Published in final edited form as:

Psychol Sex. 2018 ; 9(1): 54–68. doi:10.1080/19419899.2018.1425220.

A comparison of self-reported sexual effects of alcohol, marijuana, and ecstasy in a sample of young adult nightlife attendees

Joseph J. Palamar^{a,b}, Marybec Griffin-Tomas^{c,d}, Patricia Acosta^a, Danielle C. Ompad^{b,c,d}, and Charles M. Cleland^{b,e}

^aDepartment of Population Health, New York University Langone Medical Center, New York, NY, USA

^bCenter for Drug Use and HIV/HCV Research, New York University Rory Meyers College of Nursing, New York, NY, USA

^cCenter for Health, Identity, Behavior, and Prevention Studies, New York University, New York, NY, USA

^dCollege of Global Public Health, New York University, New York, NY, USA

^eRory Meyers College of Nursing, New York University, New York, NY, USA

Abstract

Alcohol, marijuana, and ecstasy (3,4-methylenedioxymethamphetamine [MDMA], ‘Molly’) are among the most prevalent substances used by young adults; however, few studies have focused on the specific sexual effects associated with use. Examining subjective sexual effects (e.g. increased libido) associated with use can inform prevention efforts. Data were analysed from 679 nightclub and dance festival attendees in New York City (ages 18–25) to examine and compare self-reported sexual effects associated with use of alcohol, marijuana, and ecstasy. Results suggest that

CONTACT: Joseph J. Palamar joseph.palamar@nyu.edu Department of Population Health, 227 E. 30th Street, 7th Floor, New York, NY 10016, USA.

ORCID

Danielle C. Ompad <http://orcid.org/0000-0003-0240-0393>

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Joseph J. Palamar, PhD, MPH is an Associate Professor in the Department of Population Health. His primary research focus is drug use epidemiology, with specialty in new psychoactive substances, club drugs, drug policy, drug-related risky sexual behaviour, and attitudinal predictors of drug use.

Marybec Griffin-Tomas, MA, MPH is a doctoral student whose work is focused in the areas of sexual healthcare including contraception, abortion, HIV prevention methods, and LGBTQ health. Her work is centred on the intersection of policy, healthcare services, and individual health seeking behaviours.

Patricia Acosta is a part-time Research Associate in the Department of Population Health. Her research interests include novel psychoactive substances and child/adolescent psychology.

Danielle C. Ompad, PhD, MHS is an epidemiologist whose work is focused in the areas of urban health, HIV, illicit drug use, and adult access to vaccines. With respect to illicit drug use, her work has spanned the entire natural history of addiction – from initiation to cessation.

Charles C. Cleland, PhD, MA is a quantitative psychologist and biostatistician. His methodological interests include longitudinal data analysis, meta-analysis, respondent-driven sampling, and multilevel modelling. His substantive research interests include health disparities, particularly in the areas of substance use and infectious disease.

compared to marijuana, alcohol and ecstasy were more strongly associated with heightened perceived sexual effects (i.e. perceived sexual attractiveness of self and others, sexual desire, length of intercourse, and sexual outgoingness). Increased body and sex organ sensitivity and increased sexual intensity were most commonly associated with ecstasy use. Sexual dysfunction was most common while using alcohol or ecstasy, especially among males, and females were more likely to report sexual dysfunction after using marijuana. Post-sex regret was most common with alcohol use. Alcohol, marijuana, and ecstasy each have different sexual effects; therefore, each is associated with different risks and benefits for users. Findings can inform prevention and harm reduction as young adults are prone to use these substances.

Keywords

Sexual behaviour; alcohol; marijuana; MDMA

Alcohol, cannabis (marijuana), and ecstasy (3,4-methylenedioxymethamphetamine [MDMA], ‘Molly’) are amongst the most prevalent psychoactive intoxicating substances used by young adults in the United States (US) (Schulenberg et al., 2017; Substance Abuse and Mental Health Services Administration, 2017). Among young adults (ages 19–28) in the US, an estimated 86% have used alcohol, 59% have used marijuana, and 13% have used ecstasy in their lifetime (Schulenberg et al., 2017). Compared to other age groups, young adults are at high risk for psychoactive substance use and associated adverse outcomes. Each psychoactive substance is associated with its own level of potential physical, psychological, and social harm – to users and to others (Nutt, King, Phillips, & Independent Scientific Committee on Drugs, 2010; Nutt, King, Saulsbury, & Blakemore, 2007).

There has been extensive research on substance use as a factor that leads to sexual risk behaviour (e.g. sex without a condom), but more studies are needed to examine how specific drugs relate to sexual risk behaviour. Most research on substance use in relation to sexual risk behaviour has been correlational in nature, and knowledge about how use of various substances may lead to sexual interactions – via specific sexual effects – is needed to inform prevention to guide safer sexual practices.

Alcohol use and sexual behaviour

An abundance of research has focused on alcohol use as a risk factor for risky sexual behaviour. For example, research has documented the relationship between alcohol use and multiple sexual partners in the past three months (Adimora, Schoenbach, Taylor, Khan, & Schwartz, 2011; Benotsch, Snipes, Martin, & Bull, 2013), inconsistent condom use (Castilla, Barrio, Belza, & de la Fuente, 1999; Heath, Lanoye, & Maisto, 2012; Scott-Sheldon, Carey, & Carey, 2010; Seth, Wingood, DiClemente, & Robinson, 2011), being in unsafe situations which can place individuals at risk for unwanted sexual encounters (Palmer, McMahon, Rounsaville, & Ball, 2010; Wells, Kelly, Golub, Grov, & Parsons, 2010), and sexual assault (Mouilso & Fischer, 2012). In addition, alcohol use has been found to be associated with negative health outcomes such as sexually transmitted infections (STIs; Scott-Sheldon et al., 2010; Seth et al., 2011), HIV transmission (Baliunas, Rehm, Irving, & Shuper, 2010), and unplanned pregnancy (Deardorff, Gonzales, Christopher, Roosa, & Millsap, 2005). The

relationships among alcohol, sexual risk behaviours, and negative sexual health outcomes persist across age groups (Heath et al., 2012; Seth et al., 2011), racial and ethnic groups (Seth et al., 2011), genders (Hutton, McCaul, Santora, & Erbeling, 2008), and sexual orientations (Heath et al., 2012).

With regards to more specific sexual effects, one study found that alcohol consumption was positively correlated with increased sensation-seeking behaviours and sexual arousal that contributed to inconsistent condom use (Norris et al., 2009). Another study focusing solely on men reported similar findings – that alcohol use was positively correlated with increased sexual arousal and decreased condom use among those using substances compared to those who were sober (Wray, Simons, & Maisto, 2015). However, studies are still needed to examine other potential sexual effects associated with alcohol use.

Marijuana use and sexual behaviour

Correlational studies have also examined sexual effects associated with marijuana use and the link between marijuana use and sexual risk behaviour. A study of substance users between the ages of 18–39 found that marijuana users were more likely to report having more than one sexual partner with no regular condom use than those who did not use marijuana (Benotsch et al., 2013; Castilla et al., 1999). Studies have also found that college-age males and females who use marijuana are more likely to report having multiple partners in the past three months (Benotsch et al., 2013; Smith et al., 2010). In a study of sexual risk behaviours among HIV-positive adults who were heavy alcohol drinkers, the number of condomless sexual encounters increased with more frequent marijuana use. Tyurina et al. (2013) found that men who reported smoking marijuana 6 or more times in the past month had an increased risk of engaging in condomless sex and higher odds of reporting having multiple sexual partners than those who did not smoke marijuana.

With regards to more direct sexual effects, studies have found an increase in male and female sexual arousal (Shamloul & Bella, 2011) and effects on the duration of sexual encounters both in prolonged orgasm and inability to achieve orgasm (Smith et al., 2010). Marijuana use has also been found to be associated with inability to maintain an erection (Shamloul & Bella, 2011). Similar to alcohol, more studies are needed to determine the direct sexual effects of marijuana.

