Published in final edited form as:

Sex Transm Dis. 2020 October ; 47(10): 672–678. doi:10.1097/OLQ.0000000000001229.

Marijuana Use, Sexual Behaviors, and Prevalent Sexually Transmitted Infections Among Sexually Experienced Males and Females in the United States:

Findings from the National Health and Nutrition Examination Survey

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Abstract

Background: Several national guidelines consider illicit drug use as an indication for testing and/or counseling for some sexually transmitted infections (STIs). The legal and social landscape of marijuana use is changing and its relevance with STI risk is unclear.

Methods: Sex-specific prevalence of *T. vaginalis* and/or *C. trachomatis* infection was examined by past-year marijuana use among 2,958 sexually-experienced, 20–39 year-old participants of the 2013–2016 National Health and Nutrition Examination Survey (NHANES). Prevalence ratios (PR) with 95% confidence intervals [CI] were estimated by Poisson regression. Adjusted PRs (aPR) were estimated following propensity score covariate-adjustment accounting for sociodemographics, alcohol use, injection drug use, depression, and age at sexual debut.

Results: Past-year marijuana use was reported by 27.3% and 36.3% of females and males, respectively. Male and female past-year marijuana users were more likely to have new and multiple sexual partners in the past year ($P<0.05$). Past-year marijuana use was associated with prevalent *C. trachomatis* and/or *T. vaginalis* infection among females (7.4% vs. 2.9%; PR=2.57 [95% CI=1.62–4.07]) and males (4.0% vs. 1.1%; PR=3.59 [95% CI=1.96–6.58]), but this association was attenuated after propensity score covariate-adjustment among females (aPR=1.15 [95% CI=0.72–1.83]) and males (aPR=2.10 [95% CI=0.88–5.02]). Additional adjustment for new or multiple sexual partners further attenuated the associations (aPR=1.02 [95% CI=0.65–1.51] and aPR=1.91 [95% CI=0.82–4.47] for females and males, respectively).

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Potential conflicts of interest: All authors: No reported conflicts of interest.

Disclaimer: The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

Conclusions: STI prevalence was higher among persons with a past-year history of marijuana use; however, this association was not significant after accounting for measured confounders. Additional work is needed to characterize STI prevalence by the mode, duration, and frequency of marijuana use.

SHORT SUMMARY

A national survey of 20–39-year-olds found a higher prevalence of *C. trachomatis* and/or *T. vaginalis* infection among past-year marijuana users, but marijuana use was not independently associated with STI prevalence.

Keywords

marijuana; cannabis; sexual behavior; chlamydia; trichomoniasis

INTRODUCTION

Globally, marijuana is one of the most commonly used psychoactive substances.¹ Over the past decade, the prevalence and frequency of marijuana use has increased in the U.S. adult population.^{2–5} In 2016, approximately 22.4 million U.S. adults reported marijuana use in the past month.⁶ This increase in marijuana use is likely due to several compounding factors. First and foremost, states are increasingly decriminalizing and legalizing marijuana for medical and/or recreational use.^{7,8} At the end of 2019, marijuana was legal in 33 states for medicinal purposes and in 11 states for recreational purposes (in addition to the District of Columbia for both). In parallel, the commercialization of marijuana has led to the emergence of novel forms of marijuana use (e.g., vaping) and increased promotion of marijuana products.^{9,10} Nationally, the perceived availability of marijuana and normative perceptions of marijuana use have substantially increased, while the perceived risk of marijuana use has declined;^{2,11,12} in 2017, over 80% of U.S. adults believed marijuana to have at least 1 health benefit.¹³ The health-related behaviors and risks of people who use marijuana may be changing and require characterization.

