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Adolescent Ecstasy and other drug use in the National Survey of Parents and Youth: the role of sensation-seeking, parental monitoring and peer's drug use

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Abstract

The association between high sensation-seeking, close friends' drug use and low parental monitoring with Ecstasy (MDMA) use in adolescence was examined in a sample of US household-dwelling adolescents aged 12–18 years (N=5,049). We also tested whether associations were of stronger magnitude than associations between these correlates and marijuana or alcohol/tobacco use in adolescence. Data from Round 2 of the National Survey of Parents and Youth (NSPY) Restricted Use Files (RUF) was analyzed via Jackknife weighted multinomial logistic regression models. High sensation-seekers were more likely to be ecstasy, marijuana, and alcohol/tobacco users, respectively, as compared to low sensation-seekers. High sensation-seeking and close friends' drug use were more strongly associated with ecstasy as compared to marijuana and alcohol/tobacco use. Low parental monitoring was associated with marijuana use and alcohol/tobacco use and there was a trend for it to be associated with ecstasy use. Ecstasy use is strongly associated with peer drug use and more modestly associated with high sensation-seeking. School prevention programs should target high-sensation-seeking adolescents and also encourage them to affiliate with non-drug using peers.

Keywords

Ecstasy (MDMA) use; sensation-seeking; peer drug use; parental monitoring

1. Introduction

Prevalence of ecstasy (3,4-methylenedioxymethamphetamine, MDMA) use among adolescents has increased in recent years. Data from the Monitoring the Future study (MTF) show that ecstasy use peaked among 12th grade students in 2001 (12% lifetime and 9% past year). In 2006 6% and 4% of 12th grade students had already used ecstasy in their lifetime and in the past year, respectively, and these rates are still of concern (Johnston, O'Malley, Bachman, & Schulenberg, 2007). The most recent National Survey on Drug Use and Health showed that 1.6% of adolescents aged 12–17 years old were lifetime ecstasy users in 2004 (SAMSHA, 2006). While studies have shown that high sensation-seeking, peer drug use and low parental

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monitoring are associated with illegal drug use (Donohew et al., 1997; Yanovitsky, 2005, Chilcoat, Dishion, & Anthony, 1995), little is known about their associations with ecstasy use relative to associations with drugs like marijuana, and alcohol/tobacco. This study aims to estimate these associations in a representative sample of adolescents from the general US population.

We chose to study the combined association of proximal risk factors such as high sensation-seeking, peer drug use and low parental monitoring with ecstasy use based on three well known theoretical developmental frameworks: Problem Behavior Theory (Jessor & Jessor, 1977, Jessor, 1987, Jessor, 1998), generality of deviance theory (Hirschi & Gottfredson, 1994), and Social Development Model (Catalano & Hawkins, 1996). In the Problem Behavior Theory there are three domains of psychosocial influence: personality (values, expectations, beliefs, attitudes toward self and others, sensation-seeking), environment (parental and family support, peer influence) and behavior (problem-behavior: e.g., marijuana use, problem drinking, precocious sexual intercourse; conventional behavior: academic achievement and church attendance), which together specify if an individual is prone to engage in behaviors that depart from the social norms (Jessor & Jessor, 1977; Jessor, 1987). Hirschi and Gottfredson's (1994) generality of deviance theory speculates that all deviance occurs in individuals who lack self-control and seek immediate pleasure (e.g., high sensation-seekers) without thinking about the risk of long term consequences. High sensation-seeking may impair judgment and decision making, leading an individual to take more risks such as engaging in drug use. Lastly, the Social Development Model (Catalano & Hawkins, 1996) incorporates propositions of social control, social learning and differential association theories into a developmental framework of both prosocial and antisocial behaviors (White et al., 2006). According to this model, when adolescents develop bonds with individuals or groups with antisocial beliefs (e.g., drug-using peers), they are more likely to engage in antisocial behaviors; if they develop bonds with individual with prosocial behaviors (e.g., non-drug using peers, high religiosity), they are less likely to engage in antisocial behaviors, and more likely to engage in prosocial behaviors. Also, external constraints such as parental monitoring and individual factors such as sensation-seeking, can affect these socialization experiences (Catalano & Hawkins, 1996; Lonczac et al., 2001; White et al., 2006).