Ecstasy use and sexual behaviour

Despite the number of studies examining sexual risk behaviour associated with alcohol and marijuana use, few studies have examined sexual effects associated with the use of ecstasy (the street name for MDMA/‘Molly’). The extant literature about ecstasy and sexual risk shows associations with condomless sex (Mattison et al., 2001), increased number of sexual partners (Castilla et al., 1999), and younger age at sexual debut (May & Parrott, 2015). May and Parrott (2015) found that ecstasy users were more likely to engage in high risk sexual behaviours including casual sex and condomless sex than those who only drink alcohol. Other studies, however, have found that men who have sex with men (MSM) that use ecstasy before sex are about twice as likely to report having condomless anal insertive sex with a

casual partner than those that do not use ecstasy (Pappas & Halkitis, 2011). One of the common effects of ecstasy use has been increased closeness with others as well as increased feelings of sensuality (Bearn & O'Brien, 2015; Cohen, 1995, 1998; McElrath, 2005; Palamar, Kiang, Storholm, & Halkitis, 2014; Zemishlany, Aizenberg, & Weizman, 2001); however, while the use of ecstasy may enhance sexual desire, other sexual effects including delayed orgasm and difficulty maintaining an erection have been reported (McElrath, 2005; Schmidt et al., 2012; Zemishlany et al., 2001).

A lack of focus on specific sexual effects of substances

Most of the available literature on sexual risk behaviours associated with use of alcohol, marijuana, and ecstasy focus on sexual behaviours such as unplanned sex, casual sex, multiple partners (Bedoya et al., 2012; Brodbeck, Matter, & Moggi, 2006; Castilla et al., 1999; Dermen & Cooper, 1994; Mutchler, McKay, McDavitt, & Gordon, 2013; Pedrelli et al., 2011; Poulin & Graham, 2001; Rehm, Shield, Joharchi, & Shuper, 2012; Tran, Nehl, Sales, & Berg, 2014; Tyurina et al., 2013), decreased condom use (Castilla et al., 1999; Gilmore et al., 2013), and reduced social and sexual inhibitions (Coleman & Cater, 2005; O'Byrne & Holmes, 2011). Other studies have focused on the phenomenon of 'chemsex' in which substances are used specifically to facilitate or enhance sexual interactions (Giorgetti et al., 2017; Sewell et al., 2017), although focus tends to be on substances such as methamphetamine rather than substances such as alcohol, marijuana, or ecstasy.

While the health risks associated with substance use are important to consider, focusing on risks alone does not take into account specific sexual effects or perceived benefits that substance use may bring to the sexual encounter (i.e. increased sexual pleasure and/or functioning) (Chao, Szrek, Leite, Peltzer, & Ramlagan, 2015). Perceived benefits to sexual functioning or pleasure, for example, may contribute to an individual's decision to use alcohol or other substances in specific social contexts (McElrath, 2005; Norris et al., 2009), which may in turn influence likelihood of risk behaviour. For example, a European study of 1,341 men and women found that 12.7% of alcohol users, 25.8% of marijuana users, and 22.6% of ecstasy users reported intentional use of these substances to enhance sexual sensation or arousal (Bellis et al., 2008). However, we know very little about how use of specific substances have effects (i.e. effects determined by one's own subjective evaluation) such as perception of sexual attraction of self or towards others, social outgoingness, or sexual desire (i.e. libido). We know little about how various substances may influence physiological reactions that may relate to intimacy or sex such as body or sex organ sensitivity. Further, more research is needed focusing on specific effects dependent on sexual interaction such as length of sexual intercourse, sexual enjoyment, length and intensity of orgasm, and sexual dysfunction (e.g. vaginal dryness, trouble achieving/maintaining an erection). In addition, little is known about how use of specific substances before or during sexual interactions may influence adverse psychological consequences such as regret after sex. While some qualitative studies have investigated sexual effects of drugs such as alcohol and marijuana (e.g. Palamar, Acosta, Ompad, & Friedman, 2016), to our knowledge, researchers have not investigated such phenomena in a quantitative manner. Also, while studies have focused on sexual risk behaviour regarding specific drugs, it is difficult to compare sexual effects of drugs as effects have been queried from different samples. A

within-subjects design would allow us to compare reported sexual effects across drugs by the same individuals. To better understand the sexual effects of specific psychoactive substances, which may in turn affect sexual risk behaviour, research is needed to compare the psychosocial and physical sexual experiences of individuals across three of the most prevalent intoxicating substances—alcohol, marijuana, and ecstasy.

The objective of this exploratory research is to better understand the perceived sexual effects of three of the most prevalent psychoactive substances. In this paper, we aim to compare psychosocial and physical sexual experiences of men and women from a high-risk population – nightlife attendees – to add more nuanced information to correlational links between substance use and sex, and also to inform counselling and intervention development. Likewise, this research can determine which substances may be riskier with regards to sexual activity and this can inform prevention.

Methods

We surveyed 679 nightclub and dance festival attendees via an electronic tablet survey in New York City during the summer of 2015. A variation of time-space sampling was used (i.e. parties are randomly selected [specific venues on specific nights] and potential participants were surveyed outside of these parties (MacKellar et al., 2007). Participants were eligible if they identified as 1) ages 18–25, and 2) were attending the randomly selected electronic dance music party. Further details regarding sampling and recruitment can be found elsewhere (Palamar, Acosta, Sherman, Ompad, & Cleland, 2016). Eligible individuals provided informed consent to participate by checking off that they agreed to take the survey upon reading the informed consent page at the beginning of the electronic survey. The informed consent page described the study and recruiters were available to answer questions. Participants were also offered a card containing study information. The survey focused mainly on self-reported substance use, but included questions about sexual effects related to use of some specific substances, as part of a larger epidemiologic survey. Recruiters ensured that participants were not visually intoxicated (e.g. speech or gait impairment) at the time of administration. Participants were compensated \$10 USD for their time completing the survey.

Variables

Participants were asked their age, sex, race/ethnicity, and sexual orientation. They were also asked if they had ever used (1) alcohol, (2) marijuana, and (3) ecstasy/MDMA/‘Molly’. Participants that answered affirmatively for each substance were directed to a page asking about potential sexual effects associated with use of that specific substance. These questions focused on some potential sexual effects that have been noted in the literature; however, these items had not been previously validated. Six questions assessed how the participant felt while under the influence of the substance. Specifically, participants were asked to rate (1) self-perception of sexual attractiveness, (2) sexual attractiveness towards others, (3) social outgoingness (which can lead to sexual interaction), (4) sexual desire (libido), (5) body sensitivity to touch, and (6) sex organ sensitivity to touch. These six items appeared in their own section of follow-up responses (if use of the specific drug was reported) as they do not

depend on a sexual interaction with another individual. We also asked whether the participant had ever engaged in an intimate encounter while under the influence of the substance, which was defined as ‘seductive or intimate situations that would generally not lead to orgasm (for example, kissing or caressing).’

Participants were then asked if they had ever had a sexual encounter under the influence of the substance. Prior to answering the questions about sexual behaviour, participants viewed a statement explaining: ‘For the purpose of this survey, sex means any sexual activity (involving some form of genital contact) with another individual that can result in orgasm in either individual.’ Participants who reported having sex while under the influence of the substance were then taken to a second page of follow-up questions, which assessed sexual effects specific to sexual interactions. The top of the page containing the sex-specific questions noted, ‘If you don’t recall how sex is in general, feel free to focus on your most recent sexual interaction while high on [the drug].’ Participants were asked seven questions about direct sexual effects and two questions focusing on thoughts or feelings, post-sexual encounter. Specifically, participants were asked whether they felt use of the substance influenced (1) sexual outgoingness, (2) sexual intensity, (3) length of sexual interaction, (4) sexual enjoyment, (5) orgasm intensity, (6) length or frequency of orgasm, and (7) sexual dysfunction which was defined specifically as vaginal dryness for females, and difficulty achieving/maintaining an erection for males. The two additional items assessed whether the participant would have been attracted to his or her partner if not under the influence of the substance and whether he or she regretted the sexual interaction.

