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Illicit Drug Use among Rave Attendees in a Nationally Representative Sample of US High School Seniors

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Abstract

Background—The popularity of electronic dance music and rave parties such as dance festivals has increased in recent years. Targeted samples of party-goers suggest high rates of drug use among attendees, but few nationally representative studies have examined these associations.

Methods—We examined sociodemographic correlates of rave attendance and relationships between rave attendance and recent (12-month) use of various drugs in a representative US sample of high school seniors (modal age: 18) from the Monitoring the Future study (2011–2013; Weighted *N*= 7,373).

Results—One out of five students (19.8%) reported ever attending a rave, and 7.7% reported attending at least monthly. Females and highly religious students were less likely to attend raves, and Hispanics, students residing in cities, students with higher income and those who go out for fun multiple times per week were more likely to attend. Rave attendees were more likely than non-attendees to report use of an illicit drug other than marijuana (35.5% vs. 15.6%, $p < .0001$). Attendees were more likely to report use of each of the 18 drugs assessed, and attendees were more likely to report more frequent use (≥6 times) of each drug (*p*s < .0001). Controlling for

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Contributors

All authors are responsible for this reported research. J. Palamar conceptualized and designed the study, conducted the statistical analyses, and drafted the initial manuscript. M. Griffin-Tomas helped conduct literature searches and draft the manuscript. D. Ompad helped draft the manuscript and interpret findings. All authors reviewed and revised the manuscript, and approved the final manuscript as submitted.

Conflict of Interest

No conflict declared.

sociodemographic covariates, frequent attendance (monthly or more often) was associated with higher odds of use of each drug (*p*s < .0001). Frequent attendees were at highest risk for use of "club drugs."

Discussion—Findings from this study can help inform prevention and harm reduction among rave attendees at greatest risk for drug use.

Keywords

raves; dance festivals; club drugs; adolescents

1. INTRODUCTION

The popularity of "electronic dance music" (EDM) and dance festivals has increased substantially in the US and worldwide in recent years (Watson, 2014). Although data from national samples suggest that drug use among adolescents in the general US population has been decreasing (Johnston et al., 2015), rave, nightclub and festival attendees are high-risk populations who may not be adequately represented in national studies. Nightclub attendees assessed through targeted samples tend to report high rates of drug use (Kelly et al., 2006; Kipke et al., 2007; Mixmag, 2013; Rogers, 2012; Van Havere et al., 2011) and rates appear to be higher than in the general population (Lim et al., 2008). As drug-related deaths are becoming more common among dance festival attendees (Centers for Disease Control and Prevention, 2010; Ridpath et al., 2014), data is needed from nationally representative samples to determine the extent to which nightlife (or "rave") attendees are in fact more likely to use various drugs.

"Raves" are dance parties with loud EDM, often accompanied by lights and visual effects. EDM raves gained popularity in the 1980s and have transformed into various scenes with different crowds and forms of EDM. Originally held at underground venues such as warehouses, many parties and scenes moved into more formal venues such as nightclubs, and more recently to large dance festivals, making them more "commercial" (Anderson and Kavanaugh, 2007). Many types of raves still exist today, but the EDM festival scene is of notable popularity as many have tens of thousands attend single events (Ridpath et al., 2014). Since rates of drug use tend to be high among nightlife attendees, it is important to determine which adolescents are more likely to attend these events and to examine which attendees are at highest risk for use in order to inform prevention and harm reduction.

The term "rave" has been used rather loosely in the scientific literature (Anderson and Kavanaugh, 2007); however, many studies have examined drug use among EDM enthusiasts or "clubbers" from various scenes and EDM venues (e.g., "raves," nightclubs, circuit parties). To our knowledge, only one study compared rates of use among dance festival attendees to national rates and they found that attendees reported higher rates of use (Lim et al., 2008). Nationally representative studies of the US population in 2013 found past-year ecstasy use, for example, to be 1.5–5.3% (Johnston et al., 2014a; Substance Abuse and Mental Health Services Administration [SAMHSA], 2014) and a study of a nationally representative sample in the UK found that 2.3% reported using ecstasy in the past year (UK Focal Point on Drugs, 2014). In comparison, in 2012, the Global Drug Survey, a large-scale