High sensation-seeking has been largely associated with drug use, polydrug use and early-onset of drug use in adolescence (Bates, Labouvie, & White, 1986; Pedersen, 1991; D'Silva, Harrington, Palmgreen, Donohew, & Lorch, 2001; Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002; Martin et al., 2002; Crawford, Pentz, Chou, Li, & Dwyer, 2003; Stephenson, Hoyle, Palmgreen, & Slater, 2003; Gerra et al., 2004; Martin et al., 2004; Yanovitsky, 2005). Sensation-seeking is a biologically based trait defined by Zuckerman as "the need for varied, novel and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experiences" (Zuckerman, 1979, p. 10). Sensation-seeking usually peaks in late-adolescence and then declines with age (Zuckerman, 1994). Even though it is a biological trait, there is a belief that sensation-seeking can be modified or changed and can be considered a developmental behavior (Bardo, Donohew, & Harrington, 1996; Crawford et al., 2003). The sensation-seeking construct measured by the original Sensation Seeking Scale form-V (SSS-V, Zuckerman et al., 1978) assesses four domains: thrill and adventure seeking (physically risking activities), experience seeking (nonconforming lifestyle, travel, music, art, drug use, and unconventional friends), disinhibition (social stimulation, parties, social drinking, several sex partners), and boredom susceptibility (aversion to boredom produced by unchanging conditions or persons) (D'Silva et al., 2001). Yanovitsky (2005) reports that high levels of sensation-seeking can be associated to illegal drug use in adolescence by three different mechanisms: a) high sensation-seeking adolescents find that the illegal risks associated with drug use are stimulating, b) high sensation-seeking adolescents use drugs due to their neurological effects, c) high sensation-seeking adolescents underestimate the risks

associated with drug use. Pedersen (1991) showed that high sensation-seeking predicted future drug use among adolescents. It is believed that 'the more socially acceptable the use of a substance is, the less likely a relationship would be found between the substance use and sensation-seeking' (Kopstein, Crum, Celentano, & Martin, 2001; Zuckerman, 1988). Thus, we hypothesize that among adolescents high sensation-seeking would be more strongly associated with ecstasy use as compared to alcohol, tobacco, and marijuana use, which are considered more 'normative' than ecstasy use by this population.

High sensation-seeking has been associated with ecstasy use among young adults in small cross-sectional studies of ecstasy users (Gerra et al., 1998; Schifano, 2000; Dughiero, Schifano, & Forza., 2001). Dughiero et al. (2001) suggest that high sensation-seeking could predispose an individual to initiate ecstasy use. In a prospective study, de Win et al. (2006) reported that high levels of sensation-seeking did not predict future ecstasy initiation among young adults, but ecstasy use predicted an increase in sensation-seeking levels from baseline to follow-up. To our knowledge, no epidemiological study has yet investigated the association of sensation-seeking tendencies with ecstasy use in adolescence.

Yanovitzky (2006) proposes that peer influences mediate the effects of high sensation-seeking on alcohol use among college students. According to his study, high sensation-seekers would interact more frequently with alcohol-using peers and believe that their peers use alcohol regularly (Yanovitzky, 2006). Yanovitzky's hypothesis might also hold true for the association between high sensation-seeking and other drug use, because drug use in adolescence usually occurs in a peer context (Donohew et al., 1997; Best et al., 2005; Barnes, Barnes, & Patton., 2005; Yanovitzky, 2006). Romer and Hennessy (2007) have shown that high sensation-seeking adolescents tend to seek peers with similar interests who further encourage risk-taking behavior. Thus, it is important to investigate whether the association between high sensation-seeking and ecstasy use is influenced by peer drug use.

Low parental monitoring is associated with illegal drug use, illegal drug initiation and other risky behaviors in childhood and adolescence (Chilcoat, Dishion, & Anthony, 1995; Chilcoat & Anthony, 1996; Di Clemente et al., 2001; Chen, Storr, & Anthony, 2005). For instance, Chilcoat and Anthony (1996) showed that low parental monitoring increased the risk of illegal drug initiation by age 10. Stephenson and Helme (2006) have shown that high sensation-seekers with authoritative parents (authoritative parenting is referred to as the optimal parent style and related to parental monitoring) were more likely to have negative attitudes towards marijuana use as compared to those whose parents were not authoritative, but parenting style did not moderate the positive association between high sensation-seeking and lifetime/past month marijuana use. Molecular genetic studies have shown that parenting style can influence sensation-seeking levels in children: for instance, among children who have the 7 repeat allele of the dopamine receptor D4 gene lower quality parenting is associated with higher sensation-seeking (Sheese, Voelkner, Rothbart, & Posner, 2007). To our knowledge, no study has explored the association between ecstasy use, parental monitoring and sensation-seeking.

It is hypothesized that religiosity and education can counterbalance sensation-seeking tendencies (Stephenson & Helme, 2006). Adolescents that have better school grades and aspirations to attend college are less likely to use drugs (Bachman, Johnston, & O'Malley, 1998). Religion, drug education, and media campaigns can reduce the chance of drug use among adolescents (Bachman et al., 1998; Palmgreen et al., 2001). Palmgreen et al. (2001) have shown that media campaigns that target high sensation-seeking adolescents reduced marijuana use in this population. Thus it is important to take these other factors into account when exploring the association between ecstasy use with high sensation-seeking, peer drug use and low parental monitoring.