Although it is well-accepted that substance use can play a role in one's sexual health, the particular role of marijuana use in sexual health is unclear. In the U.S., people who have ever used marijuana have historically had a lower age at sexual debut than individuals who have never used marijuana.¹⁴ Marijuana use has also been associated with individual-level sexual behaviors, such as a greater number of sexual partners and less frequent condom use;¹⁵ however, event-level analyses suggest marijuana use before and/or during sex is associated with lower condom use among adolescents but not among adults.¹⁶ A recent national survey of the U.S. adult population found that increased frequency of marijuana use in the past year was associated with increased sexual frequency.¹⁷ Although increased frequency of marijuana use has also been associated with erectile dysfunction and a decreased ability to orgasm in adult males,¹⁸ some males and females have reported that marijuana use relaxes them during sex and increases their sexual desire and satisfaction.^{19,20} Thus, it has been hypothesized that marijuana use may partly influence sexual behavior by enhancing an individual's sexual experience. Alternatively, marijuana use and sexual behaviors may simply be co-occurring behaviors. The purported associations between marijuana use and

various sexual behaviors may be the consequence of residual confounding by contextual conditions,²¹ an individual's personality disposition (i.e., risk preference or propensity for sensation-seeking behaviors),²² and/or other confounding factors that are difficult to disentangle (e.g., polysubstance use).²³ Potential reporting bias with regards to marijuana use, confounders, and sexual behaviors is also a key limitation of these studies.

Few contemporary population-based studies have examined the association of marijuana use with the incidence or prevalence of laboratory-confirmed STIs. An association between marijuana use and STIs has been reported in clinic-based populations as well as some community-based populations of adolescents and socioeconomically-disadvantaged young women,^{24–28} but most of these studies did not adjust for known confounders and/or were conducted well before the changing legal context of marijuana use. Should marijuana use lead to sexual behaviors that increase risk of STI acquisition, as previously outlined, a potential causal association between marijuana use and STIs could plausibly be mediated by sexual behavior. It is also possible that marijuana use may lead to increased exposure to a sexual contact network that has a higher underlying vulnerability to STIs.^{29,30} In contrast to these hypotheses, a recent community-based study of men who have sex with men (MSM) in California found that use of marijuana alone (i.e., without other substances) was associated with decreased risk of incident STIs compared to persons who reported no substance use.²³ It is unknown whether marijuana use is associated with incident or prevalent STIs in the general U.S. adult population.

In this study, we use population-based data from the National Health and Nutrition Examination Survey (NHANES) to assess the association between marijuana use and prevalent *C. trachomatis* and *T. vaginalis* infection among male and female adults in the U.S. household population.

METHODS

Study design and sample

Data were obtained from the continuous NHANES, which is conducted annually by the National Center for Health Statistics (NCHS), U.S. Centers for Disease Control and Prevention (CDC). NHANES is a stratified, multistage probability cluster sampling survey of the noninstitutionalized, civilian U.S. population. The study design and procedures are described in detail elsewhere.^{31s,32s} After completing in-home interviews, participants were asked to complete additional interviews and provide biospecimens (e.g., urine) at a local medical examination center (MEC). All participants provided informed consent. Data collection was approved by the NCHS/CDC Research Ethics Review board and this analysis of publicly-available data was deemed “exempt from human research” by the Institutional Review Board of the Johns Hopkins University School of Medicine.

This cross-sectional analysis was conducted among a sample of 20–39 year-olds who participated in the medical examination component in 2013–2016. This age range and study period were selected due to data availability on variables of interest. The unconditional (unweighted) response rate for the medical examination component among persons aged 20–39 years was 69.2% in 2013–2014 and 56.4% in 2015–2016, yielding 3,744 age-eligible

participants for analysis. Participants with missing data on marijuana use, key covariates, lifetime sexual history and STI outcomes were excluded from the analytic sample (n=642; Supplemental Figure 1). Male and female participants excluded from the analytic sample due to item non-response were more likely to be of a minority race/ethnicity (Supplemental Table 1). An additional 144 participants were excluded from this analysis because they reported not being sexually-experienced. The final analytic sample consisted of 2,958 sexually-experienced participants (n=1,452 males and n=1,506 females).