Internet survey, found that US "clubbers" reported high rates of use with 61% reporting 12-month use of MDMA, 44% LSD, 41% magic mushrooms, 34% cocaine, 27% amphetamine, and 15% ketamine (Mixmag, 2013). "Club drugs" in particular tend to be highly prevalent among nightlife attendees (McCambridge et al., 2005; Rogers, 2012). The term "club drugs" typically refers to a specific subset of drugs including ecstasy (MDMA, "Molly"), gamma-hydroxybutyrate (GHB), and ketamine ("Special K"); and sometimes Rohypnol ("roofies"), LSD, powder cocaine and methamphetamine have been categorized as club drugs (Gable, 2004; Halkitis et al., 2007; Kelly et al., 2006; Maxwell, 2005). Studies conducted in US cities focusing on nightclub attendees have found that relatively large proportions of attendees had used club drugs (Kelly et al., 2006; Kipke et al., 2007; Mattison et al., 2001; Pantalone et al., 2010). Older studies of UK club attendees recruited via the Internet found that 88–97% of respondents reported lifetime ecstasy use and high rates of other illicit drugs as well (McCambridge et al., 2005; Winstock et al., 2001). While few studies have focused specifically on "raves," the literature does suggest that drug use among nightlife attendees tends to be prevalent.

The association between drug use and raves may be related, in part, to music preference. For example, one study found that compared to those who preferred listening to other genres (e.g., rock, funk), individuals who preferred dance music were at higher risk for using illicit drugs (Van Havere et al., 2011). Research has also found that use of certain drugs reportedly heightens or increases the sensation of the rave environment (e.g., lights, music), or facilitates socialization or a sense of "oneness" (Hunt et al., 2009a; Ramo et al., 2010). For others, participating in the rave experience may be spiritual experience (St. John, 2004); however, other reasons for drug use among party attendees may be to self-medicate or "fit in" with particular social groups (Hunt et al., 2009a; Kubicek et al., 2007; Mansergh et al., 2001; Moonzwe et al., 2011).

Some studies have examined rates and correlates of club drug use in representative US samples (e.g., Palamar et al., 2014a, 2014b; Palamar and Kamboukos, 2014; Wu et al., 2006), but use among rave attendees has not been compared to use among non-attendees within the same national sample. In this analysis of a nationally representative sample of high school seniors (modal age: 18) we 1) determine sociodemographic correlates of rave attendance, 2) compare drug use between rave attendees and non-rave attendees, and 3) determine how frequency of rave attendance relates to use of various drugs. This study is needed to inform prevention and harm reduction education among a new cohort of adolescents approaching adulthood who attend or plan to attend rave events.

2. METHODS

2.1. Procedure

Monitoring the Future (MTF) is a nationally representative study of US high school students. A new cohort of students is surveyed every year in approximately 130 public and private schools throughout 48 states. Using a multi-stage random sampling procedure, geographic areas were selected, then schools within areas were selected, and then classes within schools were selected. MTF surveys approximately 15,000 high school seniors every year and content is assessed through six different survey forms, which are distributed

randomly. Only Form 6 asks about rave attendance (in addition to drug use and demographics). Since only a sixth of the sample was asked about rave attendance, in order to have adequate power, this analysis focuses on aggregated (and weighted) data collected from the three most recent cohorts (2011–2013). MTF protocols were approved by the University of Michigan Institutional Review Board (IRB) and the authors' IRB approved this secondary data analysis.

2.2. Measures

Students were asked their sex, age (defined by MTF as <18, ≥18 years) and race/ethnicity (i.e., black, white, Hispanic). Population density of students' residences were defined as non-, small-, or large-metropolitan statistical areas (MSAs). Religiosity was assessed via two ordinal items asking about religious attendance and importance. These items were computed into a composite and divided into tertiles representing low (1.0–2.0), moderate (2.5–3.0) and high (3.5–4.0) religiosity. Students were asked which parent(s) they resided with in order to assess family composition. Answers were coded into no parents, one parent, or two parents. Students were also asked about educational attainment of each parent and a mean score for both parents (or a raw score if only one parent) was coded into tertiles representing low (1.0–3.0), medium (3.5–4.0), and high (4.5–6.0) education. Students were also asked how much money they earn during the average week from 1) a job or other work, and 2) from other sources. Responses for each of these two income items were coded into $10 or less, $11–50, or $51 or more. Coding of demographic variables was based on previous MTF analyses (Palamar et al., 2014a, 2014b; Palamar and Ompad, 2014; Wallace et al., 2009).

