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Molly Users versus Non-users in a Sample of College Alcohol Drinkers: Differences in Substance-Related Harms and Sensation Seeking

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Abstract

Background—Molly is one form of MDMA that is touted to be more “pure” and potentially less harmful than other forms, such as ecstasy. Media reports and case studies suggest this drug is popular among college students and is related to adverse health problems. The current study sought to address the gaps in our knowledge about Molly by examining whether users differ in substance use outcomes and sensation seeking than non-users. Specifically, we tested whether Molly users engaged in heavier use of other substances and experienced more substance-related harms in general than non-users. Further, we investigated whether Molly users exhibited higher levels of sensation seeking than non-users. Lastly, we examined whether Molly user status would be associated with substance-related harms beyond the confounding influence of other substance use and trait sensation seeking.

Methods—Participants were 710 (71.9% female) college alcohol drinkers who completed self-report surveys about substance use (i.e., Molly, alcohol, other drug use), substance-related problems, and sensation seeking.

Results—Results revealed that approximately 12% of our sample reported lifetime Molly use. Molly users compared to non-users reported higher levels of other drug use, alcohol use, substance-related problems, and sensation seeking. Further, Molly users reported experiencing poorer substance use outcomes (e.g., blacking out, academic/occupational problems, withdrawal symptoms) after accounting for sensation seeking and other substance use.

Conclusions—Our findings indicate that Molly users are higher in sensation seeking and use is uniquely related to greater risk for substance-related harms. These preliminary findings demonstrate a need for correcting possible misperceptions regarding the purity of Molly and

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AUTHOR CONTRIBUTIONS

All authors significantly contributed to the manuscript. Ashley N. Linden-Carmichael wrote the Introduction and Discussion sections and conducted statistical analyses. Amy L. Stamates wrote the Results section, aided in conducting statistical analyses, and assisted in editing the manuscript. Brynn E. Sheehan wrote the Method section, administered data collection, and edited the manuscript. Cathy Lau-Barraco provided substantial feedback in study design and conceptualization in addition to editing drafts of the paper.

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educating users on the potential for experiencing associated harms. Such information could be used to develop efficacious prevention programming for college students.

Keywords

Molly; MDMA; ecstasy; college students; alcohol; substance-related problems

INTRODUCTION

Molly, a synthetic psychoactive substance, has recently received media attention as an increasingly popular drug.¹ Molly is a form of MDMA (or ecstasy) with stimulant and hallucinogenic properties, producing feelings of euphoria, emotional closeness, and sensory distortions.² It is marketed as being a more “pure” powder form of MDMA, which may lead some to perceive it as relatively safer than other psychoactive drugs.³ Recent research suggests that rates of ecstasy have increased⁴ as have ecstasy-related emergency room visits.⁵ Scant research has specifically examined Molly use, but limited evidence indicates that use may be associated with similar adverse health effects as other forms of MDMA,⁶ especially given recent reports of Molly-related deaths.⁷ The current study sought to address the gaps in extant knowledge by identifying negative consequences associated with Molly use as well as whether sensation seeking (SS), an individual characteristic related to substance use and problems, is associated with the likelihood of using Molly.

Given the energy-enhancing and intimacy-boosting effects of MDMA, this “club drug” is often used at parties, nightclubs, or raves.⁸ Epidemiological reports indicate that 18.2% of individuals aged 13-28 report past-year MDMA use, primarily among young adults (9.5%).^{9,10} Research indicates that although MDMA use can increase positive mood, its use also is related to physiological and psychological harms. MDMA can produce immediate physical effects, such as rapid heart rate, increased blood pressure, overheating, feelings of dehydration, and jaw clenching.¹¹ Use is linked to health issues overall, such as paranoia, confusion, and moodiness,¹² and some findings suggest that ecstasy use is associated with symptoms of drug dependence,^{13,14} such as craving.¹⁵ Importantly, ecstasy use is associated with other drug use (e.g., alcohol, illicit drugs),¹⁶ which may increase the likelihood of experiencing negative drug-related consequences.

