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Underreporting of Ecstasy Use among High School Seniors in the US*

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Abstract

Background—National surveys suggest ecstasy (3,4-methylenedioxymethamphetamine [MDMA]) use has decreased substantially among adolescents in the US since 2001; however, the recent phenomenon of “Molly” (ecstasy marketed as “pure MDMA”) may be leading to underreporting of use as not all users are aware that “Molly” is a form of ecstasy.

Methods—We examined 2014 data from Monitoring the Future, a nationally representative survey of high school seniors in the US ($N=6,250$, modal age: 18). Three randomly distributed survey forms asked about ecstasy use, and one included “Molly” in the definition. Self-reported lifetime, 12-month, and 30-day ecstasy use were compared to determine whether including “Molly” in the definition was associated with higher prevalence or frequency of use.

Results—The form including “Molly” in the definition had significantly higher prevalence than the two (combined) forms that did not. Lifetime use (8.0% vs. 5.5%) and 12-month use (5.1% vs. 3.6%) were significantly higher with “Molly” in the definition. Lifetime prevalence remained higher with “Molly” in the definition when controlling for correlates of ecstasy use; however, 12-month use did not. Differences in prevalence were associated with lifetime occasions of use, with

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Contributors

All authors are responsible for this reported research. J. Palamar conceptualized and designed the study, and conducted the statistical analyses. C. Cleland and K. Keyes mentored and assisted J. Palamar with regard to statistical analyses. J. Palamar drafted the initial manuscript, and all authors interpreted results, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted.

Conflict of Interest

No conflict declared.

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lower concordance between forms at lower levels of lifetime occasions (e.g., 1–2 times). Survey form was not related to number of times used among more frequent users.

Conclusions—Prevalence of ecstasy use appears to be underestimated when “Molly” is not included in the definition of ecstasy/MDMA. Surveys should include “Molly” in the definition of ecstasy to more adequately assess prevalence of use.

Keywords

ecstasy; MDMA; adolescents; underreporting

1. INTRODUCTION

Ecstasy has been a popular party drug in the US and elsewhere since the 1980s. The term “ecstasy” is a street name describing 3,4-methylenedioxymethamphetamine (MDMA), though purity and level of MDMA content varies substantially throughout the US (Baggott et al., 2000; Tanner-Smith, 2006) and much of the world (Parrott, 2004).

Despite ecstasy receiving media attention in recent years (generally describing popularity of the drug; Aleksander, 2013; Racioppi, 2014), self-reported lifetime use among high school seniors was highest in 2001 (11.7%), and has decreased substantially in recent years (e.g., 5.6% in 2014; Miech et al., 2015). Similar trends have been documented for initiation and 12-month use among both adolescents and young adults across several national surveys (Kann et al., 2014; Miech et al., 2015; Substance Abuse and Mental Health Services Administration [SAMHSA], 2014).

After 2008, the term “Molly” (short for “molecular”) became synonymous with ecstasy in popular culture (Aleksander, 2013). While “Molly” typically refers to powder or crystalline MDMA (commonly marketed as “pure MDMA”) as opposed to the more traditional pill form of ecstasy, two concerns remain coterminous. First, not all users may be aware that “Molly” is essentially a new street name for “ecstasy”. Second, ecstasy/“Molly” appears to be increasingly adulterated with novel psychoactive substances such as synthetic cathinones (e.g., butylone, methylone, and alpha-PVP [“Flakka”]; Palamar et al., 2016), suggesting that even if users are aware that ecstasy is now termed “Molly”, the substance that is being consumed may be quite different. Increasing adulteration with new potentially dangerous drugs adds to the importance of knowing prevalence of use.

The two major annual national surveys of drug use in the US (Monitoring the Future [MTF] and the National Household Survey of Drug Use and Health [NSDUH]; Miech et al., 2015; SAMHSA, 2014) recently incorporated “Molly” into the definition of ecstasy/MDMA. NSDUH incorporated “Molly” into their definition in 2015 (Federal Register, 2014), and MTF included test questions including “Molly” in the definition of ecstasy in 2014, with a sixth of their sample assessed via these new questions (Miech et al., 2015); all respondents were queried with “Molly” as an example of ecstasy use as of 2015.

With the popularity of the term “Molly” increasing, we hypothesized that including “Molly” in the definition of ecstasy use would be associated with significantly increased prevalence

of self-reported use as many adolescents and young adults are becoming increasingly aware of “Molly” as a street name for ecstasy.