Students were asked how often they go to raves. Answer options were: 1) never, 2) a few times a year, 3) once or twice a month, 4) at least once a week, and 5) almost every day. We dichotomized this variable into any rave attendance: yes/no. We also created a variable collapsing higher frequency attendance (monthly or more frequent) into a single category. Annual ("recent") use of various drugs was assessed. These analyses focus on recent use of alcohol ("more than just a few sips"), cannabis (marijuana), synthetic cannabinoids, LSD, hallucinogens other than LSD, salvia divinorum, powder cocaine, crack, ketamine, GHB, ketamine, "bath salts" (only assessed in years 2012–2013), methamphetamine ("crystal meth," "ice"), Rohypnol ("roofies"), heroin, and nonmedical use of opioids (narcotics, "pain killers"), stimulants, tranquilizers and sedatives. MTF did not assess ecstasy/MDMA use in this survey form so this variable could not be analyzed (discussed further in *Limitations*). Answer options for use of each drug were 1) 0 occasions, 2) 1–2 occasions, 3) 3–5 occasions, 4) 6–9 occasions, 5) 10–19 occasions, 6) 20–39 occasions, and 7) 40 or more occasions. Recent use of each was dichotomized (into yes/no). Annual use was also dichotomized into "more frequent" use indicating whether each drug was used ≥6 times in the last year.

2.3. Statistical Analyses

Analyses focused on students (N = 7,373) who answered the question about rave attendance. Descriptive statistics for each demographic covariate were examined first, and then we examined potential relations between each covariate and 1) any rave attendance (yes/no),

and 2) frequent rave attendance (yes/no). All covariates were fit into two separate multivariable logistic regression models, which produced adjusted odds ratios (AORs) in order to determine conditional associations while controlling for all other covariates. Therefore, the first model delineated associations regarding any attendance and the second model delineated associations regarding frequent attendance. These covariates have been examined and controlled for in numerous other MTF studies (e.g., Palamar et al., 2014a, 2014b; Palamar and Ompad, 2014). In both models, we controlled for potential cohort effects and/or secular trends by entering indicators for cohort, with 2011 as the comparison. In addition, since there was a substantial amount of missing data—particularly missing race (16.7%) and missing religiosity (25.5%), we included missing data indicators in multivariable models instead of deleting these cases. For example, for the 16.7% who were missing race, an indicator variable was included to account for the missing level of race so these cases would still be included in the analyses. This method has been used in many MTF analyses (e.g., Palamar and Ompad, 2014; Terry-McElrath et al., 2013). Retaining these cases allowed us to maintain power.

Next, we compared rates of recent use of each drug according to whether or not any rave attendance was reported. Comparisons were tested using Rao-Scott chi-square tests for homogeneity, which correct for the complex study design (Rao and Scott, 1984). We implemented a strict correction for potential non-independent drug use outcomes by using a Bonferroni correction ($\alpha = .05/18 = .003$). We also computed proportions to determine how much more prevalent use is among rave attendees compared to non-attendees. We then repeated these analyses to examine differences by more frequent use (used ≥6 times). To further examine differences in use by level of attendance, we then repeated analyses comparing those who only attend raves a few times a year with more frequent attendees.

Finally, controlling for all other covariates, we used logistic regression to examine how frequency of rave attendance (with “never” as the comparison) was associated with use of each drug. Specifically, we examined how attending once or twice and frequent attendance relate to use of each drug, compared to no rave attendance. We did not model alcohol as an outcome because use was too prevalent (used by 68% of the sample) and we could not model heroin use because use was too rare (used by only 0.4% of the sample). Again, we applied a strict Bonferroni correction ($\alpha = .05/16 = .003$) for multiple non-independent outcomes. All analyses were design-based for survey data (Heeringa et al., 2010) and utilized sample weights provided from MTF. SAS 9.3 software (SAS Institute, 2011) was used for all analyses.

3. RESULTS

Sample characteristics are presented in Table 1. One in five students (19.8%) reported ever attending a rave. Most attendees reported only attending a few times a year, and 7.7% of the full sample indicated attendance of at least once per month. Table 2 presents how each covariate relates to rave attendance. Compared to males, females were at half the odds of ever attending and for frequently attending raves. Compared to whites, black students (AOR = 0.64, $p = .001$) were at low odds for ever attending, but not significantly for frequent attendance. Hispanics, however, were at increased odds for any attendance and for frequent

attendance. Residing in a small MSA increased the odds for any attendance and for frequent attendance, and residing in a large MSA increased the odds for any attendance (AOR = 1.41, $p < .001$), but not for frequent attendance. Students who are highly religious, or resided with one or two parents, were consistently at low odds for ever attending or attending frequently. Earning >$50 per week from a job or from another source increased odds for any attendance and frequent attendance. Earning >$10 per week from other sources also increased the odds of reporting any attendance, but not frequent attendance. Going out more than one night per week for fun robustly increased odds of any attendance and frequent attendance. There was a slight dose-response with higher income and going out more nights out per week increasing the odds of attendance.