As mentioned, Molly is intended to be a more pure form of MDMA (i.e., free of adulterants found in MDMA) and allows the user to experience a high more quickly and “come down” more subtly.^{3,6,17} In addition, because Molly has become a part of pop culture (e.g., Molly use is incorporated in some pop stars’ lyrics) and is popular in certain contexts, such as electronic dance music (EDM) events¹⁸, some may use Molly in order to fit in and feel connected with others. Molly is often perceived to be less harmful than other forms of MDMA³. This perception of its purity may not be accurate, however, given at least one report of three healthy young adults developing intracranial hemorrhaging after using Molly.⁶ Some research has tested the chemical content of psychoactive substances sold to drug users as MDMA, finding that the pharmacological composition and subjective effects varied widely across the tablets provided.¹⁹ Thus, tablets sold as MDMA (e.g., ecstasy, Molly) may be adulterated with potentially dangerous synthetic substances.

Despite harms, theoretical frameworks such as the Health Belief Model²⁰ suggest that perceiving a low level of seriousness in a health behavior with high perceived benefits may impact an individual's decision to engage in the behavior. Therefore, if an individual believes that Molly is relatively harmless but will produce positive effects (e.g., euphoria), they may be inclined to use Molly. Indeed, some evidence indicates factors such as low perceived risk can increase the likelihood of using ecstasy.²¹ Overall, the perception that Molly is a more pure and safe form of MDMA may put an individual at risk for using Molly. The dearth of investigations focusing on Molly use warrants additional research investigating its relationship with substance-related harms.

Identifying individual-level differences associated with Molly use are needed to determine characteristics that may increase one's likelihood of use. In particular, evidence from the broader substance use literature suggests that individuals exhibiting higher levels of SS, or who search for new and exciting experiences, tend to use more drugs in general.²² Higher levels of SS are related to increased alcohol and drug dependence symptoms.²³ In fact, one longitudinal study of college students found that SS was predictive of substance use disorders six years later.²⁴ Based on theory,^{25,26} this trait may be particularly relevant for Molly users for a couple of reasons. Because sensation seekers are drawn toward novel experiences, they may be particularly drawn toward Molly use as it is a relatively new drug gaining in popularity. This is consistent with findings that link SS to other types of new drugs (i.e., new tobacco products²⁷). Further, theory suggests when sensation seekers engage in risk appraisal they tend to value the reward (i.e., excitement, novelty) more than the potential for harm. The combination of Molly being perceived as producing excitatory effects *and* its relatively low risk may be appealing factors for sensation seekers and lead to its use. Given the basis for sensation seekers to use Molly, in addition to the influence SS has on substance use negative outcomes such as blacking out and experiencing academic and occupational problems, identifying whether Molly users are higher in SS than non-users would aid intervention efforts aimed at reducing risky substance use behaviors.

Although Molly is often perceived to be a safer form of MDMA, extant research suggests that its use may be related to adverse health outcomes. Scant research has, however, examined personality characteristics and consequences associated with one's likelihood of using Molly. Consequently, the current study had four aims. First, we examined whether Molly users consumed more alcohol and were more likely to use other drugs as compared to non-users. Second, we examined whether Molly users experienced more alcohol-related and drug-related problems. Third, given that sensation seekers may be particularly drawn toward novel drugs with perceived low risk, we compared users and non-users on SS. Finally, we aimed to further clarify the potential association between Molly user status and substance-related problems by examining this relationship after accounting for potential confounding factors including SS, typical drinking, and other substance use.

METHODS

Participants

Participants were 710 (71.9% female) undergraduate student alcohol drinkers recruited from a research pool at a large-size public southeastern university. To be eligible, participants

must have been at least 18 years old and reported consuming alcohol at least once during a typical week. Mean age of participants was 21.65 ($SD = 3.93$) years. Participants were 52.3% Caucasian, 30.4% African American, 6.5% Biracial, 4.8% Asian, 0.6% American Indian or Alaskan Native, 4.5% identified as “Other,” and 1% did not respond. Class standings of participants were 26.6% freshmen, 20.7% sophomores, 22.4% juniors, 29.7% seniors, 0.3% non-degree seeking, and 0.3% did not respond.