2. METHODS

2.1. Procedure

MTF is a nationally representative annual cross-sectional survey including approximately 15,000 12th graders (high school seniors) in approximately 130 public and private schools in the 48 contiguous US states (Miech et al., 2015). Schools are selected using a multi-stage random sampling procedure. MTF assesses content through six different survey forms, which are assigned randomly. Through 2013, only survey Forms 3 and 4 assessed use of ecstasy/MDMA. However, in 2014, MTF added additional ecstasy questions to an additional survey form (Form 6), which included “Molly” in the definition of ecstasy/MDMA. MTF protocols were reviewed and approved by the University of Michigan Institutional Review Board (Miech et al., 2015).

2.2. Measures

Lifetime ecstasy use was assessed on two survey forms via the following item: “On how many occasions (if any) have you used MDMA (“ecstasy”) in your lifetime?” Answer options ranged from 0 to 40+ occasions. The same question stem and answer items were used to assess use “during the last 12 months” and “during the last 30 days”. Surveys in 2014 included an edited ecstasy question: “On how many occasions (if any) have you used MDMA (“Molly,” “ecstasy”) in your lifetime?” The same question stem was used to ask about 12-month and 30-day use. Items were recoded into dichotomous (0 versus 1+ occasions) and two trichotomous variables. First, we assessed ecstasy use as 0, 1–2, or 3+ occasions of use. Second, among users, we assessed occasions of use as 1–2, 3–9, and 10+. All three survey forms also assessed self-reported lifetime use of alcohol, cigarettes, marijuana, cocaine, heroin, and nonmedical use of amphetamine, narcotics other than heroin, tranquilizers (e.g., benzodiazepines), and sedatives (e.g., barbiturates).

Students were asked to indicate their sex, age (released as <18, 18 years) and race/ethnicity (black, white, Hispanic). Students also were asked about their parents’ level of educational attainment, and weekly student income (from jobs), religiosity, and number of days per week of going out for fun. MTF also classified population density of the school.

2.3. Statistical Analyses

Analyses focused on the 6,250 students who answered ecstasy questions. We combined data from Forms 3 and 4 (which did not specify “Molly” in the definition) to compare to Form 6 (which specified “Molly” in the definition). Self-reported prevalence of lifetime ($p = 0.80$) and 12-month ($p = 0.93$) ecstasy use were not significantly different between Forms 3 and 4.

Analysis proceeded in four steps. First, we compared characteristics of high school seniors according to survey form (Form 6 versus Forms 3/4). All bivariable statistics were computed using Rao-Scott chi-square tests for homogeneity, which correct for the complex survey design (Rao and Scott, 1984).

Second, we compared ecstasy use (including “Molly” in the definition) via Form 6 ($N=2,136$) to ecstasy use (without “Molly” in the definition) in Forms 3 and 4 combined ($N=4,114$), for lifetime, 12-month, and 30-day use using bivariable comparisons.

Third, we used multivariable modeling with lifetime ecstasy use (as reported in either form) as the dependent variable. Independent variables were in three groups: 1) form (form 3/4 versus form 6); 2) only covariates that significantly differed across survey form; and 3) all covariates.

Fourth, to determine whether number of times used was related to survey form, we compared frequency of use in bivariate analysis, and then regressed the number of times used on survey form in two proportional odds logistic regression analyses, first with number of occasions of use as an ordinal variable with a cumulative logit function, and then dichotomized as 1–2, 3–9, or 10+ occasions with a generalized logit function. All analyses were design-weighted for survey data (using PROC SURVEYFREQ and PROC SURVEYLOGISTIC [Heeringa et al., 2010]), conducted using SAS version 9.3 software (SAS Institute Inc.).

3. RESULTS

Sample characteristics and prevalence of lifetime drug use are presented in Supplemental Table 1¹ by survey form group. Lifetime alcohol and cigarette use ($p < 0.01$) were higher in the subsample assessed with the survey forms not asking specifically about “Molly”, and cocaine use was significantly higher ($p < 0.001$) in the subsample assessed with the survey form that included “Molly” in the definition of ecstasy.

The forms including “Molly” in the definition had significantly higher prevalence than the forms that did not. Lifetime use (8.0% [CI = 6.5–9.5] vs. 5.5% [CI = 4.7–6.4], $p = 0.002$) and 12-month use (5.1% [CI = 3.9–6.3] vs. 3.6% [CI = 2.9–4.3], $p = 0.025$) were significantly higher when including “Molly” in the definition (Figure 1). However, there was no significant difference with regard to 30-day use (1.6% [CI = 0.8–2.4] including “Molly” in the definition vs. 1.4% [0.9–1.8] without “Molly” in the definition).

Students assessed with the survey form that included “Molly” in the definition were at significantly higher odds for reporting lifetime ecstasy use when controlling for covariates associated with survey form (adjusted odds ratio [AOR] = 1.57, 95% CI = 1.17–2.10, $p = 0.003$) and when controlling for covariates associated with ecstasy use regardless of survey form (AOR = 1.58, 95% CI = 1.14–2.18, $p = 0.006$) (Supplemental Table 2²). The multivariable model was then recomputed to test potential 2×2 interactions between survey form and all covariates. No interactions were significant.