Questionnaire Data

Sociodemographic data were collected using a Computer-Assisted Personal Interview (CAPI) system in the in-home interview. Participants completed the Patient Health Questionnaire (PHQ-9) via CAPI at the MEC. Data on alcohol use were collected via CAPI at the MEC. A drug use questionnaire was self-administered via the Audio Computer-Assisted Self Interview (ACASI) system in a private room at the MEC. Data on methamphetamine, cocaine, and heroin use, injection drug use of illicit drugs, and marijuana use were obtained in the same module. Participants also completed a sexual history module via ACASI in a private room at the MEC.

Regarding marijuana use, participants were asked, “Have you ever, even once, used marijuana or hashish?”. Participants who responded ‘yes’ were asked, “how old were you the first time you used marijuana or hashish?” (response: age in years) and “how long has it been since you last used marijuana or hashish?” (response: time in days, weeks, months, years). Participants who reported marijuana use during the past 30 days, 1–4 weeks, or 1 month were asked, “during the past 30 days, on how many days did you use marijuana or hashish?” (response: 0–30 days).

The primary independent variable of interest in this analysis was a person’s history of marijuana use in the past year (no/yes). We also examined a person’s history of marijuana use in the past month (no/yes) as a secondary independent variable of interest. To further characterize past-year marijuana users, we considered “recent initiation” of marijuana use as having an age at *first* marijuana use that was within one year of the participants’ estimated age at *last* marijuana use (i.e., the difference between their age at interview and reported time of last marijuana use).

In this analysis, individuals who reported ever having had vaginal, anal, or oral sex or reported 1 lifetime sexual partner were considered to be “sexually-experienced”. Individuals who reported 1 vaginal, anal, or oral sexual partner in the past year were considered “sexually-active”. The total number of lifetime sexual partners and number of past-year sexual partners were calculated regardless of the sex of the sexual partner and refer to any type of sex that was performed (vaginal/anal/oral). Data on whether an individual had a new sexual partner in the past year was similarly evaluated. The questionnaire also captured data on consistent condom use (i.e., always using a condom when having vaginal and/or anal sex) in the past year.

Laboratory data

Stored urinary specimen were assayed for *C. trachomatis* via the Aptima Combo 2 *C. trachomatis* assay (Hologic, San Diego, California) and *T. vaginalis* via the Gen-Probe Aptima Combo *Trichomonas vaginalis* assay (Hologic).^{33s} Laboratory data on gonorrhea, syphilis, and other curable STIs were not available.

Statistical Analysis

To account for the complex survey design, all statistical analyses were conducted using *svy* commands in Stata/MP, version 15.2 (StataCorp LP, College Station, TX). NCHS-derived medical examination center (“*mec*”) weights were pooled across survey cycles and used to account for the differential probabilities of selection, nonresponse to the medical examination, and under coverage of the U.S. population. These complex survey sampling design weights were used for all reported estimates, unless specified otherwise. Taylor series linearization was used to estimate design-based standard errors (SE). Estimates with a relative standard error (RSE) ≥ 30% are noted and should be cautiously interpreted.

All analyses were conducted following stratification by sex. Sociodemographic and behavioral characteristics of the study population were examined by past-year marijuana use using descriptive statistics. Differences in proportions were determined using *Rao-Scott* χ^2 tests, unless specified otherwise. The primary outcome was the prevalence of *C. trachomatis* and/or *T. vaginalis* infection; however, the prevalence of each infection was also individually examined. The crude association between past-year marijuana use and each STI-related outcome was estimated using univariable Poisson regression; prevalence ratios (PRs) with 95% confidence intervals (CI) are reported as the measure of association.