Most items had four possible responses – one indicating increased levels or enhancement (e.g. ‘more sexual desire’); another indicating decreased levels (detracting from sex; e.g. ‘less sexual desire’), ‘no difference’ and/or ‘not sure’. For general sexual effect variables (effects not dependent on intercourse), we deleted responses of ‘not sure’ and recoded responses into -1 = decreased levels, 0 = no difference, and 1 = increased levels. We recoded responses for sexual effect variables that were dependent on intercourse in a similar manner; however, ‘no difference’ was not an answer option for all items; for such items we dichotomised responses (e.g. increased vs. not increased). All questions and response options are listed in Table 1.

Analyses

First, descriptive statistics were computed for all variables and we calculated percentages indicating agreement with each sexual effect for alcohol, marijuana, and ecstasy. We also examined whether differences existed between self-reported sexual effects with regards to gender using chi-square. We then constructed mixed-effects ordinal regression models (Hedeker & Gibbons, 1994) with each ordinal sexual effect variable as the outcome to determine how type of drug used was associated with the odds of self-reported enhanced sexual effects. Specifically, in each model, we used a command that allowed us to make pairwise comparisons of drugs: (1) alcohol and marijuana, (2) alcohol and ecstasy, and (3) ecstasy and marijuana, with the effect size for each comparison described by an odds ratio. The mixed-effect models included all available data, and thus each pairwise comparison utilised both within and between-participant differences. Participants who did not report use

of a particular pair of substances (or were missing data for that specific variable) were excluded from specific comparisons involving those substances. We applied a Bonferroni statistical correction for multiple comparisons separately for the 8 general sex questions ($.05/8 = .006$) and for the 9 encounter-specific questions ($.05/9 = .005$) to minimise Type I Error. However, this correction is conservative, so we also present unadjusted p-values to allow readers to see the impact of adjustment. All statistics were computed using Stata SE 13 (StataCorp, 2009). This study was approved by the New York University Langone Medical Center Institutional Review Board.

Results

On average the sample was 21.89 (SD = 2.10) years old and 38.6% identified as female. The majority (60.1%) identified as White, and 5% identified as Black, 17.6% Hispanic, 8.5% Asian, and 8.8% Other/ Mixed race. With regards to sexual orientation, the majority (84.6%) self-identified as heterosexual; 6.4% identified as gay/lesbian/homosexual, and 9.1% identified as bisexual. Of the 679 participants surveyed, 593 (87.3%) reported lifetime use of any of the three substances queried. Most (39.2%, $n = 266$) reported use of all three substances, followed by use of only alcohol and marijuana, but not ecstasy (20.6%, $n = 140$). Less frequent lifetime substance ‘combinations’ were alcohol and ecstasy (but not marijuana; 3.8%, $n = 26$) and marijuana and ecstasy (but not alcohol; 4.6%, $n = 31$). With regards to those reporting use of only one of the three substances, 9.7% ($n = 66$) of the sample reported only using alcohol, 4.6% ($n = 31$) reported only using marijuana, and 4.9% ($n = 33$) of the sample reported only using ecstasy in their lifetime. Prevalence of reported lifetime use of these substances did not significantly differ by gender ($p = .718$). The percentages presented in tables are based on those reporting use of that particular substance, regardless of whether another substance was used. However, comparisons between substances were limited to only those reporting use of the two substances being compared (e.g. the 19.2% of the sample reporting use of only one of the three substances were excluded from pairwise analyses).

As shown in Table 2, two-thirds of participants (66.8%) reported feeling more attractive on alcohol, 6 out of 10 (60.6%) reported feeling more attractive on ecstasy, and a quarter (25.3%) felt more attractive on marijuana. Attraction to others was similar, with the most participants (72.3%) reporting alcohol use as leading them to be more attracted to others, followed by ecstasy (64.3%), and then marijuana (27.0%). Increased social outgoingness was reported by the majority of users of alcohol (77.1%) and ecstasy (72.3%), yet only a quarter (26.1%) of participants reported that this increased when using marijuana. In fact, over a third (36.4%) reported that being high on marijuana decreased social outgoingness. Similarly, increased sexual desire was reported by the majority of users of alcohol (62.3%) and ecstasy (58.3%), but this was reported by far fewer users of marijuana (31.6%). Three quarters (74.5%) of participants reported that ecstasy increases body sensitivity, followed by marijuana (49.1%), and alcohol (38.3%). In fact, over a quarter (27.8%) of alcohol users reported decreased sensitivity on alcohol (compared to fewer than 1 out of 10 reporting this for marijuana or ecstasy). Findings were similar for sex organ sensitivity. Most (85%) users of alcohol reported having a sexual encounter after drinking, followed by marijuana

(74.7%), and ecstasy (56.8%). A similar pattern was found for those reporting any type of intimate encounter.

Among those reporting having sexual encounters on a particular substance (Table 3), sexual outgoingness was more common with alcohol (81.7%) and ecstasy (74.3%) compared to marijuana (45.9%), and sexual intensity (83.0%) and length of sexual interaction (64.7%) were highest in relation to ecstasy use. Reported sexual enjoyment was also higher on ecstasy (66.5%) compared to alcohol (41.1%). With regards to orgasm, intensity was reportedly higher on ecstasy (63.0%) compared to alcohol (29.5%) and marijuana (44.9%), and reported length of orgasm was greater on ecstasy (45.1%) compared to alcohol (22.8%) and marijuana (29.6%). Sexual dysfunction, however, was more commonly associated with ecstasy (46.7%) and alcohol (40.2%) use compared to marijuana use (21.3%). Post-sex regret was also most commonly reported with alcohol (30.7%) compared to ecstasy (12.6%) and marijuana (7.2%).

There were six statistically significant differences by gender (not presented in tables). Sexual outgoingness on alcohol was higher among females (87.1%) than males (78.3%) ($p = .038$) and sexual intensity was greater with alcohol use more among females (69.8%) than males (57.9%) ($p = .018$). Males were more likely to report increased length of sexual intercourse compared to females after use of alcohol (58.5% vs. 35.9%; $p < .001$). In addition, there were reported differences in sexual dysfunction by gender for all three substances; specifically, males were more likely to report dysfunction after alcohol use (49.5% vs. 24.8%; $p < .001$) and ecstasy use (53.6% vs. 34.6%, $p = .031$), but females were more likely to report dysfunction after marijuana use (30.6% vs. 15.0%, $p = .002$).

Table 4 presents odds ratios comparing self-reported sexual effects between each substance. Compared to marijuana, both alcohol and ecstasy were associated with increased odds of reporting increased sexual attractiveness of self and others, social outgoingness, and sexual desire. Increased body and sex organ sensitivity tended to be more associated with ecstasy compared to alcohol and marijuana, and both sexual and intimate encounters were more likely to occur when a participant used alcohol as compared to marijuana or ecstasy. With regards to encounter-specific effects, compared to marijuana, users of alcohol and ecstasy were at higher odds for reporting sexual outgoingness after use. Compared to alcohol and marijuana, ecstasy increased the odds for reporting greater sexual intensity and length of intercourse. Compared to alcohol, use of marijuana and ecstasy was associated with an increased odds of reporting heightened sexual enjoyment or intensity. Compared to marijuana, ecstasy was associated with an increased odds of reporting longer length/frequency of orgasm. Alcohol and ecstasy were associated with increases in odds of reporting sexual dysfunction compared to marijuana, and alcohol was associated with increased odds of reporting post-sex regret compared to marijuana and alcohol.

Discussion

As prevalence of, and acceptance towards use of substances like marijuana and ecstasy have increased (Schulenberg et al., 2017), it is important to understand the potential sexual effects associated with use to inform prevention and harm reduction. Examining specific substances

and not just ‘substance use’ is important as unique substances tend to have different effects, which may differentially affect sexual risk behaviour such as condomless sex. This study adds to the extant literature providing information about various perceived sexual effects of three of the most commonly used psychoactive substances. Most studies investigating links between drug use and sex have been correlational, focusing largely on associations between use and sex-related outcomes (e.g. condom use). This study helps fill in gaps regarding how use of various drugs may be related to specific sexual effects which – alone or in combination – may influence sex-related outcomes.