This paper aims to explore the associations between high sensation-seeking, peer drug use and low parental monitoring with ecstasy use among adolescents in the National Survey of Parents and Youth. Because almost all ecstasy users have used marijuana (Martins, Mazzotti, & Chilcoat, 2005) we sought to test the association of ecstasy use above and beyond that for marijuana. To test whether the belief that ‘the more socially acceptable the use of a substance is, the less likely a relationship would be found between the substance use and sensation-seeking’ hold true, we also compared the associations with adolescents who used alcohol/tobacco but had never used marijuana (Kopstein et al., 2001; Zuckerman, 1988). We hypothesized that ecstasy users would have stronger associations with high sensation-seeking, peer drug use and low parental monitoring than marijuana users and than alcohol/tobacco users. Thus, we estimate these associations for four mutually exclusive groups of adolescents: 1- lifetime non-drug users (never used alcohol, tobacco, marijuana or ecstasy prior to the interview), 2- lifetime alcohol/tobacco users (defined as respondents that use alcohol and/or tobacco at least one but had never used marijuana or ecstasy prior to the interview) 2- lifetime marijuana users (defined as respondents that used marijuana at least once but had never used ecstasy prior to the interview independent of their alcohol/tobacco use status), and 3- lifetime ecstasy users (defined as respondents that used ecstasy at least once independent of their marijuana, alcohol and tobacco use status). From this point onwards, we will simply refer to respondents as non drug users, alcohol/tobacco users, marijuana users, and ecstasy users. Therefore, the specific aims of this study are to: 1) test whether high levels of sensation-seeking, peer drug use and low parental monitoring are associated with ecstasy use in adolescence; and 2) test whether associations with sensation-seeking, peer drug use and parental monitoring are of similar magnitude or of stronger magnitude for ecstasy or marijuana use or alcohol/tobacco use in adolescence.

2. Methods

2.1. Sample and measures

2.1.1. Sample—Data for this research are from the Restricted Use Files (RUF) of the National Survey of Parents and Youth (NSPY), which is a household survey designed to evaluate the impact of the National Youth Anti-Drug Media Campaign sponsored by the Office of National Drug Control Policy and conducted by Westat under contract to NIDA. A multi-stage sampling design was used to provide an efficient and representative cross-section of America’s youth between the ages of 9–18 years. Adolescents living in all types of residential housing units were eligible; however, youth living in institutions, group homes, or dormitories were excluded. The NSPY investigators felt that experiences of youth living in dormitory settings would be different from the majority of youth interviewed at home, thus requiring separate analyses. The weighting procedure took the sampling strategy into account. It was estimated that the sample represented 70% of the age 9–18 civilian population (Hornik et al., 2003). Detailed information about the sampling and survey methodology of the NSPY can be found elsewhere (Hornik et al., 2003; Orwin et al., 2005).

Children 9–11 years were recruited to complete a questionnaire that focused more on children’s perception of the media campaign, rather than on children’s actual drug use and drug use correlates, and were excluded from this study because there was no data on their ecstasy use or other correlates of drug use. This study focuses on the 12–18 years old who were asked about ecstasy use (n=5,090) that first appeared in the follow-up (Round 2) conducted between July 2001 and June 2002 (85% response rate). A few youth (n=41) were excluded because of incomplete or missing data. The 5,049 12–18 year-old youth included in this report represent 77.5% of the 6,516 youth aged 9–18 years old interviewed in round 2 of the NSPY. The analysis sample was comprised of 51% male, 66% White, 29% 12–13 year olds, 45% 14–16 year olds, and 26% aged 17–18 years (weighted proportions).

2.1.2. Assessment—The survey questions were chosen to resemble questions included in other surveys such as the Monitoring of the Future (MTF) (Bachman, Johnston, & O'Malley, 1996), the Community Action for Successful Youth (Metzler, Biglan, Ary, & Li, 1998), the National Household Education Survey (NHES, Collins & Chandler, 1997), and the National Survey on Drug Abuse—now renamed as the National Survey on Drug Use and Health (NSDUH, SAMSHA, 1996). Because of the sensitive nature of the drug behavior data, a Certificate of Confidentiality was obtained. Interviews were conditional on parental or legal guardian permission (active written parental consent) and participant written assent was secured. Questionnaires were administered in respondents' home using lap-top computers. Audio-assisted self interview (ACASI) methods allowed respondents to self-administer the survey in total privacy. A recorded voice presented sensitive questions and answer categories orally over headphones and responses were selected by touching the computer screen. In addition to extensive assessment of exposure to anti-drug and Media Campaign messages, other questions assessed personal drug experiences with tobacco, alcohol, marijuana, ecstasy, and inhalants, peer drug use, sensation-seeking, parental monitoring, and other personal data (e.g., demographics). Data analysis activities were approved by a Johns Hopkins University institutional review board.