Due to a limited number of STI cases, propensity score covariate adjustment was used rather than conventional regression methods to account for measured confounding.^{34s} A propensity score is an individual’s predicted probability of exposure (i.e., marijuana use in the past year) conditional on values for observed confounding variables. Sex-specific propensity scores for past-year marijuana use were calculated from sex-stratified logistic regression models that included measured characteristics determined *a priori* to be potential confounders based on existing literature: age group; race/ethnicity; country of birth; educational attainment; annual family income; marital status; sexual identity/orientation; weekly alcohol consumption; past-year cocaine, methamphetamine, heroin, and/or injection drug use; PHQ-9 depression severity; and age at sexual debut. For each sex, we estimated adjusted prevalence ratios (aPR) from a multivariable modified Poisson regression model that included the sex-specific propensity score as a covariate. The propensity score was flexibly modeled using restricted cubic splines with three knots (10th, 50th, and 90th percentiles). Since sexual behaviors can be considered potential confounders and/or mediators of the potential association between marijuana use and STI prevalence, sexual behaviors were excluded from the propensity score. However, a secondary analysis was conducted in which we included adjustment for the propensity score as well as a separate covariate for new *or* multiple past-year sexual partners in the same model.

The association between *past-month* marijuana use and the prevalence of *C. trachomatis* and/or *T. vaginalis* infection was also similarly examined. Separate sensitivity analyses were done restricted to: (1) sexually-active females, (2) sexually-active males, and (3) sexually-experienced males who reported only ever having had sex with women. A separate sensitivity analysis was also conducted using inverse probability of exposure weighting (Supplemental Digital Content).^{35s}

RESULTS

Characteristics of the study population

Overall, 27.3% (SE=2.1) of females and 36.3% (SE=2.3) of males in the study population reported using marijuana at least once in the past year. Of the past-year marijuana users, 8.8% (SE=1.8) of females and 3.2% (SE=1.2) of males were considered recent initiates of marijuana use (i.e., the vast majority of past-year marijuana users in this study were not first-time users). The overall prevalence of past-month marijuana use was 17.1% (SE=1.5) among females and 25.2% (SE=1.7) among males. Among past-month marijuana users, the median number of days individuals reported using marijuana during the past month was 6 days (interquartile range [IQR]=1–25) and 10 days (IQR=3–28) among females and males, respectively.

The distribution of all sociodemographic characteristics examined varied by past-year marijuana use among females (Table.1). Similar findings were observed among males, except level of educational attainment did not differ by past-year marijuana use. Among both sex groups, past-year marijuana use was associated with greater weekly consumption of alcohol, past-year illicit substance use, increased severity of depression, and younger age at sexual debut. Unweighted characteristics of the study sample are shown stratified by sex and past-year marijuana use in Supplemental Table 2.

Marijuana use and sexual behaviors

The majority of males and females in the study population were sexually active in the past year (93.6% [SE=0.7] of males and 95.4% [SE=0.6] of females). Males and females with a past-year history of marijuana use were more likely to have multiple (>1) sexual partners in the past year than those who did not have a past-year marijuana use history (Figure.1A). In the unmarried, sexually-active population, a past-year history of marijuana use was positively associated with having a new sexual partner among males and females (Figure.1B). Among unmarried, sexually-active females who reported vaginal/anal sex in the past year, a past-year history of marijuana use was positively associated with no or inconsistent condom use in the past year (Figure.1C). A past-year history of marijuana use was not associated with no or inconsistent condom use in the past year among unmarried, sexually-active males (Figure.1C).

Marijuana use and sexually transmitted infections

The prevalence of *C. trachomatis* and/or *T. vaginalis* infection was significantly higher in females who used marijuana in the past year compared to females who did not use marijuana in the past year (7.4% vs. 2.9%; PR=2.57 [95%CI=1.62–4.07];Table.2). The prevalence of

C. trachomatis and/or *T. vaginalis* infection was also significantly higher in males who used marijuana in the past year compared to males who did not use marijuana in the past year (4.0% vs. 1.1%; PR=3.59 [95%CI=1.96–6.58]; Table.2). Table 2 shows the sex-specific prevalence of each STI by past-year marijuana use; the prevalence of *T. vaginalis* infection could not be examined in males due to a limited number of cases.