Increased attraction – both feeling more attractive and attraction to others – were most commonly associated with consumption of alcohol. These results align with previous research on the social effects of alcohol, which linked alcohol use to increased feelings of self-acceptance and decreased feelings of social anxiety in social situations (Heilig, Goldman, Berrettini, & O’Brien, 2011). Increased self-acceptance and decreased anxiety while under the influence of alcohol may also apply to sexual encounters. When comparing the sexual effects of alcohol between males and females, females reported greater sexual outgoingness than did males. Existing gender norms with regards to sexual activity often imply that women are less likely to express sexual desire than men (Bradshaw, Kahn, & Saville, 2010). The effect of alcohol in social situations may decrease inhibitions and increase a woman’s comfort with expressing her sexual desires (Allison & Risman, 2013; Armstrong, Hamilton, Armstrong, & Seeley, 2014; Montemurro, Bartasavich, & Wintermute, 2015).

Sexual outgoingness was more commonly associated with use of ecstasy; however, ecstasy use was less likely to be reportedly used in comparison to alcohol or marijuana use. Due to a lower likelihood of reporting sexual encounters on ecstasy (which may also be dependent on prevalence and/or number of times used), ecstasy users reported the greatest sexual pleasure when compared to levels of sexual pleasure associated with use of alcohol or marijuana. These findings add to previous research regarding the association between substance use and sexual pleasure; specifically, that the use of ecstasy may increase feelings of sexual desire and engagement (Bearn & O’Brien, 2015; McElrath, 2005) even though ecstasy use is more typically associated with sensuality rather than actual sexual intercourse (Baylen & Rosenberg, 2006; Palamar et al., 2014). Thus, it is important to keep in mind that some participants may have been more aware of sensuality as a form of sexual interaction. Increased sexual desire was more associated with alcohol and ecstasy use than marijuana use for both men and women in this sample. Studies have found that ecstasy use is often associated with increased sexual desire (Kennedy, Grov, & Parsons, 2010) as has alcohol use (Norris et al., 2009; Wray et al., 2015).

For men, sexual dysfunction was more often associated with alcohol and ecstasy use than with marijuana use. However, for women, sexual dysfunction was more often associated with marijuana and ecstasy use than with alcohol. Previous studies have found an association between erectile dysfunction and use of marijuana (Shamloul & Bella, 2011) and ecstasy (McElrath, 2005; Schmidt et al., 2012; Zemishlany et al., 2001). Studies on female sexual dysfunction are often contradictory. For example, in contrast to our findings, a study on females who used ecstasy reported increased vaginal lubrication (Zemishlany et al.,

2001). Similarly, a study of sexual dysfunction among women found that alcohol use can increase the risk for vaginal dryness and painful sexual intercourse (Diehl, Silva, & Laranjeira, 2013; Di siz, Beji, & Oskay, 2015). Findings about sexual dysfunction among men and women who use substances should be interpreted carefully because sexual dysfunction is more easily recognised in men than women. Furthermore, arousal non-concordance (the difference between mental arousal and signs of physical arousal like vaginal wetness) is more common among women than men (Suschinsky & Lalumière, 2011) and is not inherently a marker of sexual dysfunction.

General body and sex-organ sensitivity were more commonly associated with ecstasy and marijuana use as compared to alcohol, which tends to numb the body and sex organs (Palamar et al., 2016). This study adds to previous literature that reports an association between ecstasy use and increased physical sensitivity (Bellis et al., 2008; Kennedy et al., 2010; Levy, O'Grady, Wish, & Arria, 2005), marijuana use and increased physical sensitivity and decreased physical sensitivity on alcohol (Palamar et al., 2016). When comparing associations regarding orgasm intensity, ecstasy use was more commonly associated with more intense orgasm than alcohol or marijuana. The literature about the effects of ecstasy on orgasm is currently inconclusive. Previous research has found an association between ecstasy use and increased orgasm intensity (Kennedy et al., 2010; Zemishlany et al., 2001), yet other studies have found that ecstasy use is associated with greater difficulty in achieving orgasm (Theall, Elifson, & Sterk, 2006). The findings of this study support previous research that marijuana use may inhibit the ability to achieve orgasm (Smith et al., 2010) as does alcohol use (George & Gilmore, 2013).

Regret after sex was more commonly associated with alcohol use as compared to marijuana and ecstasy use. Previous studies indicate that regret after sex may be related to less attraction to partners after the encounter is over (Palamar et al., 2016; Parsons et al., 2004). Moreover, regret often occurs after having sex with partners that are not known very well (Cooper, 2002; Dunn, Bartee, & Perko, 2003; Palamar et al., 2016; Parsons et al., 2004). Alcohol use also has been reported to decrease social inhibitions that may lead individuals to engage in sexual encounters they would not usually engage in (Lewis et al., 2008; Parsons et al., 2004), and, thus, may lead to regret.

Limitations

Recall bias is a factor in this study and may have been introduced in two distinct ways. First, intoxication could have affected participants' recall of sexual experiences as some of these substances can impair memory or perception of events as they occur. Second, the retrospective nature of this study relies on accuracy of participant memories. Polysubstance use (i.e. use of multiple substances simultaneously) was not assessed so we cannot determine whether use of additional substances influenced perceived sexual effects. We were also unable to assess dose or frequency of use in relation to sexual effects. This can be problematic as frequent sexual interactions while under the influence of a substance may affect expectations and possibly the experience of those effects. Recency of use and sex were not assessed and neither were recency of use related to self-reported sexual effects or sexual

interactions. We also did not ask participants to directly compared sexual effects across substances.

While we deleted ‘not sure’ responses for various sexual effect variables, we did conduct sensitivity analyses combining ‘not sure’ with ‘no difference’ and results were nearly identical. Thus, we do not believe such ‘missing’ data biased analyses. Likewise, we also tested ‘not sure or don’t recall’ as the middle response for sexual interaction-specific items (as many did not have a ‘no difference’ answer option), and results of these sensitivity analyses were similar, which gives us confidence that such deleted responses did not affect results.

We did not control for gender in multivariable models as there were very few gender-specific bivariable differences. We did test models controlling for gender (e.g. for sexual dysfunction) and results were nearly identical so to remain consistent we simply present all unadjusted ORs. Multiple testing can increase Type I Error rates, so we applied a Bonferroni correction when we interpreted results. However, Bonferroni corrections are conservative so we also present unadjusted p-values to allow readers to see the impact of adjustment and consider other adjustments less conservative than Bonferroni’s correction. It should be noted that the majority of significant findings remain significant after applying the correction.

There are many types of alcohol (e.g. spirits, beer, wine), there are many strains of marijuana, and ecstasy now comes in different forms (e.g. pills, powder, crystals). In addition, the ecstasy used might not have contained actual MDMA and could have contained adulterants such as ‘bath salts’ which may have different effects (Palamar, Salomone, Vincenti, & Cleland, 2016). Therefore, we essentially assessed what substance(s) the participants believe they used. This potential misclassification may have biased our results.

Participants might also have experienced different sexual effects at different times. We also do not know whether participants deemed specific effects as positive or negative or whether they were aware of such effects prior to use or used intentionally for such effects. Effects can largely be E situational (e.g. depending on one’s partner) and dependent on ‘set’ (mindset) and setting (context and environment) (Zinberg, 1984). For this reason, we specified that the participant should answer according to either the most recent interaction or how he or she perceives the effect(s) in general. More research is needed to determine the extent to which substance-related sexual effects are physical or more dependent on mindset and/or environment. In addition, some terms (e.g. sexual outgoingness) were not defined for participants so it is possible that some items could have led to misinterpretation, confusion, or even underreporting. Sexual dysfunction was defined as vaginal dryness or trouble achieving/maintaining an erection, but it is possible that some participants experienced different types of sexual dysfunction. Likewise, multi-item measures (e.g. for dysfunction) would likely be more reliable; however, it was not possible to include such measures in this rapid electronic survey.