2.1.3. Measures—To assess lifetime alcohol, tobacco, inhalant, marijuana and ecstasy use all adolescent respondents in the NSPY Round 2 answered the following questions: 'Have you ever smoked part or all of a cigarette?', 'Have you ever, even once, had a drink of any alcoholic beverage, that is, more than a few sips?', 'Have you ever, even once, used an inhalant for kicks or to get high?', 'Have you ever, even once, used marijuana?', 'Have you ever, even once, used ecstasy?' Based on the responses to these questions adolescents were divided into 4 mutually exclusive groups: 1) non-drug users, 2) lifetime alcohol and tobacco users who were non-marijuana and non-ecstasy users, 3) lifetime marijuana users (who could use alcohol, tobacco but did not use ecstasy), and 3) lifetime ecstasy users (who could use any other drug, in Round 2 only 14 ecstasy users were non-marijuana users). Due to the small number of respondents who used inhalants in the NSPY, inhalant users could belong to any of the three drug using groups. Among alcohol and tobacco users 2.2% of the respondents had used inhalants, among marijuana users 10.1% of respondents had used inhalants, and among ecstasy users 32.9% had used inhalants. The survey did not assess lifetime frequency of drug use for alcohol, tobacco, marijuana or ecstasy to allow us to differentiate experimenters from long-term, frequent, or heavy users, however one item assessed the frequency of past year use of marijuana.

All respondents were asked about their close friends illegal drug use behavior. They answered the following question: 'Do you think any of your close friends sometimes use marijuana, inhalants, or other illicit drugs? Illicit drugs do not include cigarettes or alcohol.' Response option was a dichotomous yes/no variable.

The four-item version of the Brief Sensation-Seeking Scale (BSSS) was used to measure sensation-seeking in the NSPY (Stephenson et al., 2003). The original BSSS is an 8-item scale developed from the original SSS-V (Zuckerman et al., 1978) and from items derived from the SSS-V but tailored for adolescents (Huba, Newcomb, & Bentler, 1981). The BSSS has high levels of reliability and validity and assesses all four domains represented in the original SSS-V. Because the BSSS was still not brief enough to be included in large nationwide surveys, Stephenson et al. (2003) developed the four-item sensation-seeking scale (BSSS-4) which has a high correlation (0.94) with the eight-item scale and is '*both a valid and reliable predictor of drug use and intention in middle and high school years*'. Recently, one study has shown that the BSS-4 is a less reliable measure of sensation-seeking for African-American youth compared to White and Hispanic youth (Vallone, Allen, Clayton, & Xiao, 2007). The BSSS-4 used in the NSPY study had an internal reliability estimate of .78 (Hornik et al., 2003). The BSSS-4 includes the following statements: 'Do you disagree or agree with the following

statements? a) I would like to explore strange places b) I like to do frightening things c) I like new and exciting experiences, even if I have to break the rules d) I prefer friends who are exciting and unpredictable.’ Possible responses for each of the statements were: Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree. Then, the NSPY investigators created a continuous sensation-seeking variable which was split by the overall median score on the four latter items, generating a dichotomous variable that represented low and high levels of sensation-seeking tendencies. This dichotomous variable was used in this study.

Parental monitoring was a variable created in the NSPY based on the responses to three different questions: ‘In general, how often does one of your (parents/caregivers): a) Know what you are doing when you are away from home?, b) Have a pretty good idea of your plans for the coming day?’, ‘How often do you spend your free time in the afternoons hanging out with friends without adults around?’ Response options for the first 2 questions were: 1-Never or almost never, 2-Sometimes, 3-About half of the time, 4-Often, 5-Always or almost always; response options for the third question were: 1-Never, 2-Seldom, 3- About half the time, 4- Often, 5-Always or Almost Always. Based on the combination of responses to these three questions respondents were classified as: 0-low monitoring, 1-medium-low monitoring, 2-medium-high monitoring, 3-high monitoring. For the purpose of this paper we dichotomized this variable into: 1-low parental monitoring (includes respondents classified as low monitoring and medium-low monitoring) and 2- high parental monitoring (includes respondents classified as medium-high monitoring and high monitoring).

A dichotomous variable representing low and high importance of religion in the youth’s lives was created from responses to: ‘How important is religion in your life?’ where not important or a little important were coded as low importance and pretty important or very important were coded as high importance. Average grade in school was assessed by: ‘Which of the following best describes your average grade in school? A response card provided options going from A (93–100) to D (69 or below), as well as an option that indicated ‘my school does not give grades’. Aspirations of attending college was a recoded variable based on the responses to: ‘Suppose you could do just what you’d like and nothing stood in your way. Please look at this card and tell me which of the following things you would want to do? Choose all that apply. Response options were: a) attend a technical or vocational school, b) serve in the armed forces, c) graduate from a 2-year college program, d) graduate from a 4-year college program, e) attend graduate or professional school after college, f) none of the above. All those who answered that they wanted to graduate from a 2 or 4 year college program and/or attend graduate or professional school after college were coded as having aspirations to attend college.