To account for confounding by sociodemographic characteristics and other factors associated with marijuana use and STIs (e.g., alcohol use, injection use, depression, and age at sexual debut), a propensity score covariate adjustment was performed via multivariable regression. In this analysis, the association between past-year marijuana use and prevalent *C. trachomatis* and/or *T. vaginalis* infection was attenuated in females (aPR=1.15 [95%CI=0.72–1.83]) and males (aPR=2.10 [95%CI=0.88–5.02]) (Table.2). Adjustment for having new or multiple sexual partners in the past year in addition to the propensity score further attenuated the association among females (aPR=1.02 [95%CI=0.65–1.51]) and males (aPR=1.91 [95%CI=0.82–4.47]) (Table.2). Similar estimates were obtained when restricting the analysis to sexually-active males or females (Supplemental Table 3), as well as among sexually-experienced males who only have sex with women—a group that comprised 93.3% [SE=0.7] of all males in the study (Supplemental Table 4). Using inverse probability weights resulted in a well-balanced distribution of potential confounders by past-year marijuana use (Supplemental Table 5); in this analysis, there was also no significant association observed between past-year marijuana use and prevalent *C. trachomatis* and/or *T. vaginalis* infection (Supplemental Table 6).

The sex-specific prevalence of *C. trachomatis* and/or *T. vaginalis* infection was significantly higher in past-month marijuana users compared to people who did not use marijuana in the past month (Figure.2). Of note, 9.3% of females who used marijuana in the past month had a prevalent *C. trachomatis* and/or *T. vaginalis* infection. However, after accounting for potential confounding, there was not significant association between past-month marijuana use and prevalent *C. trachomatis* and/or *T. vaginalis* infection in males or females.

DISCUSSION

In this population-based study, adults who used marijuana during the past year had a higher prevalence of *C. trachomatis* and *T. vaginalis* infections compared to those who did not use marijuana in the past year. Similar results were observed when examining past-month marijuana use. Notably, 9.3% of females who used marijuana in the past month had a prevalent *C. trachomatis* and/or *T. vaginalis* infection. These nationally-representative findings extend upon prior risk factor analyses that found associations between marijuana use and STIs in select U.S. populations.^{24–28} However, after accounting for measured confounders, the observed associations between recent marijuana use and prevalent STIs in this study were no longer significant.

The incidence of some STIs is on the rise in the U.S.,^{36s} which is consistent with the high prevalence of *C. trachomatis* and *T. vaginalis* infections noted among 20–39 year-olds in this study. Developing more effective STI prevention and screening programs requires a refined characterization of the contemporary determinants of STIs. It is well-accepted that social

and structural determinants such as structural racism have unacceptably remained persistent causes of STI transmission.^{37s} However, new behavioral determinants are emerging (e.g., use of mobile dating apps), and the prevalence of traditional behavioral STI determinants has been changing over time and between birth cohorts.^{38s–42s} Data from this report suggest recent marijuana use is likely not a causal determinant of STI risk among adults despite historical associations.^{24–28} Substance using populations have often broadly been considered a “high-risk” group for STIs, but the level of risk likely differs by the type of substance that is used and should be more finely characterized.

Marijuana’s changing legal status may have important implications for the language used in national STI prevention, screening, and treatment guidelines. For example, the CDC currently recommends “illicit” drug use as an indicator for *T. vaginalis* screening in women.^{43s} The American Congress of Obstetricians and Gynecologists also recommends screening for gonorrhea in asymptomatic women who are at high risk for infection owing to “illicit” drug use.^{44s} These national guidelines should consider specifying whether they wish to include marijuana use or not as its own indicator for STI interventions to avoid ambiguity for providers in states where marijuana use is already legalized. This is important because in a few settings, providers are already routinely asking patients about marijuana use.^{45s} As marijuana use further normalizes, a greater number of patients may ask questions about marijuana use or openly disclose marijuana use to their providers without being prompted about it.^{46s} Disclosure of marijuana use may be an opportunity to probe further about co-occurring high-risk behaviors.