Due to only small subsamples of participants identifying as gay/lesbian/homosexual and bisexual, we could not adequately compare sexual effects by different sexual orientations. Future research should examine subjective sexual effects associated with use of various

substances according to sexual orientation as those who identify as one orientation may be more likely to experience (or be aware of) particular sexual effects. ‘Chemsex’ also appears more common among men who have sex with men (MSM; Giorgetti et al., 2017; Sewell et al., 2017) so it is possible that MSM, for example, may be more aware (or expecting of) specific sexual effects and thus more likely to use that particular substance to enhance sex. Sex of partner(s) does not necessarily correspond with one’s sexual orientation, so it would also have been unknown, for example, with which gender(s) individuals of any sexual orientation had the reported sexual experiences. Finally, this sample consisted of nightclub and dance festival-attending young adults so results may not be fully generalisable to other populations.

Conclusions

This study contributes to the growing body of research demonstrating that these substances may enhance sexual experiences, or increase the likelihood of engaging in such experiences. Enhanced experiences, or increased pleasure, coupled with fewer inhibitions, may result in condomless sex and other sexual risk behaviours. The extent to which participants used substances specifically to enhance their sexual experiences, that is – engage in chemsex, is unclear. Although typically described as a phenomenon in the gay community, chemsex also occurs among heterosexuals (Ma & Perera, 2016). Future epidemiological research is needed to determine whether and how specific sexual effects influence commonly studied outcomes such as condomless sex as this information can more adequately inform prevention (e.g. rather than common information such as that use of a given drug is associated with increased risk of unsafe sex).

Substance abuse and sexual education programmes should address harm reduction related to having sex while using psychoactive substances. These programmes may help inform substance users about the effects of these substances on sexual experiences. Similarly, sexual education programmes may expand the topics covered to include the effects of substance use on sexual decision-making. Harm reduction strategies for those having sex while using psychoactive substances may include helping people recognise the need to carry condoms and lube as well as developing strategies for partner selection and negotiating condom use while inebriated. This is especially important if an individual feels he or she is acquiring positive sexual effects from use of such substances. In addition, both substance and sexual education programmes should address reasons why individuals engage in these behaviours (i.e. the pleasure derived from substance use and sex). Pleasure is an important factor in the decision to use substances or engage in sexual activity yet these discussions are often excluded from health education.

Acknowledgments

Funding

This project was funded by the NIH [K01 DA-038800, PI: Palamar; P30 DA011041, PI: Deren]; National Institute on Drug Abuse [K01 DA038800, P30 DA011041].

References

- Adimora AA, Schoenbach VJ, Taylor EM, Khan MR, Schwartz RJ. Concurrent partnerships, nonmonogamous partners, and substance use among women in the United States. *American Journal of Public Health*. 2011; 101:128–136. [PubMed: 20724694]
- Allison R, Risman BJ. A double standard for “Hooking Up”: How far have we come toward gender equality? *Social Science Research*. 2013; 42:1191–1206. [PubMed: 23859725]
- Armstrong EA, Hamilton LT, Armstrong EM, Seeley JL. “Good girls” gender, social class, and slut discourse on campus. *Social Psychology Quarterly*. 2014; 77:100–122.
- Baliunas D, Rehm J, Irving H, Shuper P. Alcohol consumption and risk of incident human immunodeficiency virus infection: A meta-analysis. *International Journal of Public Health*. 2010; 55:159–166. [PubMed: 19949966]
- Baylen CA, Rosenberg H. A review of the acute subjective effects of MDMA/ecstasy. *Addiction*. 2006; 101:933–947. [PubMed: 16771886]
- Bearn J, O’Brien M. “Addicted to euphoria”: The history, clinical presentation, and management of party drug misuse. *International Review of Neurobiology*. 2015; 120:205–233. [PubMed: 26070759]
- Bedoya CA, Mimiaga MJ, Beauchamp G, Donnell D, Mayer KH, Safren SA. Predictors of HIV transmission risk behavior and seroconversion among Latino men who have sex with men in Project EXPLORE. *AIDS and Behavior*. 2012; 16:608–617. [PubMed: 21390540]
- Bellis MA, Hughes K, Calafat A, Juan M, Ramon A, Rodriguez JA, ... Phillips-Howard P. Sexual uses of alcohol and drugs and the associated health risks: A cross sectional study of young people in nine European cities. *BMC Public Health*. 2008; 8:155. [PubMed: 18471281]
- Benotsch EG, Snipes DJ, Martin AM, Bull SS. Sexting, substance use, and sexual risk behavior in young adults. *Journal of Adolescent Health*. 2013; 52:307–313. [PubMed: 23299017]
- Bradshaw C, Kahn AS, Saville BK. To hook up or date: Which gender benefits? *Sex Roles*. 2010; 62:661–669.
- Brodbeck J, Matter M, Moggi F. Association between cannabis use and sexual risk behavior among young heterosexual adults. *AIDS and Behavior*. 2006; 10:599–605. [PubMed: 16691461]
- Castilla J, Barrio G, Belza MJ, de la Fuente L. Drug and alcohol consumption and sexual risk behaviour among young adults: Results from a national survey. *Drug and Alcohol Dependence*. 1999; 56:47–53. [PubMed: 10462092]
- Chao LW, Szrek H, Leite R, Peltzer K, Ramlagan S. Risks deter but pleasures allure: Is pleasure more important? *Judgment and Decision Making*. 2015; 10:204–218. [PubMed: 26120373]
- Cohen RS. Subjective reports on the effects of the MDMA (‘ecstasy’) experience in humans. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*. 1995; 19:1137–1145. [PubMed: 8787037]
- Cohen, RS. *The love drug: Marching to the beat of ecstasy*. London: Haworth; 1998.
- Coleman LM, Cater SM. A qualitative study of the relationship between alcohol consumption and risky sex in adolescents. *Archives of Sexual Behavior*. 2005; 34:649–661. [PubMed: 16362249]
- Cooper ML. Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *Journal of Studies on Alcohol*. 2002; 63:101–117.
- Deardorff J, Gonzales NA, Christopher FS, Roosa MW, Millsap RE. Early puberty and adolescent pregnancy: The influence of alcohol use. *Pediatrics*. 2005; 116:1451–1456. [PubMed: 16322170]
- Dermen KH, Cooper ML. Sex-related alcohol expectancies among adolescents: I. Scale development. *Psychology of Addictive Behaviors*. 1994; 8:152–160.
- Diehl A, Silva RLD, Laranjeira R. Female sexual dysfunction in patients with substance-related disorders. *Clinics*. 2013; 68:205–212. [PubMed: 23525317]
- Di siz M, Beji N, Oskay Ü. The effects of alcohol dependence on the quality of life and sex life of women. *Substance Use & Misuse*. 2015; 50:1373–1382. [PubMed: 26548892]
- Dunn MS, Bartee RT, Perko MA. Self-reported alcohol use and sexual behaviors of adolescents. *Psychological Reports*. 2003; 92:339–348. [PubMed: 12674302]