The three-level general exposure to the Anti-Drug Media Campaign was an index created by the designers of the NSPY based on response to a set of six different questions on exposure to the anti-drug Media campaign ads on TV, radio, newspapers or magazines, movie theaters or rental videos, and public anti-drug ads on buses, malls or sport events (Westat, 2006). Drug education classes or programs included attending several special classes about drugs, films, lectures or discussions, drug information on Channel One, or a special in-school TV channel.

2.2. Statistical Analyses

After basic contingency tables analyses, we estimated the crude associations and then adjusted for demographics and average grades in school and importance of religion because they were significantly associated with the odds of being either a marijuana or an ecstasy user. To account for sample weighting and the complex survey design, STATA 9.0 survey commands and the jackknife replicate weight commands were used to correctly estimate the variance (StataCorp, 2005). The NSPY has specific cross-sectional survey weights and each round includes 100 replicate weights designed for variance estimation. Possible associations between adolescents

high sensation-seeking, peer drug use and low parental monitoring with adolescent alcohol/tobacco, marijuana and ecstasy use were analyzed using jackknife weighted multinomial logistic regression models (outcome variable: 0- non-drug use, 1-alcohol and or tobacco use but no marijuana nor ecstasy use, 2-marijuana use but not ecstasy use (could use alcohol/tobacco), 3-ecstasy use (could use alcohol/tobacco and marijuana). In all models, to ensure generalizability of the findings, missing data on any of the covariates was included as a separate category. Results are presented via Odds Ratio (OR), adjusted Odds Ratio (aOR) and 95% confidence intervals (CI).

3. Results

3.1 Demographics and Other Correlates of Alcohol/Tobacco, Marijuana and Ecstasy Use

Table 1 provides a description of likelihood of alcohol/tobacco, marijuana and ecstasy use by demographic and other characteristics. There were no regional, racial, or sex differences in the odds of being an alcohol/tobacco user, marijuana user or an ecstasy user. Older adolescents were more likely to be alcohol/tobacco, marijuana or ecstasy users than non-users of these drugs. There was a greater proportion of marijuana and ecstasy users than non-drug users among adolescents who had lower grades in school (grades C/D) or who considered religion less important in their lives. Those who were non-drug users, alcohol/tobacco users, marijuana users or ecstasy users had the same exposure levels to the anti-drug media campaign and a similar proportion of each subgroup had attended drug education programs. In the alcohol/tobacco group 84.0% were alcohol users and 51.5% were tobacco users. Almost all marijuana and ecstasy users had already used alcohol (92.2% and 99.5%), tobacco (84.4% and 89.2%).

3.2. Sensation-seeking, peer drug use and parental monitoring among ecstasy users

More than 80% of the ecstasy users had high sensation-seeking levels, 86% had close friends that used drugs and 90% had low parental monitoring (Table 2). Ecstasy use was significantly associated with high sensation-seeking, close friends' drug use and low parental monitoring in the crude and adjusted models. The addition of demographics, religiosity and average grades in school only diminished slightly the strength of the associations for sensation-seeking and parental monitoring, but strongly diminished the strength of the associations for close friends' drug use (which remained significant). There were no racial/ethnic differences in sensation-seeking levels in our study (not shown, available upon request). However, there was only a trend for ecstasy use to be associated with low parental monitoring in the final adjusted model (adjusted for sensation-seeking and close friends' drug use), estimates might not be precise due to small sample size of ecstasy users. Associations were stronger for close friends drug use followed by low parental monitoring and high sensation-seeking (aOR=14.6; aOR=4.3; aOR=3.4 respectively).

3.3 Comparison of sensation-seeking, peer drug use, and parental monitoring among alcohol/tobacco users, marijuana users and ecstasy users

Alcohol/tobacco only use was significantly associated with high sensation-seeking, close friends' drug use and low parental monitoring in the crude and adjusted models (Table 2). Three quarters of the marijuana users had high sensation-seeking levels and close friends that used drugs and almost 80% had low parental monitoring (Table 2). Marijuana use was significantly associated with high sensation-seeking, close friends' drug use and low parental monitoring in the crude and adjusted models. For both the alcohol/tobacco only group and for the marijuana (without ecstasy) group Associations were stronger for close friends drug use, followed by high sensation seeking and low parental monitoring. Even though the 95% CIs overlapped, sensation-seeking and close friends' drug use were more strongly associated with ecstasy use as compared to marijuana use and alcohol/tobacco use; and more strongly associated with marijuana use as compared to alcohol/tobacco use. Low parental monitoring

was slightly more strongly associated with marijuana use as compared to alcohol/tobacco use, but, in regards to ecstasy use estimates were not precise in the final adjusted model. Interestingly, close friends' drug use was more strongly associated with any drug use group as compared to high sensation-seeking.