NHANES is the premier source for sentinel STI surveillance in the U.S. However, these data have limitations that warrant consideration. Since the data are cross-sectional, we cannot infer causality from this study. A longitudinal study design is needed to determine whether marijuana use is a predictor of STI acquisition. The outcomes in this study were also relatively rare, which led to large confidence intervals and precluded stratified analyses of interest. The use of urine to detect *T. vaginalis* infection may have underestimated its true prevalence in males.^{33s,47s} Additionally, there were no laboratory data available on syphilis and gonorrhea, and there were insufficient cases of HIV infection to examine its association with marijuana use.

This study is subject to additional limitations. There may have been errors in the measurement of marijuana use due to potential recall and social desirability bias, as well as non-response bias. Due to limited sample sizes and outcomes, we were unable to examine STI prevalence by frequency of marijuana use, which may reveal a different relationship with STI prevalence. There were also no data available on the mode or duration of marijuana use, or to differentiate between people who use marijuana for recreational and/or medicinal purposes. However, data from National Survey on Drug Use and Health suggest the vast majority of persons who reported marijuana use in this study population of young and middle-age adults likely engaged in recreational marijuana use.^{48s} State-specific marijuana laws may also modify STI outcomes associated with marijuana use, and this should be evaluated in future studies. In high-income countries where recreational drug use is decriminalized and legalized (i.e., Netherlands), recreational drug use before sex is not even crudely associated with STI prevalence.^{49s}

Finally, a modest response rate could have resulted in potential selection bias. This limitation coupled with the exclusion of some high-risk populations (e.g., homeless and incarcerated persons) from the sampling frame may potentially limit the generalizability of the study findings. It is likely that the study findings cannot be generalized to younger populations (i.e., adolescents). For instance, it was recently demonstrated in a randomized controlled trial of high-risk youth that a sexual risk-reduction counseling intervention with additional content on alcohol and marijuana use was associated with a significant reduction in STI incidence as compared to a counseling intervention with only alcohol use content.^{50s}

The observed associations between past-year marijuana use and *C. trachomatis* and/or *T. vaginalis* infection in this national probability sample were confounded by individual-level factors. However, the high prevalence of these curable STIs observed in this national sample of marijuana users, many of whom co-used other drugs like methamphetamine and cocaine, highlights the need to better understand and address the sexual health of substance using populations. In particular, additional work is needed to further characterize the sexual health of marijuana users using alternative measures of marijuana use as well as by the mode, reason, duration, and frequency of marijuana use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGMENTS

The authors are grateful to the NHANES study staff and participants, without whom this analysis would not have been possible.

Financial support: This work was supported in part by the Division of Intramural Research, National Institute of Allergy and Infectious Diseases and extramural support from the National Institutes of Health [R01AI120938 and R01AI128779 to A.A.R.T; U54EB007958 and U01068613 to C.A.G.; and T32AI102623 to E.U.P.].

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Figure 1.

Data are weighted percentages. Error bars reflect design-adjusted, logit-transformed 95% confidence intervals. An asterisk (*) denotes a statistically significant difference in the outcome prevalence by past-year history of marijuana using Rao-Scott χ^2 tests (two-sided P value < 0.05).

Figure 2:

Data are weighted percentages. Error bars reflect design-adjusted, logit-transformed 95% confidence intervals. Abbreviation(s): aPR, adjusted prevalence ratio; PR, prevalence ratio.

Table 1.