- George WH, Gilmore AK. Alcohol's effects on sexual arousal and sexual functioning. *Principles of Addiction: Comprehensive Addictive Behaviors and Disorders*. 2013; 1:339–347.
- Gilmore AK, George WH, Nguyen HV, Heiman JR, Davis KC, Norris J. Influences of situational factors and alcohol expectancies on sexual desire and arousal among heavy-episodic drinking women: Acute alcohol intoxication and condom availability. *Archives of Sexual Behavior*. 2013; 42:949–959. [PubMed: 23661324]
- Giorgetti R, Tagliabracci A, Schifano F, Zaami S, Marinelli E, Busardò FP. When “chems” meet sex: A rising phenomenon called “chemsex”. *Current Neuropharmacology*. 2017; 15:762–770. [PubMed: 27855594]
- Heath J, Lanoye A, Maisto SA. The role of alcohol and substance use in risky sexual behavior among older men who have sex with men: A review and critique of the current literature. *AIDS and Behavior*. 2012; 16:578–589. [PubMed: 21390534]
- Hedeker D, Gibbons RD. A random-effects ordinal regression model for multilevel data. *Biometrics*. 1994; 50:933–944. [PubMed: 7787006]
- Heilig M, Goldman D, Berrettini W, O'Brien CP. Pharmacogenetic approaches to the treatment of alcohol addiction. *Nature Reviews: Neuroscience*. 2011; 12:670–684. [PubMed: 22011682]
- Hutton HE, McCaul ME, Santora PB, Erbeling EJ. The relationship between recent alcohol use and sexual behaviors: Gender differences among sexually transmitted disease clinic patients. *Alcoholism: Clinical and Experimental Research*. 2008; 32:2008–2015.
- Kennedy KE, Grov C, Parsons JT. Ecstasy and sex among young heterosexual women: A qualitative analysis of sensuality, sexual effects, and sexual risk taking. *International Journal of Sexual Health*. 2010; 22:155–166.
- Levy KB, O'Grady KE, Wish ED, Arria AM. An in-depth qualitative examination of the ecstasy experience: Results of a focus group with ecstasy-using college students. *Substance Use & Misuse*. 2005; 40:1427–1441. [PubMed: 16048826]
- Lewis MA, Hove MC, Whiteside U, Lee CM, Kirkeby BS, Oster-Aaland L, ... Larimer ME. Fitting in and feeling fine: Conformity and coping motives as mediators of the relationship between social anxiety and problematic drinking. *Psychology of Addictive Behaviors*. 2008; 22:58–67. [PubMed: 18298231]
- Ma R, Perera S. Safer 'chemsex': GPs' role in harm reduction for emerging forms of recreational drug use. *British Journal of General Practice*. 2016; 66:4–5. [PubMed: 26719455]
- MacKellar DA, Gallagher KM, Finlayson T, Sanchez T, Lansky A, Sullivan PS. Surveillance of HIV risk and prevention behaviors of men who have sex with men—A national application of venue-based, time-space sampling. *Public Health Reports*. 2007; 122:39–47. [PubMed: 17354526]
- Mattison AM, Ross MW, Wolfson T, Franklin D, Neurobehavioral HGSDH, Center R, ... Wallace MR. Circuit party attendance, club drug use, and unsafe sex in gay men. *Journal of Substance Abuse*. 2001; 13:119–126. [PubMed: 11547613]
- May AL, Parrott AC. Greater sexual risk-taking in female and male recreational MDMA/ecstasy users compared with alcohol drinkers: A questionnaire study. *Human Psychopharmacology*. 2015; 30:272–275. [PubMed: 26216562]
- McElrath K. MDMA and sexual behavior: Ecstasy users' perceptions about sexuality and sexual risk. *Substance Use & Misuse*. 2005; 40:1461–1477. [PubMed: 16048828]
- Montemurro B, Bartasavich J, Wintermute L. Let's (not) talk about sex: The gender of sexual discourse. *Sexuality & Culture*. 2015; 19:139–156.
- Mouilso ER, Fischer S. A prospective study of sexual assault and alcohol use among first-year college women. *Violence and Victims*. 2012; 27:78–94. [PubMed: 22455186]
- Mutchler MG, McKay T, McDavitt B, Gordon KK. Using peer ethnography to address health disparities among young urban Black and Latino men who have sex with men. *American Journal of Public Health*. 2013; 103:849–852. [PubMed: 23488490]
- Norris J, Stoner SA, Hessler DM, Zawacki T, Davis KC, George WH, ... Abdallah DA. Influences of sexual sensation seeking, alcohol consumption, and sexual arousal on women's behavioral intentions related to having unprotected sex. *Psychology of Addictive Behaviors*. 2009; 23:14–22. [PubMed: 19290686]

- Nutt D, King LA, Saulsbury W, Blakemore C. Development of a rational scale to assess the harm of drugs of potential misuse. *Lancet*. 2007; 369:1047–1053. [PubMed: 17382831]
- Nutt DJ, King LA, Phillips LD. Independent Scientific Committee on Drugs. Drug harms in the UK: A multicriteria decision analysis. *Lancet*. 2010; 376:1558–1565. [PubMed: 21036393]
- O’Byrne P, Holmes D. Desire, drug use and unsafe sex: A qualitative examination of gay men who attend gay circuit parties. *Culture, Health & Sexuality*. 2011; 13:1–13.
- Palamar JJ, Acosta P, Ompad DC, Friedman SR. A qualitative investigation comparing psychosocial and physical sexual experiences related to alcohol and marijuana use among adults. *Archives of Sexual Behavior*. 2016 Epub ahead of print.
- Palamar JJ, Acosta P, Sherman S, Ompad DC, Cleland CM. Self-reported use of novel psychoactive substances among attendees of electronic dance music venues. *The American Journal of Drug and Alcohol Abuse*. 2016; 42:624–632. [PubMed: 27315522]
- Palamar JJ, Kiang MV, Storholm ED, Halkitis PN. A qualitative descriptive study of perceived sexual effects of club drug use in gay and bisexual men. *Psychology & Sexuality*. 2014; 5:143–160. [PubMed: 24883174]
- Palamar JJ, Salomone A, Vincenti M, Cleland CM. Detection of “bath salts” and other novel psychoactive substances in hair samples of ecstasy/MDMA/“Molly” users. *Drug and Alcohol Dependence*. 2016; 161:200–205. [PubMed: 26883685]
- Palmer RS, McMahon TJ, Rounsaville BJ, Ball SA. Coercive sexual experiences, protective behavioral strategies, alcohol expectancies and consumption among male and female college students. *Journal of Interpersonal Violence*. 2010; 25:1563–1578. [PubMed: 20040711]
- Pappas MK, Halkitis PN. Sexual risk taking and club drug use across three age cohorts of HIV-positive gay and bisexual men in New York City. *AIDS Care*. 2011; 23:1410–1416. [PubMed: 22022849]
- Parsons JT, Vicioso KJ, Punzalan JC, Halkitis PN, Kutnick A, Velasquez MM. The impact of alcohol use on the sexual scripts of HIV-positive men who have sex with men. *Journal of Sex Research*. 2004; 41:160–172. [PubMed: 15326541]
- Pedrelli P, Bitran S, Shyu I, Baer L, Guidi J, Tucker DD, ... Farabaugh AH. Compulsive alcohol use and other high-risk behaviors among college students. *The American Journal on Addictions*. 2011; 20:14–20. [PubMed: 21175916]
- Poulin C, Graham L. The association between substance use, unplanned sexual intercourse and other sexual behaviours among adolescent students. *Addiction*. 2001; 96:607–621. [PubMed: 11300964]
- Rehm J, Shield KD, Joharchi N, Shuper PA. Alcohol consumption and the intention to engage in unprotected sex: Systematic review and meta-analysis of experimental studies. *Addiction*. 2012; 107:51–59. [PubMed: 22151318]
- Schmidt HM, Hagen M, Kriston L, Soares-Weiser K, Maayan N, Berner MM. Management of sexual dysfunction due to antipsychotic drug therapy. *Cochrane Database of Systematic Reviews*. 2012; 11
- Schulenberg, JE., Johnston, LD., O’Malley, PM., Bachman, JG., Miech, RA., Patrick, ME. Monitoring the Future national survey results on drug use, 1975–2016: Volume II, College students and adults ages 19–. Vol. 55. Ann Arbor: Institute for Social Research, The University of Michigan; 2017. Retrieved from http://www.monitoringthefuture.org/pubs/monographs/mtf-vol2_2016.pdf
- Scott-Sheldon LA, Carey MP, Carey KB. Alcohol and risky sexual behavior among heavy drinking college students. *AIDS and Behavior*. 2010; 14:845–853. [PubMed: 18648928]
- Seth P, Wingood GM, DiClemente RJ, Robinson LS. Alcohol use as a marker for risky sexual behaviors and biologically confirmed sexually transmitted infections among young adult African-American women. *Women’s Health Issues*. 2011; 21:130–135. [PubMed: 21276736]
- Sewell J, Miltz A, Lampe FC, Cambiano V, Speakman A, Phillips AN. ... Attitudes to and Understanding of Risk of Acquisition of HIV (AURAH) Study Group. Poly drug use, chemsex drug use, and associations with sexual risk behaviour in HIV-negative men who have sex with men attending sexual health clinics. *International Journal of Drug Policy*. 2017; 43:33–43. [PubMed: 28189979]
- Shamloul R, Bella AJ. Impact of cannabis use on male sexual health. *The Journal of Sexual Medicine*. 2011; 8:971–975. [PubMed: 21269404]