4. Discussion

The main findings of this study can be summarized as: 1) Adolescents with high sensation-seeking were more likely to be ecstasy, marijuana, and alcohol/tobacco users than non-users of these drugs, respectively, as compared to those with low sensation-seeking; 2) High sensation-seeking and close friends' drug use were more strongly associated with ecstasy use as compared to marijuana and alcohol/tobacco use in adolescence; 3) Low parental monitoring was associated with marijuana use and alcohol/tobacco use and there was a trend for it to be associated with ecstasy use; 4) The correlate most strongly associated with any drug use was close friends' drug use.

Our findings regarding the associations between sensation-seeking and alcohol/tobacco, marijuana and ecstasy use resemble findings from other studies (Bates et al., 1986; Pedersen, 1991; D'Silva, 2001; Hoyle et al., 2002; Martin et al., 2002; Stephenson et al., 2003; Martin et al., 2004; Yanovitzky, 2005; Gerra et al., 1998; Schifano, 2000). However, our findings did not completely support our initial hypothesis that the associations would be stronger for ecstasy use. The magnitude of the association between high levels of sensation-seeking and ecstasy use was only slightly stronger than that between high sensation-seeking and marijuana use or between high sensation-seeking and alcohol/tobacco use in the final adjusted model. While this finding is somewhat consistent with the belief that 'the more socially acceptable the use of a substance is, the less likely a relationship would be found between the substance use and sensation-seeking' (Kopstein et al., 2001; Zuckerman, 1988), it differs from findings from Dughiero et al.'s study (2001) in which 43 ecstasy users had higher sensation-seeking scores as compared to controls that included marijuana users and polydrug users who were not ecstasy users. Based on our findings, we believe that high sensation-seeking is associated with any drug use in adolescence and that the magnitude of these associations possibly does not vary by type of drug used, but might vary slightly by number of different drugs used (e.g., in our study, most ecstasy users were also alcohol, tobacco and marijuana users). It is possible that more frequent drug users and polydrug users might have higher sensation-seeking levels than individuals who are only drug experimenters. Unfortunately, the NSPY does not have data on frequency of ecstasy use; nor data on other drug use such as cocaine and heroin exists, so we could not test these hypotheses in this study.

Respondents whose close friend used illegal drugs were more likely to be alcohol/tobacco, marijuana and ecstasy users. Interestingly, peer drug use was more strongly associated with any drug use than high sensation-seeking. Peer drug use has been consistently associated with adolescent drug use (Donohew et al., 1997; Best et al., 2005; Barnes et al., 2005; Yanovitzky, 2006). Also, it is important to note that adding religiosity and average grades in school to the model diminished the strength of the association between close friends' drug use and marijuana or ecstasy use. Because this is a cross-sectional study we are unable to know whether the adolescents started using drugs because their peers were already drug users or vice-versa. The addition of peer drug use to the logistic regression model somewhat diminished the strength of the association of high sensation-seeking with any drug use, which is consistent with findings from Yanovitzky's study (2006). On the other hand, adding sensation-seeking to the model also diminished the strength of the association of close friends' drug use with any drug use. It will be useful to further explore these relationships when analyzing the NSPY longitudinally. Additional studies will be needed to explore whether encouraging adolescent ecstasy users

who are high sensation-seekers to bond with non-drug using peers will have the effect of minimizing their ecstasy and other drug use.

As expected, low parental monitoring was associated with alcohol/tobacco and marijuana use in all models and with ecstasy use in the crude model and in the model adjusted for demographics. Our findings are consistent with other studies (Chilcoat et al., 1995; Chilcoat & Anthony, 1996; Di Clemente et al., 2001; Chen et al., 2005). The addition of sensation-seeking and close friends' drug use to the model diminished the strength of the association between low parental monitoring and any drug use. The final model only showed a trend for the association between ecstasy use and low parental monitoring possible due to the small sample size of ecstasy users.

This preliminary data analysis is not without limitations. It is a cross-sectional study which limits abilities to make causal inference; future longitudinal analyses of the NSPY data will be able to overcome this limitation. Ecstasy users in our study might refer to ecstasy as tablets/capsules that do not contain pure MDMA but might contain other substances (Baggott et al., 2000), as such; studies which verify MDMA use might yield different results. There is the possibility that experimental and regular users of alcohol/tobacco, marijuana and ecstasy might differ in regards to sensation-seeking, close friends' drug use and parental monitoring, however, the NSPY does not have data on lifetime frequency of drug use, thus, we could not test for differences between experimental and regular users of these drugs. The adolescent respondents might be underreporting their drug use (Morrall, McCaffrey, & Chien, 2003). However, the NSPY data was collected via ACASI and studies show that the higher the privacy of a survey interview method, the higher the likelihood that the respondent will not underreport sensitive or stigmatized behaviors such as drug use (Schütz, Chilcoat & Anthony, 1994; Turner et al., 1998). Another of the study's limitations is in regards to the fact that youth living in institutions, group homes, or dormitories were excluded from the data collection, thus, it is not possible to extrapolate our findings to this potentially vulnerable subpopulation.