All analyses above were then repeated for 12-month and 30-day ecstasy use. The unadjusted odds of 12-month ecstasy use were increased for those responding to the form including “Molly” in the definition of ecstasy (OR = 1.43, 95% CI = 1.05–1.97, $p = .025$); however,

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while controlling for all covariates mentioned above, survey form was no longer significantly associated with the odds of reporting use (AOR = 1.32, 95% CI = 0.90–1.93) (Supplemental Table 3³). The interaction model contained no significant interactions with 12-month ecstasy use as the outcome variable. With regard to 30-day use, the unadjusted odds use were not significant (OR = 1.18, 95% CI = 0.65–2.16), and findings were similar when controlling for all covariates mentioned above (AOR = 1.20, 95% CI = 0.62–2.34) (Supplemental Table 4⁴).

Bivariable comparisons suggest that reporting use 1–2 times was significantly higher in those receiving the form with “Molly” in the definition among those reporting lifetime or 12-month use, but no difference emerged with regard to higher frequency use (Table 1). Among those reporting lifetime ecstasy use, survey form was not related to number of times used in the bivariable model (OR = 1.51, 95% CI = 0.93–2.45). However, when adjusting for use of alcohol, cigarette use, and cocaine, those assessed with the form including “Molly” in the definition were at increased odds (AOR = 1.82, 95% CI = 1.09–3.07, $p = .022$) for reporting higher frequency of use. When examined in a generalized logit function, those assigned to the form including “Molly” in the definition were at higher odds of reporting 3–9 past-year occasions of use, compared with 1–2 occasions of use (unadjusted OR = 2.64, 95% CI = 1.13–6.20, $p = .026$), suggesting higher concordance between forms among higher frequency users, and concomitantly, suggesting that prevalence differences are likely mostly confined to lower-occasion users. Odds were not significantly increased when controlling for all covariates (AOR = 1.62, 95% CI = 0.96–2.73). Among those reporting 12-month ecstasy use, survey form was not related to the number of times used (OR = 1.58, 95% CI = 0.81–3.05) and results were similar in both multivariable models. For 30-day use, analyses showed the proportional odds assumption was not consistent with the data. Therefore, we estimated a multinomial logistic regression for number of times used and found no relation with survey form ($\chi^2(4) = 6.94$, $p = .14$).

4. DISCUSSION

Data from recent national surveys suggest self-reported use of ecstasy (MDMA) has decreased in recent years; however, self-reported prevalence of use was not assessed with inclusion of “Molly” in the definition of ecstasy use (Miech et al., 2015; Kann et al., 2014; SAMHSA, 2014). Results from this analysis suggest national surveys that do not include “Molly” in the definition of ecstasy use appear to be underestimating prevalence of ecstasy use among adolescents and young adults in the US. While differences in lifetime prevalence held while adjusting for potential confounders, differences in 12-month use were explained by differences between survey form groups or other factors. We also found higher concordance among high frequency users, suggesting that underreporting is associated with less experienced users that did not report recent use.

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4.1. Limitations

Public data for the question including “Molly” in the definition of ecstasy were not available for 8th or 10th graders. While we documented differences regarding frequency of use between forms, students who did not consider “Molly” ecstasy most likely reported using ecstasy 0 times. A within-subjects design would be most ideal to determine more directly whether students are aware that “Molly” is ecstasy. It is possible that some students overreported use of ecstasy (or “Molly”) as purity varies and ecstasy/”Molly” sometimes contains little to no MDMA (Baggott et al., 2000; Parrott, 2004) and may contain adulterants such as synthetic cathinones (Palamar et al., 2016). While results are generalizable to adolescents in the US, results may not be generalizable to individuals outside the US as the term “Molly” appears to be limited to US popular culture.

4.2. Conclusions

Street names for drugs tend to change over time and it is important to consider these names when assessing prevalence. Further, especially in the case of ecstasy and other club drug users, those who use may not have an accurate sense of contents, purity, or adulterants for the substances consumed, creating challenges for designing survey instruments. National surveys underestimated prevalence of ecstasy use in the US when “Molly” was not included in the definition of ecstasy. National and local surveys should maintain vigilance in assessing current street names in order to more accurately assess prevalence. Underreported use may suggest prevalence of a potentially dangerous drug is decreasing and this may equate to less public health concern. Adolescents and young adults require better education about ecstasy (and other drugs) as it is essential that we aim to prevent use among those at risk for using, and try to reduce potential harm among those who reject abstinence.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Highlights