Procedure

Students volunteered to participate in the current study via an online psychology research pool (i.e., SONA systems) associated with the university. Participants were assigned a unique identification code, thus no identifiable information was collected. Upon selecting the present study, participants were provided with informed consent. Participants then completed a research survey online, which took between 30 and 60 minutes to complete. All participants were awarded course credit for their participation. This study was approved by the university’s college committee on human subjects research and followed American Psychological Association ethical guidelines.²⁸

Measures

Molly use—Lifetime Molly use was assessed by asking participants, “Have you ever tried Molly?” Responses were coded such that 0 = have never tried Molly, and 1 = tried Molly at least once.

Alcohol use—The Daily Drinking Questionnaire (DDQ²⁹) was used to assess alcohol use. Participants reported the number of alcoholic drinks they typically consumed each day during a typical week over the previous three months. The total number of alcoholic drinks consumed in a typical week (i.e., alcohol use quantity) was used as a measure of alcohol consumption.

Past-year other substance use—Participants were asked how frequently they have used a variety of drugs aside from alcohol and Molly, based on a scale adapted from previous research.³⁰ Specifically, participants were asked about the frequency in which they used the following illicit drugs in the past year: LSD or other hallucinogens, marijuana, cocaine/crack, ecstasy/MDMA, heroin or opiates, methamphetamine or other amphetamines, prescription drugs for nonmedical reasons, GHB or roofies, synthetic marijuana (“spice” or “K2”), and ketamine. Participant responses were on a scale ranging from 0 (*I have never tried this drug*) to 7 (*Everyday or nearly everyday*). Responses were recoded to reflect whether participants tried at least one of the drugs listed in the past year (1) or did not use any of these drugs in the past year (0).

Alcohol-related problems—Alcohol-related problems were assessed using the Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ³¹). The BYAACQ is a 24-item questionnaire that measures problems experienced in the past year. The response options consist of “yes” (1) or “no” (0) to each item (e.g., “When drinking, I have done impulsive things that I regretted later”). Total scores are calculated by summing the positive

endorsements. Higher scores indicate more alcohol-related problems. In the current study, $\alpha = .91$.

Drug-related problems—The Drug Abuse Screening Test (DAST-10³²) was used to assess drug-related problems. The DAST is a 10-item measure that asks participants about their involvement with drugs, not including alcoholic beverages, in the previous 12 months. Participants respond “yes” (1) or “no” (0) to each item (e.g., “Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs?”). Responses are summed, with higher scores indicating more drug-related problems. In the current study, $\alpha = .71$.

Sensation seeking—SS was assessed using the Brief Sensation Seeking Scale (BSSS³³). The BSSS is an 8-item measure that asks participants to report the degree to which they agree with a variety of statements about their SS behavior on a 5-point Likert scale (e.g., “I would love to have new and exciting experiences, even if they are illegal”). Responses range from 1 = *strongly disagree* to 5 = *strongly agree*. A composite score was created by summing all responses with higher scores indicating a greater propensity for SS behavior. In the current study, $\alpha = .84$.

Data Analytic Plan

Prior to conducting analyses, data were inspected for outliers and missing data. Box plots revealed 14 extreme scores (i.e., outside the three interquartile range) on the DDQ and 3 extreme scores on the DAST. The results of the present study did not differ based on the inclusion of the outliers; thus, to reduce the impact on statistical estimates, these scores were Winsorized to match the next highest score.³⁴ Pairwise deletion was used to account for missing data (ranging from 0% on the DDQ to 14.9% on the BYAACQ).

Independent samples *t*-tests were used to examine differences on typical alcohol use, alcohol-related problems, drug related-problems, and SS between Molly users and non-users. A Bonferroni correction was applied to account for multiple comparisons. When the assumption of homogeneity of variance was violated, the Welch *F*-ratio was analyzed. All results remained significant.

An analysis of covariance (ANCOVA) was used to determine differences between Molly users and non-users on alcohol-related problems, while controlling for SS, typical alcohol use, and past-year other drug use. A separate ANCOVA was used to determine differences between Molly users and non-users on drug-related problems, while controlling for SS and typical alcohol use. Analyses in which drug-related problems was the outcome included only those who reported other drug use (aside from alcohol) in our sample. All analyses were conducted in SPSS version 21.0.