Notwithstanding these limitations, we believe this study has several strengths, including the NSPY research methods, its large sample size and generalizability to the U.S. non-institutionalized adolescent population. The probability sample of household-dwelling adolescents includes youths who have become disengaged from school (i.e., chronic absentees) and dropouts, as well as those in very disadvantaged families, making its sample frame more complete than the corresponding sampling frames in school-based, clinic or telephone surveys. Additional strengths of the surveys include the standardized and structured formats, extensively trained interviewers to minimize interviewer variation and bias, as well as high quality of data cleaning and imputations measures taken to minimize missing data.

This study's findings have significant implications, especially for the prevention of ecstasy and other drug use among adolescents. Prevention media campaigns should employ strategies that target adolescents with high sensation-seeking in order to attempt to decrease both ecstasy and other drug use (Stephenson et al., 1999; Palmgreen et al., 2001). These strategies attempt to reach high sensation-seekers with advertisements that appeal to their need for stimulation (e.g., SENTAR-sensation-seeking targeting; Stephenson, 2003). School drug use prevention programs should also develop interventions that target high sensation-seeking adolescents, which could be easily done by incorporating messages from mass media campaigns that target sensation-seeking youth. School drug use prevention programs should also keep in mind that ecstasy and marijuana use are strongly associated with peer drug use in adolescence, and try to develop intervention strategies that limit the interaction of adolescents with high sensation-seeking with drug using peers, encouraging their contact with non-drug using adolescents.

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Table 1

Demographics and other correlates by lifetime substance use among 12–18 year-olds, NSPY-RUF, round 2.

	Total			Alcohol/Tobacco Use Only			Marijuana Use			Ecstasy Use [§]		
	n			n	row %wt	OR (95%CI) [†]	n	row %wt	OR (95%CI) [†]	n	row %wt	OR (95%CI) [†]
Sex	5,049	---		---	29.8		802	19.3	---	164	4.2	---
Male	2,603	763		763	30.3	1.0	426	19.8	1.0	87	4.3	1.0
Female	2,446	718		718	29.3	0.9 (0.6–1.4)	376	18.8	0.9 (0.6–1.3)	77	4.0	1.0 (0.3–2.7)
Age												
12–13 years old	1,837	383		383	19.9	1.0	79	4.8	1.0	12	0.7	1.0
14–16 years old	2,341	795		795	33.9	3.0 (1.8–4.8)	423	20.4	7.4 (4.0–13.8)	58	2.5	6.0 (1.0–37.2)
17–18 years old	871	303		303	33.9	6.2 (3.5–10.9)	300	33.9	25.6 (10.0–65.5)	94	11.4	58.5 (9.3–367.5)
Race/ethnicity												
White	3,404	1,041		1,041	31.1	1.0	522	19.4	1.0	119	4.9	1.0
African-American	709	192		192	28.1	0.8 (0.4–1.6)	118	18.7	0.8 (0.4–1.5)	7	1.1	0.2 (0.01–3.0)
Other	201	42		42	25.0	0.7 (0.2–2.7)	32	18.0	0.8 (0.3–2.1)	6	3.1	0.5 (0.03–11.4)
Hispanic	735	206		206	27.2	0.8 (0.4–1.6)	130	19.7	0.9 (0.5–1.9)	32	5.1	1.0 (0.2–4.7)
Region												
Northeast	775	244		244	30.7	1.0	106	18.8	1.0	29	5.5	1.0
Midwest	1,148	359		359	33.4	1.1 (0.6–2.2)	191	19.1	1.1 (0.4–2.8)	42	4.2	0.8 (0.1–4.3)
South	1,862	565		565	30.3	0.9 (0.5–1.8)	291	19.1	1.0 (0.5–1.8)	53	3.7	0.6 (0.2–2.7)
West	1,264	313		313	24.8	0.7 (0.3–1.6)	214	20.2	1.0 (0.3–2.6)	40	4.2	0.7 (0.2–3.0)
Average grade in school												
A/B	(4,982)	1,139		1,139	30.0	1.0	492	15.9	1.0	94	3.4	1.0
C/D	3,882	323		323	29.8	1.4 (0.8–2.5)	275	28.3	2.5 (1.4–4.6)	56	6.2	2.6 (1.0–6.9)
School does not give grades	1,078	3		3	19.1	0.9 (0.1–177.0)	5	26.8	2.4 (0.03–184.0)	5	18.9	8.1 (0.3–192.4)
College plans												
Yes	(5,039)	1,111		1,111	30.5	1.0 (0.6–1.7)	566	18.2	0.8 (0.4–1.3)	108	3.9	0.7 (0.2–2.0)
No	3,739	367		367	27.9	1.0	234	22.5	1.0	56	5.3	1.0
Importance of religion												
Low	1,359	412		412	29.2	1.5 (0.9–2.3)	305	27.5	2.6 (1.5–4.4)	94	9.1	5.8 (1.8–18.7)
High	3,687	1,069		1,069	30.0	1.0	495	16.1	1.0	70	2.4	1.0
General exposure to Anti-Drug Media Campaign												
Low	(4,964)	306		306	27.2	1.0	180	18.9	1.0	42	4.6	1.0
Moderate	1,166	322		322	28.6	1.1 (0.6–2.1)	207	21.9	1.2 (0.6–2.5)	33	3.8	0.9 (0.2–4.5)
High	1,140	834		834	31.8	1.3 (0.8–2.0)	404	18.4	1.1 (0.6–1.8)	84	4.2	1.0 (0.3–3.1)
Attended Drug Education Program												
Yes	3,821	1,095		1,095	28.9	0.8 (0.5–1.3)	599	19.4	1.0 (0.5–1.8)	120	4.3	0.9 (0.3–2.5)
No	1,197	380		380	32.8	1.0	199	18.9	1.0	44	4.3	1.0