Sex-specific characteristics of sexually experienced persons aged 20–39 years by history of marijuana use in the past year, National Health and Nutrition Examination Survey, 2013–2016.^a

Characteristics	Weighted % (Standard Error)			
	Females		Males	
	Past-Year Marijuana Use		Past-Year Marijuana Use	
	No	Yes	No	Yes
Age, years				
20–24	20.2 (1.4)	39.0 (3.3)	18.2 (1.8)	35.6 (2.8)
25–29	25.9 (1.8)	26.5 (2.5)	25.2 (1.6)	26.7 (2.5)
30–34	25.2 (1.3)	19.8 (2.4)	29.7 (1.6)	20.7 (2.2)
35–39	28.7 (1.6)	14.7 (2.2)	27.0 (1.9)	17.1 (2.3)
Race/Ethnicity				
Non-Hispanic White	57.0 (3.2)	61.8 (3.5)	58.5 (3.3)	59.0 (3.5)
Non-Hispanic Black	11.4 (1.6)	16.6 (3.1)	8.5 (1.3)	16.9 (2.2)
Hispanic	21.9 (2.6)	11.0 (1.7)	22.7 (2.6)	16.7 (2.7)
Non-Hispanic Asian	6.3 (0.9)	3.5 (0.6)	6.7 (1.2)	2.2 (0.5)
Other/multiracial ^b	3.4 (0.4)	7.1 (1.3)	3.5 (0.6)	5.2 (0.9)
Country of Birth				
Not US-born	21.8 (1.8)	6.4 (0.9)	23.6 (2.5)	9.2 (1.3)
US-born	78.2 (1.8)	93.6 (0.9)	76.4 (2.5)	90.8 (1.3)
Educational Attainment				
Less than high school	10.5 (1.3)	11.4 (2.1)	14.0 (1.5)	15.3 (2.3)
High school graduate/GED	16.7 (1.5)	19.7 (2.7)	22.6 (2.0)	26.0 (2.5)
Some College	37.8 (1.7)	46.1 (3.5)	32.0 (2.3)	34.0 (2.5)
College Graduate	35.0 (2.2)	22.8 (3.2)	31.4 (3.2)	24.8 (3.2)
Annual Family Income				
<\$20,000	16.0 (1.2)	28.9 (2.3)	14.2 (1.4)	18.7 (1.7)
\$20,000	84.0 (1.2)	71.1 (2.3)	85.8 (1.4)	81.3 (1.7)
Marital Status				
Married	51.0 (2.5)	21.6 (2.5)	51.3 (2.2)	22.5 (2.0)
Unmarried				
Divorced	6.2 (0.7)	4.2 (1.2)	3.0 (0.6)	4.3 (1.1)
Separated/Widowed	2.8 (0.5)	2.2 (0.9)	1.4 (0.5)	2.8 (0.7)
Never Married	25.9 (1.9)	51.9 (3.0)	29.7 (1.9)	50.0 (2.7)
Living With Partner	14.2 (1.4)	20.2 (2.1)	14.6 (1.4)	20.5 (2.0)
Sexual Orientation/Identity				
Heterosexual	91.1 (0.8)	76.7 (2.2)	94.5 (1.0)	90.9 (1.9)
Gay/Lesbian/Bisexual/Other	8.9 (0.8)	23.3 (2.2)	5.5 (1.0)	9.1 (1.9)
Alcohol Consumption, drinks/week				
<1	68.2 (2.3)	33.6 (3.4)	47.0 (2.7)	26.1 (2.2)
1–9	29.1 (2.1)	52.4 (3.8)	40.7 (2.3)	48.8 (3.3)