RESULTS

Sample Descriptive Characteristics

Participants reported consuming an average of 10.48 ($SD = 9.03$) standard alcoholic drinks per week. Approximately 12.4% of the sample reported trying Molly at least once in their lifetime. Of the entire sample, 53.1% reported using at least one other drug (i.e.,

hallucinogens, marijuana, cocaine, ecstasy, heroin, methamphetamine, prescription drugs, GHB or roofies, synthetic drugs, and ketamine) in the past year. A chi-square test was used to determine the relationship between Molly user status on past-year other drug use. Results revealed 90.4% of Molly users reported past-year other drug use, whereas 47.8% of non-users reported past-year other drug use. This difference was statistically significant, $\chi^2(1, N = 669) = 52.92, p < .001$. A chi-square analysis also was used to examine whether Molly user status varied by gender. A 2 (Gender: Males versus Females) \times 2 (Molly user status: Yes versus No) revealed no significant difference in gender between Molly user status, $p = .621$. All descriptive statistics can be found in Table 1.

Molly User Status

Substance use outcomes and sensation seeking—Regarding typical alcohol use, results revealed a significant difference between user status, such that Molly users reported greater weekly alcohol use than non-users. For alcohol-related problems, results indicated that Molly users reported experiencing more alcohol-related problems than non-users. Regarding drug-related problems, results revealed a significant difference between user status with Molly users reporting more drug-related problems than non-users. For SS, results revealed a significant difference between user status such that Molly users reported greater levels of SS. See Table 1.

Alcohol and drug problems with controls—Results from a one-way ANCOVA revealed a significant main effect, $F(1, 534) = 4.95, p = .027, \eta^2 = .009$, indicating that Molly users reported experiencing more alcohol-related problems above and beyond the influence of the other control variables. For drug-related problems, results revealed a significant main effect, $F(1, 302) = 26.28, p < .001, \eta^2 = .081$, indicating that Molly users reported experiencing more drug-related problems above the influence of SS and typical alcohol use.

DISCUSSION

Molly, perceived to be a more “purified” form of MDMA, is an understudied yet potentially dangerous drug used among young adults.⁶ Scant research has investigated whether Molly, a drug thought to be more low-risk,³ is associated with other substance use and general substance-related problems. Further, the extent to which risky personality characteristics are related to one’s likelihood of using Molly has not been studied. To address these gaps in our knowledge, the present study sought to examine Molly use in a sample of college student alcohol drinkers, as well as to examine its associated consequences (i.e., other substance use, general substance-related problems) and individual-level characteristics (i.e., SS).

Our first two aims were to determine whether Molly users differed from non-users in their reported use of other drugs and related problems. We found that Molly users reported consuming alcohol more heavily during a typical week and indicated a greater likelihood of using other drugs in the past year (e.g., marijuana, cocaine, or hallucinogens). Molly users also reported experiencing more alcohol-related problems, such as blacking out from drinking, experiencing academic/occupational problems, or engaging in risk-taking behaviors. Additionally, among college students who used other drugs, Molly users as

compared to non-users reported experiencing more drug-related problems in general (i.e., not necessarily specific to Molly use). These drug-related harms included withdrawal and dependence symptoms as well as social-interpersonal problems. Findings suggest that Molly users are at greater risk for heavier substance use and substance-related harms overall. These risks associated with using Molly appear to be similar to the risks related to other forms of MDMA, such as ecstasy.^{13,16}