- We compared self-reported ecstasy/MDMA use with and without Molly in the definition
- Lifetime use was significantly higher with Molly in the definition (8.0% vs. 5.5%)
- 12-month use was higher with Molly in the definition until controlling for confounders
- Differences in reported use were driven by those reporting use only 1–2 times
- Ecstasy use among infrequent users is underreported without Molly in the definition

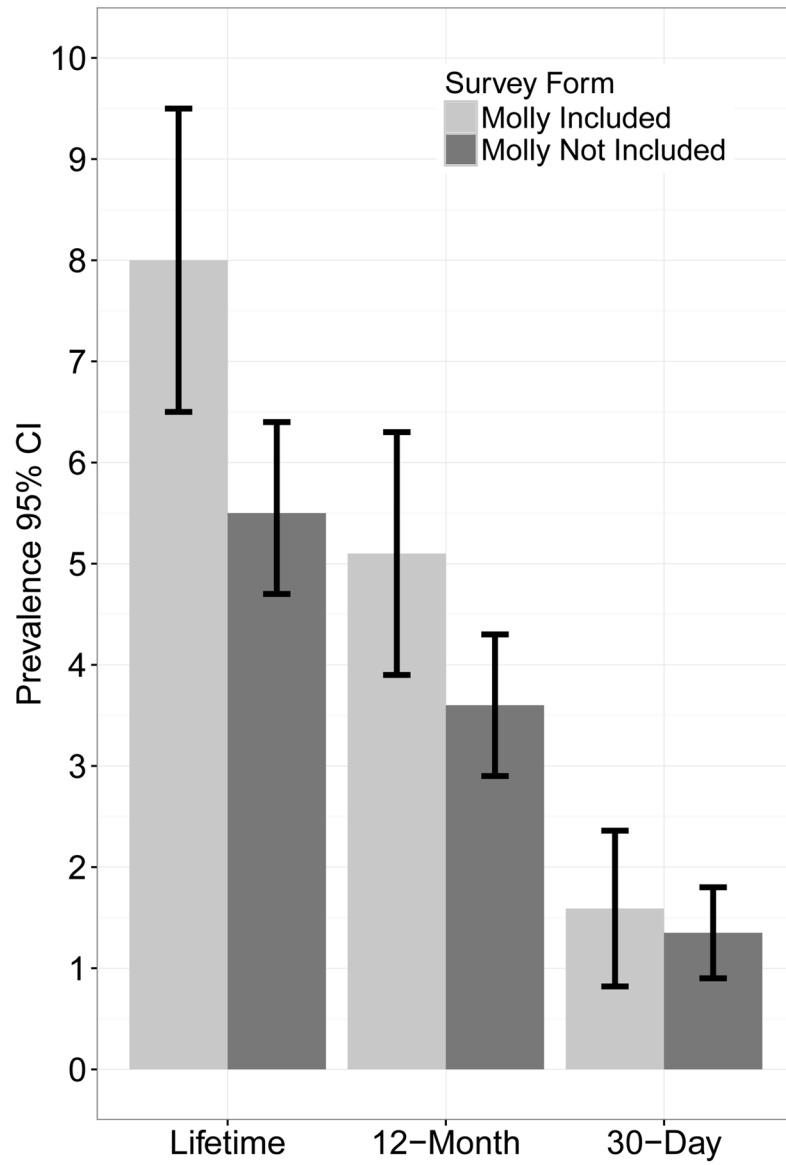


Figure 1.
Prevalence of self-report ecstasy use according to survey form

Table 1

Frequency of reported ecstasy use by survey form

Frequency of Lifetime Ecstasy Use	Not Including Molly in Definition % (95% CI)	Including Molly in Definition % (95% CI)
	Lifetime Use **	
Used 0 Times	95.5 (93.6, 95.3)	92.0 (90.5, 93.5)
Used 1–2 Times	2.9 (2.3, 3.4)	4.9 (3.8, 6.0)
Used 3 Times	2.7 (2.0, 3.3)	3.1 (2.1, 4.1)
	12-Month Use *	
Used 0 Times	96.4 (95.7, 97.1)	94.9 (93.7, 96.1)
Used 1–2 Times	2.0 (1.5, 2.5)	3.4 (2.5, 4.3)
Used 3 Times	1.6 (1.1, 2.1)	1.7 (0.9, 2.5)
	30-Day Use	
Used 0 Times	98.7 (98.2, 99.1)	98.4 (97.6, 99.2)
Used 1–2 Times	0.8 (0.5, 1.1)	0.8 (0.4, 1.3)
Used 3 Times	0.5 (0.2, 0.8)	0.8 (0.1, 1.4)

Note. CI = confidence interval. Two specificity tests were conducted for lifetime use replacing “Used 3 Times” with 1) two groups indicating “Used 3–10 Times” and “Used 11 Times” and then 2) “Used 3–19 Times” and “Used 20 Times” and results and significance were similar.

* $p < .05$,

** $p < .01$