Table 3 presents comparisons of rates of recent use of each drug by any rave attendance. Rave attendees were significantly (all *p*s< .0001) more likely to report use of each drug assessed. They were also more likely to report more frequent use (≥6 times) than non-attendees. We also present proportions representing how much more prevalent use of each drug is among attendees, and all illicit drugs other than marijuana were at least twice as prevalent among attendees. The common “club drugs” ketamine and GHB were both almost six-times more prevalent among attendees, and heroin use was more than 11-times more prevalent among attendees. Proportions tended to be larger when examining frequent use. Of note, about a third (35.5%) of rave attendees reported using any illicit drug (other than marijuana) and this proportion was significantly higher compared to non-attendees (15.6%, $p < .0001$).

We then compared use of each drug within rave attendees, comparing prevalence of use between those who only attend a few times per year and those who attend monthly or more often (Table 4). Prevalence of use of most drugs tended to be significantly higher among more-frequent attendees. Some differences were not significant given the conservative correction, but of note, differences in alcohol and marijuana use were small or non-existent even before the correction. Again, club drugs such as ketamine, GHB and methamphetamine were more likely to be used—more frequently—among frequent attendees. About a third (35.7%) of infrequent rave attendees reported using any illicit drug (other than marijuana) and this proportion was significantly lower compared to more frequent attendees (43.8%, $p = .007$).

We then further examined how frequency of rave attendance relates to use of each illicit drug (controlling for all covariates). Table 5 presents results from the 16 multivariable logistic regression models. Higher frequency of attendance was consistently associated with higher odds for reporting recent use of each drug, especially use of the party drugs LSD, ketamine, GHB and methamphetamine. Associations between infrequent attendance and drug use were not as robust and were less consistent, and infrequent attendance was not related to use of bath salts, LSD, ketamine, GHB or methamphetamine.

4. DISCUSSION

With increasing popularity of EDM and dance festivals, it is important to determine risk of use of various drugs among individuals who attend such events. This is among the first

national studies to examine drug use in relation to “rave” attendance. We found that one out of five students reported attending a rave.

We first examined which students were most likely to report rave attendance and found that females, blacks, highly religious students, and those residing with parents were less likely to have ever attended a rave. Hispanics, those residing in MSAs, those with higher income and those who go out for fun multiple times per week were more likely to have attended a rave. Results for more frequent (monthly or more) attendance were similar for most covariates. Of note, the majority of significant covariates delineated in these models are also risk factors for drug use. For example, males were much more likely to attend raves than females with a quarter of males reporting ever attending, and one out of ten reporting attending at least monthly. Research consistently shows that males are at higher risk for drug use than females (Degenhardt el at., 2007; Johnston et al., 2014b) so it should not be surprising that rave attendees (which are mostly male) report relatively high rates of drug use. Previous examinations of MTF data have also found that identifying as a male, residing in a city, living with fewer parents, going out many nights per week, and making higher income are risk factors for use of ecstasy, powder cocaine, synthetic cannabinoids and hookah (Palamar and Ompad, 2014; Palamar and Kamboukos, 2014; Palamar et al., 2014b; Palamar and Acosta, 2015). Although many covariates are shared risk factors for attendance and for drug use, we did find robust associations between attendance and drug use while controlling for all of these factors.

These national results add to results of smaller, non-national studies of nightlife scenes. Several studies of targeted samples have found that male nightlife attendees represent the majority gender group (Hunt et al., 2009b; Kelly et al., 2006; Kipke et al., 2007), and previous studies have found that nightlife attendees are more likely to be of a higher socioeconomic status. For example, an investigation of club drug-using gay and bisexual males in NYC found that 51% of subjects had at least a Bachelor’s degree (Halkitis et al., 2007). “Rave” and other nightlife parties today tend to have high admission fees, which may limit attendance to wealthier patrons (Golub et al., 2001; Kelly et al., 2013; Mansergh et al., 2001). In fact, admission for one-day attendance for many large dance festivals is >$100 so attendees generally need the means to afford admission fees.

Compared to those who had never attended a rave, prevalence of drug use was higher and more frequent among rave attendees, and often even higher and more frequent among regular attendees. Students who had ever attended raves were more likely to have reported use of each of the 18 drugs and they were also more likely to use each more frequently (≥6 times) in the last year. In particular, those who had attended raves were much more likely to have used “club drugs” such as ketamine, GHB, powder cocaine, LSD, methamphetamine and Rohypnol. Frequent attendees tended to report higher prevalence of use and more frequent use of various drugs than those who attended only once. We then examined these associations while controlling for sociodemographic variables, and we confirmed somewhat of a dose-response with higher levels of rave attendance being related to higher odds of use of each drug. Interestingly, in multivariable models, common club drugs and party drugs such as ketamine, GHB, LSD, bath salts and methamphetamine were not related to infrequent attendance, but associations were robustly associated with frequent attendance.

