Drug and Alcohol Dependence xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Short communication

Underreporting of ecstasy use among high school seniors in the US

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ARTICLE INFO

Article history:
Received 12 February 2016
Received in revised form 31 May 2016
Accepted 2 June 2016
Available online xxx

Keywords:
Ecstasy
MDMA
Adolescents
Underreporting

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 ($N = 6250$, 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 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.

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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.

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http://dx.doi.org/10.1016/j.drugalcdep.2016.06.001
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Please cite this article in press as: Palamar, J.J., et al., Underreporting of ecstasy use among high school seniors in the US. Drug Alcohol Depend. (2016), http://dx.doi.org/10.1016/j.drugalcdep.2016.06.001

The two major annual national surveys of drug use in the US (Monitoring the Future [MTF] and the National 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 on a separate form 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 6250 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 ($p = 0.80$), 12-month ($p = 0.93$), and 30-day ($p = 0.82$) 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 ($N = 2136$) to ecstasy use (without "Molly" in the definition) in Forms 3 and 4 combined ($N = 4114$), 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 tichotomized 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), and 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 1 by survey form group. Lifetime alcohol and cigarette use ($ps < 0.01$) 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 (Fig. 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 2). 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, $p = 0.025$); however, 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 3). 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 4).

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