Our third aim was to compare Molly users and non-users on self-reported SS, given prior research²⁷ and theory²⁶ suggesting that individuals higher in SS are drawn toward novel substances. Past research indicates that young adults who exhibited higher levels of SS tended to engage in heavier and more frequent substance use.^{13,35} Additionally, given that Molly is often perceived to be a more low-risk drug, individuals higher in SS who also have low risk appraisal²⁵ may be especially more likely to use Molly than those lower in SS. Our findings indicate that young adults with higher levels of SS also reported being more likely to use Molly. This finding is important given literature suggesting that SS is tied with substance use longitudinally²⁴ and sensation seekers experience more substance-related problems.²³ Given findings that Molly users report experiencing more problems than non-users, prevention and intervention efforts focused on party drug use may benefit from specifically targeting sensation seekers. For example, interventionists could work with students higher in SS to weigh the benefits and consequences of using party drugs, including Molly. Such techniques could aid students who are higher on SS in decision-making. Intervention efforts may benefit from utilizing a harm reduction approach, given that some students may have difficulty abstaining from party drug use completely. Similar to some college drinking intervention programs,³⁶ Molly users could receive education and training on ways to use strategies to protect themselves from problematic drug use as well as other harm reduction techniques.

Our final aim sought to examine differences in substance-related harms between Molly users and non-users after controlling for potential confounding factors. We found that beyond one's use of other drugs, typical drinking habits, and trait level of SS, Molly users reported higher levels of alcohol-related problems. With regard to drug-problems, among college students who reported other drug use, Molly users indicated greater risk for drug-related harms beyond the influence of SS and alcohol consumption. Thus, despite our small sample of Molly users ($n = 88$), user status was significantly related to greater substance-related harms, with a medium to large effect found in drug-related problems and a small effect found in alcohol-related problems. Prior research has found substance use in general is heaviest among young adults than any other age group⁹ and is related to experiencing negative consequences concurrently and prospectively.^{37,38} Because our findings show that Molly users report experiencing harms beyond their other substance use, it is clear that additional research is needed to investigate the short and long-term effects of Molly in college students. Such research may be important due to the perception that Molly is safer despite the rise in MDMA-related hospital visits.⁵

To the best of our knowledge, this is the first study to directly compare college student alcohol drinkers who use versus do not use Molly. There is a perception that because Molly is touted as a more "pure" form of MDMA, it is safer than other substances. There are

several theoretical frameworks that could offer insight to explain why some college students may decide to try Molly. First, based on the aspect of identity exploration from the theory of emerging adulthood,^{39,40} as well as theories concerning SS,²⁶ young adults in general and those high in SS may be drawn toward new and exciting experiences in an effort to define themselves. Using party drugs, such as Molly, may be one way for individuals within this age group to engage in seeking out novel experiences.⁴⁰

A second explanation as to why some college students use Molly may be gleaned from the Health Belief Model.²⁰ That is, because Molly is often perceived to have relatively few risks, students may be more inclined to use Molly. The findings in our study demonstrate that despite perceptions that Molly is relatively harmless, its use is associated with drug- and alcohol-related problems even after accounting for other confounding factors (i.e., personality traits, other substance use). In accordance with a recent case study, Molly use is associated with adverse health effects.⁶ Perceptions that Molly has low risk may influence one's decision to try Molly even if they abstain from other drug use. Such a pattern has been observed in prior investigations of other drug types. For example, recent research has suggested that the perception of e-cigarettes as being less harmful than cigarettes is linked with e-cigarette use⁴¹ and that some e-cigarette users do not report other cigarette use.⁴² In accordance with our findings that 10% of Molly users do not report other drug use aside from alcohol, these findings may indicate that some users who do not normally use drugs could be willing to try drugs, such as e-cigarettes or Molly, due to their low perceived risk. This low perceived risk combined with the potential for harm from Molly use highlights the critical need for additional research in this area. National surveys on drug use among young adults such as Monitoring the Future may gain a more accurate representation of drug use among college students if questions about Molly use specifically are included.

A final explanation for Molly use may be related to its emergence in popular culture. With some pop stars including lyrics about Molly drug use in their songs, Molly may be increasing in popularity. Additionally, media reports suggest that the EDM is often accompanied by "party drugs" such as ecstasy and Molly.¹⁸ The recent deaths of concert goers has turned attention to the increasing availability and use of these drugs. As Molly use becomes more immersed and normalized into popular culture, some college students may see their friends use Molly and consequently may choose to use Molly themselves. Because short- and long-term consequences do not necessarily always occur from Molly use, some students may be unaware of the harms that could arise from its use when using or seeing their friends use Molly. Importantly, the normalization of Molly use is evident in our sample as our results indicate that despite men typically using more drugs in general⁴, women in our sample were found to be just as likely as men to use Molly.