- Smith A, Ferris JA, Simpson JM, Shelley J, Pitts MK, Richters J. Cannabis use and sexual health. *The Journal of Sexual Medicine*. 2010; 7:787–793. [PubMed: 19694929]
- StataCorp, L. Stata version 11.0. College Station, TX: StataCorp LP; 2009.
- Substance Abuse and Mental Health Services Administration. Results from the 2016 national survey on drug use and health: Summary of national findings, NSDUH series. 2017. (HHS Publication No. SMA 17-5044, NSDUH Series H-52). Retrieved from <https://www.samhsa.gov/data/sites/default/files/NSDUH-FFR1-2016/NSDUH-FFR1-2016.htm>
- Suschinsky KD, Lalumière ML. Category-specificity and sexual concordance: The stability of sex differences in sexual arousal patterns. *The Canadian Journal of Human Sexuality*. 2011; 20(3):93.
- Theall KP, Elifson KW, Sterk CE. Sex, touch, and HIV risk among ecstasy users. *AIDS and Behavior*. 2006; 10:169–178. [PubMed: 16456728]
- Tran A, Nehl EJ, Sales J, Berg CJ. Problem drinking behaviors: Differential effects of stress and school type on college students. *Open Journal of Preventive Medicine*. 2014; 4:216. [PubMed: 24999445]
- Tyurina A, Krupitsky E, Cheng DM, Coleman SM, Walley AY, Bridden C, ... Samet JH. Is cannabis use associated with HIV drug and sex risk behaviors among Russian HIV-infected risky drinkers? *Drug and Alcohol Dependence*. 2013; 132:74–80. [PubMed: 23410616]
- Wells BE, Kelly BC, Golub SA, Grov C, Parsons JT. Patterns of alcohol consumption and sexual behavior among young adults in nightclubs. *The American Journal of Drug and Alcohol Abuse*. 2010; 36:39–45. [PubMed: 20141395]
- Wray TB, Simons JS, Maisto SA. Effects of alcohol intoxication and autonomic arousal on delay discounting and risky sex in young adult heterosexual men. *Addictive Behaviors*. 2015; 42:9–13. [PubMed: 25462647]
- Zemishlany Z, Aizenberg D, Weizman A. Subjective effects of MDMA ('Ecstasy') on human sexual function. *European Psychiatry*. 2001; 16:127–130. [PubMed: 11311178]
- Zinberg, NE. *Drug, set, and setting: The basis for controlled intoxicant use*. New Haven, CT: Yale University Press; 1984.

Table 1

Questions asked regarding sexual effects of alcohol, marijuana, and ecstasy.

Non-sexual encounter-specific questions and answers (all users queried)	
Do you feel more or less sexually attractive while high on <i>[drug name]</i> ?	(a) No difference, (b) More attractive, (c) Less attractive, (d) Not sure
Do you find OTHERS more or less sexually attractive while you're high on <i>[drug name]</i> ?	(a) No difference, (b) More attractive, (c) Less attractive, (d) Not sure
Do you feel you're more socially outgoing while high (meaning more likely to be able to meet a partner) on <i>[drug name]</i> ?	(a) No difference, (b) More socially outgoing, (c) Less socially outgoing, (d) Not sure
Do you desire sex more than usual on <i>[drug name]</i> ?	(a) No difference, (b) More desire, (c) Less desire, (d) Not sure
Do you feel your body (overall) is more sensitive to touch on <i>[drug name]</i> ?	(a) No difference, (b) More sensitive, (c) Less sensitive, (d) Not sure
Do you feel your sex organs (penis or vagina) are more sensitive to touch on <i>[drug name]</i> ?	(a) No difference, (b) More sensitive, (c) Less sensitive, (d) Not sure
Have you ever had an intimate encounter other than actual sex while high on <i>[drug name]</i> ? (This includes other seductive or intimate situations that would generally not lead to orgasm (for example, kissing or caressing).	(a) No, (b) Yes, (c) Not sure
Have you ever had SEX on <i>[drug name]</i> ?	(a) No, (b) Yes, (c) Not sure
Sexual encounter-specific questions and answers (only those indicating sex were queried)	
Do you feel you're more outgoing during sex on <i>[drug name]</i> ?	(a) No, (b) Yes, (c) Not sure
Is sex more intense when you're high on <i>[drug name]</i> ?	(a) No, (b) Yes, (c) Not sure
Does sex last shorter or longer on <i>[drug name]</i> ?	(a) No difference, (b) Shorter amount of time, (c) Longer amount of time, (d) Not sure or don't recall
Do you enjoy sex more or less on <i>[drug name]</i> ?	(a) No difference, (b) More enjoyment, (c) Less enjoyment, (d) Not sure or don't recall
Is your orgasm more or less intense on <i>[drug name]</i> ?	(a) No difference, (b) More intense, (c) Less intense, (d) Not sure or don't recall
Is your orgasm longer or more frequent than usual on <i>[drug name]</i> ?	(a) No/No difference, (b) Yes, (c) Not sure or don't recall
Do you have any difficulty getting or staying wet (females) or hard (males) on <i>[drug name]</i> ?	(a) No, (b) Yes, (c) Not sure or don't recall
Would you have been attracted to your partner(s) if you weren't high on <i>[drug name]</i> ?	(a) No, (b) Yes, (c) Not sure or don't recall
Have you regretted having sex while high on <i>[drug name]</i> ?	(a) No, (b) A little bit, (c) Somewhat, (d) Very much, (e) Not sure or don't recall

Table 2

Comparisons of self-reported non-sexual encounter-specific sexual effects by drug.

	Alcohol % (<i>n</i>)	Marijuana % (<i>n</i>)	Ecstasy % (<i>n</i>)
Sexual attractiveness (Self)			
Less attractive	7.5 (<i>n</i> = 33)	18.2 (<i>n</i> = 70)	7.6 (<i>n</i> = 23)
No difference	25.7 (<i>n</i> = 113)	56.5 (<i>n</i> = 217)	31.8 (<i>n</i> = 96)
More attractive	66.8 (<i>n</i> = 294)	25.3 (<i>n</i> = 97)	60.6 (<i>n</i> = 183)
Sexual attractiveness (Others)			
Less attractive	4.5 (<i>n</i> = 20)	12.9 (<i>n</i> = 49)	6.3 (<i>n</i> = 19)
No difference	23.1 (<i>n</i> = 102)	60.1 (<i>n</i> = 229)	29.3 (<i>n</i> = 88)
More attractive	72.3 (<i>n</i> = 319)	27.0 (<i>n</i> = 103)	64.3 (<i>n</i> = 193)
Social outgoingness			
Less socially outgoing	4.5 (<i>n</i> = 20)	36.4 (<i>n</i> = 145)	8.4 (<i>n</i> = 26)
No difference	18.4 (<i>n</i> = 82)	37.4 (<i>n</i> = 149)	19.4 (<i>n</i> = 60)
More socially outgoing	77.1 (<i>n</i> = 343)	26.1 (<i>n</i> = 104)	72.3 (<i>n</i> = 224)
Sexual desire			
Less desire	5.2 (<i>n</i> = 23)	16.8 (<i>n</i> = 64)	12.1 (<i>n</i> = 36)
No difference	32.5 (<i>n</i> = 145)	51.6 (<i>n</i> = 196)	29.6 (<i>n</i> = 88)
More desire	62.3 (<i>n</i> = 278)	31.6 (<i>n</i> = 120)	58.3 (<i>n</i> = 173)
Body sensitivity (to touch)			
Less sensitive	27.8 (<i>n</i> = 120)	9.8 (<i>n</i> = 38)	5.8 (<i>n</i> = 18)
No difference	33.9 (<i>n</i> = 146)	41.1 (<i>n</i> = 160)	19.7 (<i>n</i> = 61)
More sensitive	38.3 (<i>n</i> = 165)	49.1 (<i>n</i> = 191)	74.5 (<i>n</i> = 231)
Sex organ sensitivity (to touch)			
Less sensitive	28.6 (<i>n</i> = 121)	10.0 (<i>n</i> = 37)	9.1 (<i>n</i> = 26)
No difference	36.4 (<i>n</i> = 154)	47.3 (<i>n</i> = 176)	27.4 (<i>n</i> = 78)
More sensitive	35.0 (<i>n</i> = 148)	42.7 (<i>n</i> = 159)	63.5 (<i>n</i> = 181)
Intimate encounter			
No	20.6 (<i>n</i> = 97)	34.8 (<i>n</i> = 154)	36.6 (<i>n</i> = 121)
Yes	79.4 (<i>n</i> = 374)	65.2 (<i>n</i> = 288)	63.4 (<i>n</i> = 210)
Sexual encounter			
No	15.0 (<i>n</i> = 74)	25.3 (<i>n</i> = 117)	43.2 (<i>n</i> = 153)
Yes	85.0 (<i>n</i> = 420)	74.7 (<i>n</i> = 345)	56.8 (<i>n</i> = 201)

There were no statistically significant differences between males and females.