This suggests that with all else being equal, infrequent attendance is not a strong risk factor for club drug use as is frequent attendance. These findings add to a wealth of data derived from targeted samples that use of various drugs is prevalent among nightlife attendees (Kelly et al., 2006; Mixmag, 2013; Pantalone et al., 2010; Ramo et al., 2010; Rogers, 2012; Van Havere et al., 2011).

The dose-response relations and the finding that club drug use is related to more frequent attendance, but not infrequent attendance, implies that it is primarily those who demonstrate deeper involvement in the rave scene who are more likely to use these drugs. Future studies need to examine more specifically how level of involvement in the rave scene relates to drug use in this latest cohort of rave attendees. We must also keep in mind that rave culture is by no means homogeneous—there are many different scenes, venues, music styles, and types of raver, and each appears to be associated with unique social trends and possibly unique trends in drug use. To our knowledge, this is the first national study in the US to examine associations between rave attendance and drug use, which adds to previous studies of non-probability samples, which have found high rates of drug use among attendees. Studies of targeted samples tend to find higher rates of drug use, but many respondents in those surveys may be more highly dedicated to their scenes. It is possible that less frequent or less dedicated attendees are underrepresented in targeted surveys. This study, which relied on more advanced sampling methodology, led to results, which may be more generalizable to adolescent ravers of various levels of dedication. Results suggest that while drug use is in fact prevalent among attendees, rates of use appear to be lower than rates found in targeted samples of club-goers. In fact, about two-thirds of attendees reported no illicit drug use (other than marijuana).

These results add to our previous knowledge about rates of drug use among nightlife attendees, but research is needed to examine whether level of attendance is related to level of knowledge or education about the drugs they are taking and whether those who reject abstinence are engaging in harm reduction practices. Importantly, more research is also needed to determine whether the drugs these individuals think they are using are in fact the drugs they are using. For example, there have been multiple instances of poisonings and deaths related to use of ecstasy or “Molly” (which is thought to be pure MDMA) in which the drug was adulterated with other synthetic drugs (Ridpath et al., 2014; The Guardian, 2015; Brunt et al., 2012; Tanner-Smith, 2006).

4.1. Limitations

An important limitation is that the term “rave” may have been open to interpretation, especially in this young cohort. While true raves are (or were) underground parties, large dance festivals are now often viewed as rave parties, so meaning or interpretation of the term may have changed. The term “rave” is also not as common in recent years, and although many academics consider all all-night EDM parties raves, it is unknown whether the students interpreted this in a similar manner (Anderson and Kavanaugh, 2007). Perhaps self-reported rates of use would be different (e.g., higher) if some students did not consider EDM festivals raves. However, our results are still consistent with results of previous nightlife studies. Another limitation is that the survey form asking about rave attendance did

not ask about ecstasy, which is known to be one of the most popular and prevalent club drugs. It is possible that prevalence of drug use would be higher if MTF asked about ecstasy in this form. We collapsed levels of frequent attendance into a "monthly or more often" group and self-reported use of any illicit drug (other than marijuana) was not significantly different between levels of more frequent attendance (p = .784), giving us confidence in collapsing these into a single category.

This study was cross-sectional so temporality could not be determined; thus, we do not know whether drug use occurred before or after attending raves. Likewise, it is unknown whether drug use took place at or before going to such events. Since more frequent use of most drugs was rare, we could not examine more frequent use (i.e., used ≥10 times—the next ordinal response option). We also could not compute multivariable models examining frequent use (used ≥6 times) because prevalence of frequent use of most drugs was <1%. Since MTF contains a lot of missing data we included missing data indicators in multivariable models in order to maintain the full sample. High school dropouts were not surveyed and this can affect generalizability of findings.

4.2. Conclusions

This was among the first national studies to examine the relationship between rave attendance and use of various drugs in the US. Results found a consistent relationship between rave attendance and use and higher frequency of use of numerous illicit drugs. These findings should not be used to pathologize or stereotype the growing popularity of rave attendance, in part, because about two-thirds of attendees did not report use of an illicit drug other than marijuana. Results should instead inform our prevention and much needed harm reduction efforts. There is a need for better drug education, which would allow those at high risk (e.g., ravers) to be able to make informed decisions if they reject abstinence. Availability of drug testing services at or outside of raves and realistic education initiatives (e.g., on social media) to prevent use and adverse outcomes would also likely reduce poisonings in this new cohort of partiers.