The current study is not without limitations. First, we used a cross-sectional design, which prevents us from making inferences about the causality in relationships among study variables. Longitudinal assessments, such as examining whether frequent Molly use is associated with experiencing alcohol- or drug-related harms over time, would allow more conclusive evidence as to whether Molly use is associated with poorer health outcomes. Second, our analyses were based on participant self-reports about alcohol and drug outcomes, which may be biased due to social desirability concerns. Recent research supports

that participants generally supply valid self-report data on substance use and symptoms of substance dependence.⁴³ Third, the present study was part of a larger study investigating students' perceptions of the drug composition of Molly. For this reason, we did not include a definition of Molly when inquiring about their use of this drug. Consequently, some students may not have been aware that Molly is a type of MDMA. Relatedly, it is important to note that although some individuals report using Molly (i.e., a pure form of MDMA), they may have unknowingly consumed an adulterated version. Thus, our results should be interpreted with respect to users' *perception* that they were using Molly. On a similar note, participants completed the survey online, thus we cannot verify the identity of respondents. Fourth, our sample consisted primarily of women (72%) which could make findings less generalizable to men, though we should note that our findings did not vary when gender was included as a control variable in the analyses. Finally, the present study focused on specific personality traits and outcomes that may be associated with Molly use. Future work may benefit from assessing other factors such as risk perception and facets of impulsivity, as they could be influential variables in the outcomes experienced.

Overall, this is the first study to examine prevalence of Molly use in a college student sample as well as test key factors that may be associated with Molly use. Our findings indicate that more than one in ten of the college student drinkers sampled have reported using Molly and that Molly users reported higher SS characteristics, heavier alcohol consumption, and more past-year other drug use. Most importantly, we found that our sample of Molly users indicated experiencing more alcohol *and* drug-related problems in general, above the influence of other relevant factors. These preliminary findings warrant additional research examining the prevalence of and harms associated with Molly use in an effort to develop effective prevention efforts that correct misperceptions that Molly is relatively harmless.

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REFERENCES

1. Aleksander, I. [Accessed September 6, 2015] Molly: Pure, but not so simple. New York Times. Jun 21. 2013 http://www.nytimes.com/2013/06/23/fashion/molly-pure-but-not-so-simple.html?_r=1
2. National Institute on Drug Abuse. [Accessed September 6, 2015] MDMA (Ecstasy or Molly). Sep. 2013 <http://www.drugabuse.gov/publications/drugfacts/mdma-ecstasy-or-molly>
3. Steinhardt SJ, Moore TR, Casella SD. Have you seen Molly? A review of Molly in primary literature. *Mental Health Clinician*. 2014; 4:231–235.
4. Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. *Monitoring the Future: National Survey Results on Drug Use, 1975-2012. Vol. Volume II: College Students and Adults Ages 19-50.* Institute for Social Research, The University of Michigan; Ann Arbor, MI: 2013.
5. Center for Behavioral Health Statistics and Quality. Substance Abuse and Mental Health Services Administration. [Accessed September 6, 2015] Drug Abuse Warning Network, 2011: Selected Tables of the National Estimates of Drug-Related Emergency Department Visits. 2015. Available at: <http://www.samhsa.gov/data/emergency-department-data-dawn/reports?tab=47>