Characteristics	Weighted % (Standard Error)			
	Females		Males	
	Past-Year Marijuana Use		Past-Year Marijuana Use	
	No	Yes	No	Yes
10	2.7 (0.7)	14.0 (3.0)	12.3 (1.2)	25.1 (2.5)
History of Cocaine, Methamphetamine, Heroin, or Injection Drug Use				
No	92.7 (1.1)	72.2 (3.3)	85.2 (1.5)	60.0 (2.8)
Yes, >12 months ago	6.6 (1.0)	15.3 (2.7)	12.6 (1.5)	18.8 (2.4)
Yes, 12 months	0.8 (0.3)	12.5 (2.1)	2.2 (0.6)	21.2 (2.6)
PHQ-9 Depression Severity				
No Depression	26.9 (1.5)	14.8 (2.3)	37.8 (2.3)	28.9 (2.6)
Minimal Depression	49.9 (1.9)	45.4 (3.1)	47.2 (2.1)	47.1 (2.7)
Mild Depression	14.8 (1.3)	24.1 (2.0)	11.2 (1.2)	15.4 (1.8)
Moderate-Severe Depression	8.3 (0.9)	15.8 (2.0)	3.8 (0.5)	8.7 (1.3)
Age at Sexual Debut, years				
15	23.5 (1.6)	40.3 (2.9)	22.8 (1.0)	46.0 (3.3)
16–18	45.6 (1.5)	48.1 (3.5)	44.3 (2.2)	43.7 (2.9)
19	31.0 (2.0)	11.6 (1.7)	32.9 (2.4)	10.2 (2.6)

^aData are survey-weighted column percentages with corresponding design-adjusted standard errors (SE).

^bThe “other” category includes persons of non-Hispanic other race including non-Hispanic multi-racial persons.

Table 2.

Sex-specific association of marijuana use in the past year with prevalence of curable sexually transmitted infections among sexually experienced persons aged 20–39 years, National Health and Nutrition Examination Survey, 2013–2016.^a

Study Outcome	Females		Males	
	Past-Year Marijuana Use		Past-Year Marijuana Use	
	No	Yes	No	Yes
<i>C. trachomatis</i> and/or <i>T. vaginalis</i> infection				
No. Positive/No. Tested ^b	60/1115	66/391	14/916	26/536
Prevalence, % (SE)	2.9 (0.6)	7.4 (1.4)	1.1 (0.3)	4.0 (0.6)
PR (95% CI)	Ref.	2.57 (1.62, 4.07)	Ref.	3.59 (1.96, 6.58)
Model 1 aPR (95% CI) ^c	Ref.	1.15 (0.72, 1.83)	Ref.	2.10 (0.88, 5.02)
Model 2 aPR (95% CI) ^d	Ref.	1.02 (0.65, 1.51)	Ref.	1.91 (0.82, 4.47)
<i>T. vaginalis</i> infection				
No. Positive/No. Tested ^b	31/1115	35/391	3/916	7/536
Prevalence, % (SE)	1.6 (0.4)	5.2 (1.3)	-	-
PR (95% CI)	Ref.	3.32 (1.81, 6.10)	-	-
Model 1 aPR (95% CI) ^c	Ref.	1.49 (0.73, 3.01)	-	-
Model 2 aPR (95% CI) ^d	Ref.	1.33 (0.65, 2.70)	-	-
<i>C. trachomatis</i> infection				
No. Positive/No. Tested ^b	30/1115	33/391	11/916	20/536
Prevalence, % (SE)	1.4 (0.3)	2.3 (0.7)	0.9 (0.3) ^e	3.4 (0.6)
Crude PR (95% CI)	Ref.	1.70 (0.93, 3.14)	Ref.	3.63 (1.80, 7.34)
Model 1 aPR (95% CI) ^c	Ref.	0.79 (0.47, 1.33)	Ref.	2.09 (0.71, 6.20)
Model 2 aPR (95% CI) ^d	Ref.	0.70 (0.42, 1.16)	Ref.	1.89 (0.65, 5.49)

^aData are weighted estimates, unless otherwise specified.

^bData are unweighted counts.

^cModel 1 included propensity score covariate adjustment. The propensity score accounted for age group; race/ethnicity; country of birth; educational attainment; annual family income; marital status; sexual orientation/identity; weekly alcohol consumption; history of cocaine, heroin, methamphetamine, or injection drug use; PHQ-9 depression severity; and age at sexual debut.

^dModel 2 included propensity score covariate adjustment and adjustment for new or multiple past-year sexual partners in the past year.

^eRSE >30%

Abbreviations: No., number; PR, prevalence ratio; aPR, adjusted prevalence ratio; PS, propensity score.