Table 3

Comparisons of self-reported sexual effects specific to sexual encounters by drug.

	Alcohol % (<i>n</i>)	Marijuana % (<i>n</i>)	Ecstasy % (<i>n</i>)
Increased sexual outgoingness ^a			
No	18.3 (<i>n</i> = 65)	54.1 (<i>n</i> = 144)	25.8 (<i>n</i> = 43)
Yes	81.7 (<i>n</i> = 291)	45.9 (<i>n</i> = 122)	74.3 (<i>n</i> = 124)
Increased sexual intensity ^b			
No	38.3 (<i>n</i> = 129)	38.2 (<i>n</i> = 102)	17.0 (<i>n</i> = 28)
Yes	61.7 (<i>n</i> = 208)	61.8 (<i>n</i> = 165)	83.0 (<i>n</i> = 137)
Length of sexual interaction ^c			
Shorter amount of time	25.6 (<i>n</i> = 89)	14.5 (<i>n</i> = 39)	12.8 (<i>n</i> = 20)
No difference	24.4 (<i>n</i> = 85)	49.1 (<i>n</i> = 132)	22.4 (<i>n</i> = 35)
Longer amount of time	50.0 (<i>n</i> = 174)	36.4 (<i>n</i> = 98)	64.7 (<i>n</i> = 101)
Sexual enjoyment			
Less enjoyment	23.0 (<i>n</i> = 79)	9.8 (<i>n</i> = 28)	9.8 (<i>n</i> = 17)
No difference	35.9 (<i>n</i> = 123)	36.7 (<i>n</i> = 105)	23.7 (<i>n</i> = 41)
More enjoyment	41.1 (<i>n</i> = 141)	53.5 (<i>n</i> = 153)	66.5 (<i>n</i> = 115)
Orgasm Intensity			
Less intense	28.9 (<i>n</i> = 96)	12.1 (<i>n</i> = 33)	12.3 (<i>n</i> = 19)
No difference	41.6 (<i>n</i> = 138)	43.0 (<i>n</i> = 117)	24.7 (<i>n</i> = 38)
More intense	29.5 (<i>n</i> = 98)	44.9 (<i>n</i> = 122)	63.0 (<i>n</i> = 97)
Length/frequency of orgasm			
No/no difference	77.2 (<i>n</i> = 250)	70.4 (<i>n</i> = 178)	54.9 (<i>n</i> = 79)
Yes	22.8 (<i>n</i> = 74)	29.6 (<i>n</i> = 75)	45.1 (<i>n</i> = 65)
Sexual dysfunction ^d			
No	59.8 (<i>n</i> = 192)	78.7 (<i>n</i> = 211)	53.3 (<i>n</i> = 80)
Yes	40.2 (<i>n</i> = 129)	21.3 (<i>n</i> = 57)	46.7 (<i>n</i> = 70)
Attracted to partner if sober			
No	22.9 (<i>n</i> = 70)	22.8 (<i>n</i> = 61)	12.1 (<i>n</i> = 18)
Yes	77.1 (<i>n</i> = 236)	77.2 (<i>n</i> = 207)	87.9 (<i>n</i> = 131)
Regret having sex			
No	69.3 (<i>n</i> = 264)	92.8 (<i>n</i> = 284)	87.4 (<i>n</i> = 153)
Yes	30.7 (<i>n</i> = 117)	7.2 (<i>n</i> = 22)	12.6 (<i>n</i> = 22)

Table 4

Mixed-effects ordinal regressions comparing self-reported sexual effects between alcohol, marijuana, and ecstasy.

General sexual effects	Alcohol vs. Marijuana (N = 384)			Alcohol vs. Ecstasy (N = 268)			Ecstasy vs. Marijuana (N = 278)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Sexual attractiveness (Self)	5.14	(3.81, 6.93)	<.001	1.29	(0.95, 1.76)	.100	3.97	(2.90, 5.44)	<.001
Sexual attractiveness (Others)	6.29	(4.59, 8.62)	<.001	1.47	(1.07, 2.03)	.017	4.27	(3.08, 5.92)	<.001
Social outgoingness	11.07	(7.80, 15.73)	<.001	1.36	(0.96, 1.91)	.079	8.16	(5.70, 11.67)	<.001
Sexual desire	3.79	(2.82, 5.08)	<.001	1.36	(0.99, 1.86)	.056	2.79	(2.03, 3.83)	<.001
Body sensitivity (to touch)	0.51	(0.39, 0.66)	<.001	0.18	(0.13, 0.26)	<.001	2.76	(2.00, 3.80)	<.001
Sex organ sensitivity (touch)	0.50	(0.37, 0.66)	<.001	0.23	(0.16, 0.32)	<.001	2.18	(1.57, 3.03)	<.001
Intimate encounter	2.61	(1.82, 3.73)	<.001	3.10	(2.07, 4.62)	<.001	0.85	(0.59, 1.20)	.342
Sexual encounter	2.37	(1.61, 3.48)	<.001	7.54	(4.77, 11.92)	<.001	0.31	(0.21, 0.46)	<.001
Encounter-specific effects	Alcohol vs. Marijuana (N = 265)			Alcohol vs. Ecstasy (N = 134)			Ecstasy vs. Marijuana (N = 131)		
	OR	95% CI	p	OR	95% CI	p	OR	95% CI	p
Sexually outgoingness	8.85	(5.18, 15.14)	<.001	1.67	(0.99, 2.84)	.055	5.29	(2.97, 9.42)	<.001
Sexual intensity	1.02	(0.71, 1.47)	.915	0.28	(0.17, 0.48)	<.001	3.59	(2.08, 6.18)	<.001
Length of sexual interaction	1.17	(0.86, 1.60)	.327	0.45	(0.30, 0.69)	<.001	2.59	(1.70, 3.95)	<.001
Sexual enjoyment	0.50	(0.36, 0.70)	<.001	0.29	(0.19, 0.45)	<.001	1.73	(1.13, 2.65)	.012
Orgasm intensity	0.43	(0.31, 0.59)	<.001	0.21	(0.14, 0.33)	<.001	2.01	(1.31, 3.10)	.001
Length/frequency of orgasm	0.63	(0.39, 1.02)	.061	0.20	(0.11, 0.38)	<.001	3.14	(1.69, 5.81)	<.001
Sexual dysfunction	3.05	(1.95, 4.77)	<.001	0.77	(0.48, 1.24)	.278	3.98	(2.33, 6.80)	<.001
Attracted to partner if sober	0.99	(0.62, 1.57)	.954	0.39	(0.20, 0.77)	.006	2.52	(1.28, 4.95)	.008
Regret having sex	9.59	(4.91, 18.73)	<.001	5.00	(2.53, 9.92)	<.001	1.92	(0.92, 4.00)	.083

Due to Bonferroni corrections, significance was indicated by $p < .006$ for general sexual effects and $p < .005$ for encounter-specific effects. OR = odds ratio, CI = confidence interval.