6. Kahn DE, Ferraro N, Benveniste RJ. 3 cases of primary intracranial hemorrhage associated with “Molly”, a purified form of 3,4-methylenedioxymethamphetamine (MDMA). *J Neurol Sci.* 2012; 323:257–260. [PubMed: 22998806]
7. Ohlheiser A. A dozen hospitalized after apparently overdosing on Molly at Wesleyan University. *The Washington Post.* Feb 23.2015 [Accessed September 6, 2015] <http://www.washingtonpost.com/news/grade-point/wp/2015/02/23/a-dozen-hospitalized-after-apparently-overdosing-on-molly-at-wesleyan-university/>.
8. Kelly BC, Parsons JT, Wells BE. Prevalence and predictors of club drug use among club-going young adults in New York City. *J Urban Health.* 2006; 83:884–895. [PubMed: 16937088]
9. Johnston, LD.; O’Malley, PM.; Bachman, JG.; Schulenberg, JE.; Miech, RA. *Monitoring the Future: National Survey Results on Drug Use, 1975-2013: Volume II, College Students and Adults Ages 19-55.* Institute for Social Research, The University of Michigan; Ann Arbor, MI: 2014.
10. Substance Abuse and Mental Health Services Administration. *Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings.* Substance Abuse and Mental Health Services Administration; Rockville, MD: 2014.
11. Parrott AC. Human psychobiology of MDMA or ‘Ecstasy’: An overview of 25 years of empirical research. *Hum Psychopharmacol.* 2013; 28:289–307. [PubMed: 23881877]
12. Fisk JE, Murphy PN, Montgomery C, Hadjilefthyoulou F. Modeling the adverse effects associated with ecstasy use. *Addiction.* 2010; 106:798–805. [PubMed: 21182557]
13. Degenhardt L, Bruno R, Topp L. Is ecstasy a drug of dependence? *Drug Alcohol Depend.* 2010; 107:1–10. [PubMed: 19836170]
14. Parrott AC. Chronic tolerance to recreational MDMA (3,4-methylenedioxymethamphetamine) or Ecstasy. *J Psychopharmacol.* 2005; 19:71–83. [PubMed: 15671132]
15. Hopper JW, Su Z, Looby AR, Ryan ET, Penetar DM, Palmer CM, Lukas SE. Incidence and patterns of polydrug use and craving for ecstasy in regular ecstasy users: An ecological momentary assessment study. *Drug Alcohol Depend.* 2006; 85:221–235. [PubMed: 16730923]
16. Palamar JJ, Kamboukos D. An examination of sociodemographic correlates of ecstasy use among high school seniors in the United States. *Subst Use Misuse.* 2014; 49:1774–1783. [PubMed: 24955818]
17. Duterte M, Jacinto C, Sales P, Murphy S. What’s in a label? Ecstasy sellers’ perception of pill brands. *J Psychoactive Drugs.* 2009; 41:27–38. [PubMed: 19455907]
18. Mason, K.; McCarthy, Z. [Accessed December 8, 2015] Dancing with Molly: The EDM community has an honest conversation about drugs. *Billboard.* Sep 20. 2013 <http://www.billboard.com/articles/columns/code/5719296/dancing-with-molly-the-edm-community-has-an-honest-conversation-about>
19. Brunt TM, Koeter MW, Niesink RJ, van den Brink W. Linking the pharmacological content of ecstasy tablets to the subjective experiences of drug users. *Psychopharmacology.* 2012; 220:751–762. [PubMed: 21993879]
20. Rosenstock IM, Strecher VJ, Becker MH. Social learning theory and the health belief model. *Health Educ Behav.* 1988; 15:175–183.
21. Leung KS, Abdallah AB, Copeland J, Cottler LB. Modifiable risk factors of ecstasy use: Risk perception, current dependence, perceived control, and depression. *Addict Behav.* 2010; 35:201–208. [PubMed: 19880258]
22. Dennhardt AA, Murphy JG. Prevention and treatment of college student drug use: A review of the literature. *Addict Behav.* 2013; 38:2607–2618. [PubMed: 23846178]
23. Grekin ER, Sher KJ, Wood PK. Personality and substance dependence symptoms: Modeling substance-specific traits. *Psychol Addict Behav.* 2006; 20:415–424. [PubMed: 17176176]
24. Sher KJ, Bartholow BD, Wood MD. Personality and substance use disorders: A prospective study. *J Consult Clin Psychol.* 2000; 68:818–829. [PubMed: 11068968]
25. Horvath P, Zuckerman M. Sensation seeking, risk appraisal, and risky behavior. *Pers Individ Dif.* 1993; 14:41–52.
26. Zuckerman, M. *Sensation Seeking and Risky Behavior.* American Psychological Association; Washington, DC: 2007. p. 51-72.