[§] Only 14 ecstasy users were non-marijuana users.

[†] Base-category: non-drug users.

Estimated prevalence and Odds Ratio[†] estimates of sensation-seeking, close friends' drug use and parental monitoring among 12–18 year-old lifetime Marijuana users, NSPY-RUF, round 2.

		Sensation-seeking		Close friends' drug use		Parental Monitoring	
		Low	High	No	Yes	High	Low
No drug use							
Alcohol/Tobacco use (no marijuana/ecstasy use)	Prevalence	61.1 (56.1–66.1)	38.9 (33.8–43.9)	85.6 (81.0–90.3)	14.4 (9.7–19.0)	51.8 (45.0–58.5)	48.2 (41.5–55.0)
	Prevalence	35.0 (28.2–41.7)	65.0 (58.2–71.8)	58.5 (52.2–64.7)	41.5 (35.3–47.8)	30.4 (23.4–37.5)	69.6 (62.5–76.6)
	Crude OR (95% CI)	1.0	2.9 (2.0–4.2)	1.0	4.2 (2.6–6.8)	1.0	2.5 (1.6–3.8)
	aOR (demo) [†] aOR (95% CI)	1.0	2.7 (1.8–4.1)	1.0	3.3 (2.0–5.5)	1.0	2.3 (1.4–3.7)
	aOR (all) [*] aOR (95% CI)	1.0	2.2 (1.4–3.4)	1.0	2.7 (1.6–4.7)	1.0	1.7 (1.1–2.9)
Marijuana use (no ecstasy use)							
	Prevalence	24.5 (14.4–33.5)	75.5 (66.4–84.6)	25.2 (16.5–33.9)	74.8 (66.1–83.5)	20.3 (11.3–29.4)	79.7 (70.6–88.7)
	Crude OR (95% CI)	1.0	4.9 (2.9–8.3)	1.0	17.7 (8.8–35.6)	1.0	4.2 (2.3–7.7)
	aOR (demo) [†] aOR (95% CI)	1.0	4.4 (2.4–7.8)	1.0	12.4 (5.9–25.9)	1.0	3.5 (1.8–6.6)
	aOR (all) [*] aOR (95% CI)	1.0	2.9 (1.6–5.3)	1.0	9.7 (4.5–20.8)	1.0	2.2 (1.1–4.4)
Ecstasy use							
	Prevalence	18.2 (1.5–34.9)	81.8 (65.1–98.5)	14.5 (0.1–34.5)	85.5 (65.5–99.9)	9.8 (0.1–20.5)	90.2 (79.5–99.9)
	Crude OR (95% CI)	1.0	7.1 (2.2–23.0)	1.0	35.0 (5.6–218.2)	1.0	9.8 (2.7–35.6)
	aOR (demo) [†] aOR (95% CI)	1.0	5.4 (1.4–20.8)	1.0	20.1 (2.7–148.0)	1.0	7.6 (1.9–29.5)
	aOR (all) [*] aOR (95% CI)	1.0	3.4 (1.1–12.0)	1.0	14.8 (2.0–108.7)	1.0	4.4 (0.9–20.4)

[†] Base-category: Non drug users (non-alcohol, tobacco, inhalant, marijuana & ecstasy users). Results are from multinomial logistic regression model with categorical outcome (0=no drug use, 1= alcohol/tobacco use (no marijuana/ecstasy use), 2=marijuana use with no ecstasy use, 3=ecstasy use).

^{*} Model 1. Adjusted Odds ratio: model includes demographics (sex, age, race, and region of the country), average grade in school, and importance of religion.

^{*} Model 2. Adjusted Odds ratio: model includes sensation-seeking, close friends' drug use, parental monitoring, demographics, average grade in school, and importance of religion.