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Characterization of substance use among underrepresented sexual and gender minority participants in The Population Research in Identity and Disparities for Equality (PRIDE) Study

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ABSTRACT

Background: Profiles of substance use among less commonly described subgroups of sexual and gender minority (SGM) people (e.g., queer, genderqueer) remain largely unknown. **Objective(s):** To identify substance use differences among less commonly described SGM identity-based subgroups. **Methods:** The PRIDE Study is a national, online, longitudinal cohort study of self-identified SGM adults living in the U.S. Between 2015–2017, an iPhone application was used to administer three cross-sectional health questionnaires to participants, one of which included questions about binge alcohol, marijuana, and other drug use (substance use). This study was a secondary data analysis of participant responses to substance use survey items. Logistic regression and generalized linear modeling assessed relationships between sexual orientation or gender and use of or reported problems with substances within the past year. **Results:** Among the 1790 participants included in this study, 51.0% reported binge alcohol use, 39.8% reported marijuana use, and 19.7% reported other drug use (65.9% endorsed use of one or more of these) within the past year. Over 30% indicated substance use had been a problem in their life. Asexual individuals had lower odds of reporting past year binge alcohol and marijuana use (*aOR*: 0.27, 95% CI: 0.12–0.61; *aOR*: 0.38, 95% CI: 0.15–0.96, respectively), and queer participants had higher odds of reporting past year marijuana use (*aOR*: 2.52, 95% CI: 1.58–4.03) compared to lesbian participants. Gender nonbinary participants had lower odds of reporting past year binge alcohol use (*aOR*: 0.48, 95% CI: 0.32–0.71) and transmasculine participants had higher odds of reporting past year marijuana use (*aOR*: 2.18, 95% CI: 1.10–4.31) compared to cisgender women. **Conclusions:** Substance use heterogeneity exists between SGM groups. Comprehensive assessment of sexual orientation and gender may improve understanding of substance use and increase equity within support and treatment services for SGM populations.

HIGHLIGHTS

- We examined substance use among less represented sexual and gender minority groups.
- Alcohol and other drug use were examined by both sexual orientation and gender identity.
- Analyses included identities such as queer, pansexual, genderqueer and nonbinary.
- Alcohol use differed across asexual, genderqueer and gender nonbinary groups.
- Marijuana use differed across queer, asexual and transmasculine groups.

KEYWORDS



LGBT; sexual orientation; gender identity; alcohol use; marijuana use; drug use

Introduction

Almost 20 million people in the United States report substance use in greater quantities for more extended periods than intended and experience problems related to substance use.¹ Both sexual minority (i.e., those with non-heterosexual sexual orientations) and gender minority (i.e., those whose

genders do not match their assigned sex at birth) individuals experience problems related to substance use at disproportionately higher rates than the general population.^{2–10}

Sexual minority men and women are more likely than heterosexual people to report currently drinking alcohol, using illicit drugs in the past year, having a substance use disorder, and experiencing negative thoughts or feelings

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about personal substance use.^{10,11} Transgender individuals are also more likely to use alcohol, marijuana, or other non-prescription or illicit drugs compared to non-transgender individuals.^{5,12} According to the minority stress model,¹³ elevated substance use among sexual minority people results from increased exposure to enacted stigma or prejudice (including trauma), expectations of prejudice, identity concealment, and internalized stigma. Numerous studies have identified links between minority stress and increased likelihood of substance use.^{13–19} Initially limited to sexual minority groups, this framework was expanded to gender minority populations²⁰ and suggests similar adverse health outcomes among gender minority individuals (e.g., transgender, gender nonbinary persons) may result from increased exposure to stigma and discrimination related to one's gender identity (i.e., someone's internal sense of their gender) and/or gender expression (i.e., how someone chooses to reflect their gender) compared to non-gender minority (i.e., cisgender¹) populations.^{20,21}

Research examining substance use across a diverse spectrum of sexual orientations and gender identities, however, remains limited.^{22–24} Substance use studies that include sexual orientation and gender identity are typically limited to lesbian, gay, and bisexual (LGB) individuals^{3,4,9,17,22,25–27} and use binary identity classifications (e.g., heterosexual vs. homosexual; cisgender vs. transgender).^{28–32} Other studies combine sexual orientation and gender identity into a single classification of sexual and gender minority (SGM) status (e.g., LGBT vs. Non-LGBT; grouping transgender participants with gay and bisexual cisgender men as men who have sex with men).^{31,33–36}

Sexual and gender minority individuals may define both their sexual orientation and gender identity in a variety of ways, not necessarily limited to LGB or man, woman, or transgender. Currently, the substance use of people from less commonly described SGM identity groups, such as pansexual, queer, and genderqueer individuals, is not well described. Without acknowledging the broader spectrum of identities that exist within this population, our understanding of the sociocultural and environmental circumstances that uniquely impact these identity groups will remain limited. Continued characterization of and assessment for harmful substance use among a limited subset of the overall SGM population also has implications in our ability to effectively tailor substance use treatment programs for those in this population most at risk for elevated substance use. Here we evaluated differences in alcohol, marijuana, and other drug use (i.e., illicit or used-not-as-prescribed) within a national cohort of self-identified SGM individuals. We examined substance use within and across SGM identity groups, including less commonly described SGM identities and explored potential relationships between sexual

orientation or gender identity and risk for elevated alcohol, marijuana, and other drug use.