27. Cohn A, Villanti A, Richardson A, Rath JM, Williams V, Stanton C, Mermelstein R. The association between alcohol, marijuana use, and new and emerging tobacco products in a young adult population. *Addict Behav.* 2015; 48:79–88. [PubMed: 26042613]
28. American Psychological Association. Ethical principles of psychologists and code of conduct. *Am Psychol.* 2002; 57:1060–1073. [PubMed: 12613157]
29. Collins RL, Parks GA, Marlatt GA. Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *J Consult Clin Psychol.* 1985; 53:189–200. [PubMed: 3998247]
30. White HR, Morgan TJ, Pugh LA, Celinska K, Labouvie EW, Pandina RJ. Evaluating two brief substance-use interventions for mandated college students. *J Stud Alcohol Drugs.* 2006; 67:309–317.
31. Kahler CW, Strong DR, Read JP. Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcohol Clin Exp Res.* 2005; 29:1180–1189. [PubMed: 16046873]
32. Skinner HA. The Drug Abuse Screening Test. *Addict Behav.* 1982; 7:363–371. [PubMed: 7183189]
33. Hoyle RH, Stephenson MT, Palmgreen P, Lorch EP, Donohew RL. Reliability and validity of a brief measure of sensation seeking. *Pers Individ Dif.* 2002; 32:401–414.
34. Barnett, V.; Lewis, T. *Outliers in Statistical Data.* Wiley; New York, NY: 1994.
35. Hittner JB, Swickert R. Sensation seeking and alcohol use: A meta-analytic review. *Addict Behav.* 2006; 31:1383–1401. [PubMed: 16343793]
36. Dimeff, LA.; Baer, JS.; Kivlahan, DR.; Marlatt, GA. *Brief Alcohol Screening and Intervention for College Students: A Harm Reduction Approach.* Guilford Press; New York, NY: 1999.
37. Perkins HW. Surveying the damage: A review of research on consequences of alcohol misuse in college populations. *J Stud Alcohol.* 2002; 14(suppl):91–100.
38. Slutske WS. Alcohol use disorders among US college students and their non-college-attending peers. *Arch Gen Psychiatry.* 2005; 62:321–327. [PubMed: 15753245]
39. Arnett J. Sensation seeking: A new conceptualization and a new scale. *Pers Individ Dif.* 1994; 16:289–296.
40. Arnett JJ. The developmental context of substance use in emerging adulthood. *J Drug Issues.* 2005; 35:235–254.
41. Amrock SM, Zakhar J, Zhou S, Weitzman M. Perception of e-cigarette harm and its correlation with use among U.S. adolescents. *Nicotine Tob Res.* 2015; 17:330–336. [PubMed: 25125321]
42. Barnett TE, Soule EK, Forrest JR, Porter L, Tomar SL. Adolescent electronic cigarette use: Associations with conventional cigarette and hookah smoking. *Am J Prev Med.* 2015; 49:199–206. [PubMed: 25840880]
43. Simons JS, Wills TA, Emery NN, Marks RM. Quantifying alcohol consumption: Self-report, transdermal assessment, and prediction of dependence symptoms. *Addict Behav.* 2015; 50:205–212. [PubMed: 26160523]

Table 1

Differences between Molly Users and Non-Users on Study Variables

Variable	Molly User		Non-User		t	d
	M (SD)		M (SD)			
DDQ – typical alcohol use	15.80 (10.79)		9.72 (8.10)		708	-6.06*
BSSS	30.28 (5.86)		26.09 (7.07)		654	-5.10*
BYAACQ	10.89 (5.71)		6.74 (5.41)		602	-6.33*
DAST	3.45 (1.80)		2.01 (1.53)		320	-6.73*
		n (%)		n (%)	df	χ^2
Other past-year drug use						
No	8 (9.6%)		306 (52.2%)		1	52.92*
Yes	75 (90.4%)		280 (47.8%)			
Gender						
Men	27 (31.0%)		169 (27.2%)		2	0.95
Women	60 (69.0%)		450 (72.3%)			

Note. DDQ = Daily Drinking Questionnaire; BSSS = Brief Sensation Seeking Scale; BYAACQ = Brief Young Adult Alcohol Consequences Questionnaire; DAST = Drug Abuse Screening Test.

* $p < .001$.