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HIGHLIGHTS

- One out of five high school seniors reported ever attending at rave
- Students residing in cities or with higher income were more likely to attend raves
- Rave attendees were more likely to report use and more frequent use of 18 drugs
- Frequent attendance was associated with higher odds of use of each drug

Table 1

Sample characteristics (Weighted *N* = 7,373).

	N	%
Sex		
Male	3,516	47.7
Female	3,456	46.9
Missing	401	5.4
Age, years		
<18	3,010	40.8
≥18	4,128	56.0
Missing	235	3.2
Race		
White	4,339	58.9
Black	808	11.0
Hispanic	997	13.5
Missing	1,229	16.7
Population Density		
Non-MSA	1,492	20.2
Small MSA	3,552	48.2
Large MSA	2,329	31.6
Religiosity		
Low	2,142	29.0
Moderate	1,585	21.5
High	1,768	24.0
Missing	1,879	25.5
Family Structure		
0 Parents	432	5.9
1 Parent	1,977	26.8
2 Parents	4,760	64.6
Missing	205	2.8
Parent Education		
Low	2,091	28.4
Moderate	2,013	27.3
High	2,812	38.1
Missing	458	6.2
Weekly Income from Job		
$10 or Less	3,350	45.4
$11–50	791	10.7
$51 or More	2,785	37.8
Missing	448	6.1

	N	%
Weekly Income from Other Source		
$10 or Less	3,836	52.0
$11–50	2,312	31.4
$51 or More	684	9.3
Missing	542	7.3
Evenings Out Per Week for Fun		
0–1	2,147	29.1
2–3	3,385	45.9
4–7	1,464	19.9
Missing	377	5.1
Rave Attendance		
Never	5,910	80.2
A few times a year	895	12.1
Once or twice a month	329	4.5
At least once a week	129	1.7
Almost every day	110	1.5

Note. MSA = metropolitan statistical area. Weighted percentages are rounded so they do not always add up to exactly 100%.

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Table 2

Correlates of lifetime rave attendance (N = 7,373).

	Rave Attendance (Raw Proportions)			Have Ever Attended		Attend Monthly or More Often	
	Have Not Attended	**Have Ever Attended**	**Attend Monthly or More Often**	**AOR**	**95% CI**	**AOR**	**95% CI**
Sex							
Male	74.9	25.1	10.3	1.00		1.00	
Female	86.1	13.9	4.8	0.51***	(0.44, 0.60)	0.50***	(0.40, 0.62)
Age, years							
<18	81.2	18.8	6.6	1.00		1.00	
≥18	79.3	20.7	8.1	1.09	(0.94, 1.26)	1.10	(0.89, 1.37)
Race							
White	80.5	19.5	6.9	1.00		1.00	
Black	86.5	13.5	5.6	0.64**	(0.49, 0.84)	0.78	(0.54, 1.12)
Hispanic	77.4	22.6	9.6	1.40**	(1.13, 1.74)	1.63**	(1.19, 2.23)
Population Density							
Non-MSA	84.5	15.5	6.5	1.00		1.00	
Small MSA	78.5	21.5	8.9	1.58***	(1.31, 1.89)	1.50**	(1.15, 1.95)
Large MSA	80.0	20.0	6.7	1.41***	(1.15, 1.72)	1.03	(0.76, 1.39)
Religiosity							
Low	77.5	22.5	9.3	1.00		1.00	
Moderate	77.0	23.0	8.3	1.06	(0.88, 1.27)	0.91	(0.69, 1.19)
High	84.3	15.7	5.7	0.72**	(0.59, 0.88)	0.68*	(0.50, 0.92)
Family Structure							
0 Parents	75.4	24.6	14.6	1.00		1.00	
1 Parent	81.6	18.4	7.8	0.67**	(0.50, 0.89)	0.51***	(0.35, 0.73)
2 Parents	80.6	19.4	6.6	0.69**	(0.53, 0.90)	0.43***	(0.31, 0.60)
Parent Education							
Low	80.8	19.2	8.5	1.00		1.00	

	Rave Attendance (Raw Proportions)			Have Ever Attended		Attend Monthly or More Often	
	Have Not Attended	Have Ever Attended	Attend Monthly or More Often	AOR	95% CI	AOR	95% CI
Moderate	80.0	20.0	7.0	1.10	(0.91, 1.33)	0.87	(0.65, 1.16)
High	80.5	19.5	6.9	1.06	(0.88, 1.27)	0.92	(0.70, 1.19)
Weekly Income from Job							
$10 or Less	83.0	17.0	6.0	1.00		1.00	
$11–50	82.1	17.9	6.3	1.13	(0.89, 1.44)	1.16	(0.79, 1.71)
$51 or More	76.7	23.3	9.8	1.45***	(1.24, 1.70)	1.64***	(1.31, 2.06)
Weekly Income from Other Source							
$10 or Less	83.4	16.6	6.2	1.00		1.00	
$11–50	78.9	21.1	7.4	1.32***	(1.13, 1.56)	1.21	(0.95, 1.54)
$51 or More	69.4	32.6	15.4	2.04***	(1.63, 2.54)	2.34***	(1.73, 3.17)
Evenings Out Per Week for Fun							
0–1	87.3	12.7	4.4	1.00		1.00	
2–3	80.0	20.0	7.2	1.57***	(1.31, 1.89)	1.64***	(1.23, 2.19)
4–7	71.0	29.0	12.9	2.27***	(1.84, 2.79)	2.66***	(1.95, 3.64)

