three groups with regard to drug use - non-drug users, users of other illicit drugs only, and ecstasy users - it was not possible to fully control for the effects of use of other specific drugs in the analyses. Our results do, nevertheless, indicate that ecstasy-using adolescents may require enhanced suicide prevention and intervention efforts.

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Table 1

Suicidal Behaviors, Ecstasy and Other Drug Use, and Other Related Factors (N=19,301)

FACTORS	Suicidal Behaviors			p value^a
	None (N=16,857)	Ideation Only (N=1,567)	Attempt (N=877)	
Drug use				
No illicit drug use	91.88	5.98	2.14	<0.0001
Used other drugs only	75.83	13.83	10.35	
Used Ecstasy	68.61	12.02	19.37	
Age (%)				
12 – 13	90.31	6.65	3.04	<0.0001
14 – 15	86.00	8.67	5.33	
16 – 17	85.89	8.79	5.32	
Gender (%)				
Girls	83.52	9.91	6.57	<0.0001
Boys	91.08	6.26	2.67	
Ethnicity (%)				
White	87.54	7.89	4.58	0.0098
African-American	88.07	8.48	3.45	
Hispanic	87.43	7.26	5.3	
Other	83.98	10.54	5.48	
Household Income (%)				
Under \$20,000	85.95	8.58	5.47	0.0085
\$20,000–39,999	86.83	8.03	5.13	
\$40,000–74,999	87.83	7.80	4.36	
\$75,000 or More	88.48	7.99	3.53	
Residential Instability (%)				
No	88.24	7.73	4.03	<0.0001
Yes	82.01	10.01	7.98	
Living with Both Parents (%)				
No	84.88	9.15	5.97	<0.0001
Yes	88.34	7.63	4.03	
Able to talk with parents about serious problems (%)				
No	78.25	13.11	8.64	<0.0001
Yes	92.02	5.47	2.51	
Probable Anxiety Disorders (Mean)				
	0.66	1.73	2.24	<0.0001
Conduct Problems (%)				
No	90.33	6.57	3.11	<0.0001
Yes	64.85	19.42	15.73	

^a p-values are from chi-square tests for categorical variables; from ANOVA for continuous variables.

Table 2

Results of Multinomial logistic regression analyses predicting suicidal behaviors

PREDICTORS	MODEL 1		MODEL 2	
	Suicidal Ideation AOR(95%CI) ^a	Suicide Attempt AOR(95%CI)	Suicidal Ideation AOR(95%CI)	Suicide Attempt AOR(95%CI)
Drug Use				
No illicit drug use	1.0	1.0	1.0	1.0
Used other drugs only	2.9 ^{***} (2.5, 3.3)	6.2 ^{***} (5.2, 7.5)	1.9 ^{***} (1.6, 2.2)	3.5 ^{***b} (2.8, 4.3)
Used Ecstasy	2.8 ^{***} (2.0, 3.8)	13.2 ^{***} (9.5, 18.3)	1.5 [*] (1.0, 2.1)	5.5 ^{***b} (3.8, 8.1)
Age				
12–13	1.0	1.0	1.0	1.0
14–15	1.2 (1.0, 1.3)	1.3 [*] (1.0, 1.6)	1.2 [*] (1.1, 1.5)	1.4 ^{**} (1.1, 1.9)
16–17	1.0 (0.8, 1.2)	0.9 (0.7, 1.1)	1.2 (1.0, 1.4)	1.2 (0.9, 1.6)
Gender				
Boys	1.0	1.0	1.0	1.0
Girls	1.8 ^{***} (1.6, 2.0)	2.9 ^{***} (2.4, 3.5)	1.5 ^{***} (1.4, 1.8)	2.3 ^{***} (1.9, 2.8)
Ethnicity				
White	1.0	1.0	1.0	1.0
African-American	1.1 (0.9, 1.3)	0.8 (0.6, 1.0)	0.9 (0.7, 1.1)	0.5 ^{***} (0.4, 0.7)
Hispanic	0.9 (0.8, 1.1)	1.1 (0.9, 1.4)	0.9 (0.7, 1.1)	1.1 (0.8, 1.4)
Other	1.4 [*] (1.1, 1.9)	1.2 (0.8, 1.9)	1.3 (1.0, 1.7)	1.1 (0.7, 1.7)
Household Income				
Under \$20,000	1.0	1.0	1.0	1.0
\$20,000–39,999	0.9 (0.8, 1.1)	0.9 (0.7, 1.2)	1.0 (0.8, 1.2)	1.0 (0.8, 1.3)
\$40,000–74,999	0.9 (0.8, 1.1)	0.8 (0.6, 1.0)	1.1 (0.9, 1.4)	1.0 (0.8, 1.3)
\$75,000 or More	1.0 (0.8, 1.2)	0.7 ^{**} (0.5, 0.9)	1.1 (0.9, 1.5)	0.9 (0.7, 1.2)
Residential Instability				
No			1.0	1.0
Yes			1.0 (0.9, 1.2)	1.3 [*] (1.0, 1.7)
Living with Both Parents				
No			1.1 (0.9, 1.2)	1.2 (0.9, 1.4)
Yes			1.0	1.0
Able to talk with parents about serious problems				
No			2.1 ^{***} (1.9, 2.4)	2.5 ^{***} (2.0, 3.0)
Yes			1.0	1.0
Anxiety Problems (mean)				
			1.5 ^{***} (1.5, 1.6)	1.7 ^{***} (1.6, 1.8)
Conduct Problems				
No			1.0	1.0
Yes			2.4 ^{***} (2.0, 2.8)	2.9 ^{***} (2.3, 3.5)

* p ≤ .05;

**
p ≤ .01;

p ≤ .001

^a Adjusted odds ratio. 95% confidence interval for odds ratio.

^b The difference between the other drugs only group and the ecstasy use group, with regard to suicide attempt, was statistically significant at p=.0121.