Note. OR = (unadjusted) odds ratio, AOR = adjusted OR, CI = confidence interval. The adjusted model contained all covariates presented in the table. Both unadjusted and adjusted models included cohort indicators and missing data indicators (when applicable). Raw proportions do not account for missing data.

* p < .05,

** p < .01,

*** p < .001

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Table 3

Comparisons of annual illicit drug use between rave attendees and non-attendees.

	Annual Use (Any Use) %			Used ≥6 Times in Last Year %		
	Have Attended a Rave		Proportion of attendees/non- attendees	Have Attended a Rave		Proportion of attendees/non- attendees
	No	Yes		No	Yes	
Alcohol	59.2	80.1	1.4	28.9	58.4	2.0
Marijuana	31.7	56.3	1.8	16.8	39.3	2.3
Synthetic Cannabis	7.6	20.4	2.7	2.3	8.1	3.6
Stimulants (nonmedical use)	5.6	16.2	2.9	1.6	6.5	4.0
Opioids (nonmedical use)	6.6	15.7	2.4	2.0	7.1	3.5
Tranquilizers (nonmedical use)	4.0	13.2	3.3	1.1	4.8	4.5
Hallucinogens (other than LSD)	2.3	11.5	5.0	0.2	2.0	8.0
Sedatives (nonmedical use)	3.3	10.8	3.3	1.0	3.5	3.5
Salvia Divinorum	3.3	10.7	3.3	0.5	2.9	6.4
Powder Cocaine	1.4	6.6	4.9	0.3	2.2	8.3
LSD	1.3	6.6	4.9	0.2	1.2	6.7
Ketamine	0.7	3.9	5.9	0.3	1.6	6.1
GHB	0.6	3.8	5.9	0.4	1.5	4.1
Bath Salts	0.9	3.7	4.0	0.5	1.4	3.1[+]
Methamphetamine	0.7	3.7	5.5	0.2	1.0	6.3
Roofies	0.6	3.5	5.5	0.5	1.7	3.8
Crack	0.6	3.5	5.5	0.1	1.6	11.0
Heroin	0.1	1.6	11.5	0.1[‡]	0.7	12.5

Note. Since multi-drug use was common (mean number of drugs used among rave attendees = 2.6, SD = 2.7, range = 0–18), significance was determined utilizing a Bonferroni correction ($p = .05/18 = .003$). All comparisons were $p < .0001$ except for frequent bath salt use, which was $p = .0005$.

‡The cell for frequent heroin use among non-attendees contained fewer than five subjects. Bath salt use was only assessed in years 2012–2013. We present raw proportions instead of odds ratios because prevalence of some drugs was too high or too rare, and thus prevented accurate estimations computed using the full value.

Table 4

Comparisons of annual illicit drug use by level of rave attendance among ever-attendees.

	Annual Use (Any Use) %			Used ≥6 Times in Last Year %		
	Rave Attendance		Proportion of infrequent attendees/frequent attendees	Rave Attendance		Proportion of infrequent attendees/frequent attendees
	A Few Times Per Year	Monthly or More Often		A Few Times Per Year	Monthly or More Often	
Alcohol	81.3	78.2	1.0+	56.2	62.0	1.1+
Marijuana	55.7	57.3	1.0+	35.8	44.8	1.3++
Synthetic Cannabis	17.0	25.8	1.5	6.1	11.3	1.9
Stimulants (nonmedical use)	14.1	19.5	1.4++	4.1	10.5	2.6
Opioids (nonmedical use)	12.8	20.4	1.6	4.9	10.7	2.2
Tranquilizers (nonmedical use)	11.0	16.8	1.5	3.1	7.6	2.5
Hallucinogens (other than LSD)	8.5	16.4	1.9	0.6	4.2	7.1
Sedatives (nonmedical use)	8.3	14.6	1.8	1.7	6.5	3.9
Salvia Divinorum	7.6	15.5	2.1	1.0	5.9	5.7
Powder Cocaine	3.7	11.2	3.0	1.0	4.0	3.9
LSD	3.4	11.7	3.5	0.3‡	2.6	10.1++
Ketamine	1.8	7.3	4.1	0.3	3.5	10.2
GHB	1.7	7.1	4.2	0.4	3.3	9.4
Bath Salts	1.8	6.7	3.7	0.5	2.8	5.6
Methamphetamine	1.3	7.6	5.9	0.3	2.1	6.5
Roofies	2.4	5.4	2.2++	0.9	3.0	3.4++
Crack	2.0	6.0	3.0	0.6	3.3	5.6

	Annual Use (Any Use) %			Used ≥6 Times in Last Year %		
	Rave Attendance		Proportion of infrequent attendees/frequent attendees	Rave Attendance		Proportion of infrequent attendees/frequent attendees
	A Few Times Per Year	Monthly or More Often		A Few Times Per Year	Monthly or More Often	
Heroin	0.7	3.1	4.7	0.3	1.5	5.0++

Note. Since multi-drug use was common (mean number of drugs used among infrequent attendees = 2.2, SD = 2.1, range = 0–15; mean number of drugs used among frequent attendees = 3.0, SD = 3.4, range = 0–18), significance was determined utilizing a Bonferroni correction ($p = .05/18 = .003$). Comparisons were significant at $p < .003$; however, three comparisons

+ were not significant before the correction ($p > .05$) and six

++ comparisons were no longer significant after the correction ($p < .05$, but greater than .003).

‡ Cell for frequent LSD use among infrequent attendees contained fewer than five subjects. Bath salt use was only assessed in years 2012–2013. We present raw proportions instead of odds ratios because prevalence of some drugs was too high or too rare, and thus prevented accurate estimations computed using the full value.

Table 5

Adjusted binary logistic regression models examining level of rave attendance in relation to recent use of various illicit drugs.

	Marijuana		**Synthetic Cannabinoids**		**Stimulants (Nonmedical Use)**		**Opioids (Nonmedical Use)**	
	AOR	**99% CI**	**AOR**	**99% CI**	**AOR**	**99% CI**	**AOR**	**99% CI**
Never attended	1.00		1.00		1.00		1.00	
A few times a year	2.40***	(1.89, 3.03)	2.01***	(1.46, 2.77)	2.44***	(1.73, 3.44)	1.84***	(1.30, 2.61)
Monthly or more	2.16***	(1.60, 2.92)	2.99***	(2.05, 4.37)	3.49***	(2.36, 5.16)	2.80***	(1.92, 4.09)
	Tranquilizers (Nonmedical Use)		Hallucinogens (other than LSD)		Sedatives (Nonmedical Use)		Salvia Divinorum	
	AOR	99% CI	AOR	99% CI	AOR	99% CI	AOR	99% CI
Never attended	1.00		1.00		1.00		1.00	
A few times a year	2.61***	(1.78, 3.83)	3.18***	(2.00, 5.05)	2.51***	(1.62, 3.86)	1.84*	(1.11, 3.03)
Monthly or more	3.96***	(2.64, 5.94)	6.09***	(3.70, 10.02)	4.59***	(2.90, 7.26)	3.67***	(2.30, 5.85)
	Powder Cocaine		LSD		Ketamine		GHB	
	AOR	99% CI	AOR	99% CI	AOR	99% CI	AOR	99% CI
Never attended	1.00		1.00		1.00		1.00	
A few times a year	2.19*	(1.18, 4.07)	2.06	(1.07, 3.96)	2.36	(0.91, 6.13)	2.35	(0.91, 6.10)
Monthly or more	6.38***	(3.58, 11.37)	7.25***	(3.96, 13.26)	7.33***	(3.35, 16.06)	7.52***	(3.22, 17.60)
	Bath Salts		Methamphetamine		Roofies		Crack	
	AOR	99% CI	AOR	99% CI	AOR	99% CI	AOR	99% CI
Never attended	1.00		1.00		1.00		1.00	
A few times a year	1.83	(0.70, 4.78)	1.69	(0.65, 4.42)	3.81***	(1.57, 9.22)	2.64	(1.09, 6.39)
Monthly or more	4.70**	(1.48,14. 94)	9.29***	(4.23, 20.40)	5.70***	(2.33, 13.96)	7.30***	(3.15, 16.90)

Note. AOR = adjusted odds ratio, CI = confidence interval. We did not model alcohol use because it was highly prevalent (used by 68% of seniors) and we did not model heroin use because use was too rare (used by only 0.4% of seniors).

After Bonferroni correction (.05/16),

* $p < .003$,

** $p < .001$,

*** $p < .0001$.