Methods

Data collection and study procedures

The Population Research in Identity and Disparities for Equality (PRIDE) Study is a U.S.-based, longitudinal study of SGM adult health. From 2015–2017, The PRIDE Study used an iPhone mobile application to engage participants and collect demographic and health information about SGM-identified research participants. Participants were recruited via convenience sampling approach through a variety of online, multi- and social media materials. Interested participants needed to download the iPhone application (app) from the Apple App Store. When launched, the app presented potential participants with study information, an eligibility screening questionnaire, and study consent forms. To be eligible, participants needed to (i) be at least 18 years old at time of participation, (ii) live in the U.S., (iii) identify as a sexual and/or gender minority, and (iv) be comfortable reading and writing in English. After eligibility screening and informed consent, individuals could engage with The PRIDE Study mobile app through a variety of optional activities, including providing basic demographic data, answering one of four optional questionnaires that surveyed (i) physical health, (ii) mental and behavioral health, (iii) social and emotional health, and (iv) how to improve The PRIDE Study, or interacting with an anonymous forum to discuss research topics of interest among SGM communities. More information about app and survey construction, participant recruitment, and sampling methods are described elsewhere.³⁷ We performed a secondary data analysis of participant responses to alcohol, marijuana, and other drug use survey items contained in the mental health survey from The PRIDE Study application, including prior problems with and past-year use of specific substances. Participants who did not report their sexual orientation, gender identity, and sex assigned at birth were excluded from our analyses of these substance use survey data. The University of California, San Francisco Institutional Review Board approved this study.

Measures

Demographics

Demographic characteristics included participant age, race, ethnicity, highest level of education, and individual annual gross income. Participant 5-digit US ZIP code was used to generate US Census Bureau geographical region.

Gender identity

Current gender identity and sex assigned at birth were assessed by asking participants, “How would you describe your current gender identity?” and “What sex were you assigned (on your birth certificate)?” Gender identity response options included “Genderqueer,” “Man,

¹“Cisgender” is used within the context of this article to describe individuals whose experience with gender identity and/or expression are congruent with that individual's sex assigned at birth. Because cisgender individuals may be referenced as members of a majority population, non-cisgender individuals (e.g., transgender, gender nonbinary individuals) may conversely be referred to as ‘gender minority.’

“Transgender Man (Female-to-Male),” “Woman,” “Transgender Woman (Male-to-Female),” and “Another Gender Identity.” Participants could select multiple responses and, if “Another Gender Identity” was selected, provide a written description of their gender. Options for sex assigned at birth included “Female” and “Male.”

Six gender categories were created for analyses: cisgender women (*i.e.*, participants assigned female sex at birth and identified as a woman), cisgender men (*i.e.*, participants assigned male sex at birth and identified as a man), trans-masculine individuals (*i.e.*, participants assigned female sex at birth and identified as a man, transgender man or both), transfeminine individuals (*i.e.*, participants assigned male sex at birth and identified as a woman, transgender woman or both), genderqueer individuals (*i.e.*, participants who exclusively identified as genderqueer regardless of sex assigned at birth), and individuals with another gender identity (*i.e.*, participants who identified with multiple genders or provided a written description of their gender that did not match the sex they were assigned at birth). In some analyses, gender experience was accounted for and was defined as masculine (*i.e.*, participants who were categorized as a gender that reflected a masculine binary, including cisgender men and transmasculine individuals), feminine (*i.e.*, participants who were categorized as a gender that reflected a feminine binary, including cisgender women and transfeminine individuals), or gender expansive (*i.e.*, participants who were categorized as having a nonbinary gender, including genderqueer and individuals with another gender identity).

Sexual orientation

Participants were asked, “How would you describe your current sexual orientation?” Participants could select multiple responses, including “Asexual,” “Bisexual,” “Gay,” “Lesbian,” “Queer,” “Questioning,” “Straight/Heterosexual,” and “Another Sexual Orientation.” If “Another Sexual Orientation” was selected, participants could provide a short, written description of their sexual orientation.

Substance use

Substances assessed included binge alcohol use (*i.e.*, five or more drinks on one occasion,³⁸ chosen as a stand-alone item as binge drinking guidelines have not yet been established for gender minority people), marijuana use, and non-prescription or recreational use of cocaine/crack cocaine; amphetamines/methamphetamine; opioids or prescription opioids such as heroin, OxyContin or Vicodin; sedatives or prescription sedatives such as Xanax, Valium or Ativan; hallucinogens such as lysergic acid diethylamide (LSD/acid) or psychedelic mushrooms; and other drugs with examples given of MDMA/Ecstasy, GHB or ketamine. For each substance, participants were asked to report the last time they used that substance: “Within the last 30 days,” “More than 30 days ago but within the last 12 months,” “More than 12 months ago,” and “Never used.” Participants who indicated the use of a particular substance within the last

30 days were prompted to provide the number of days used in the past 30 days.

Prior substance use problems were examined by asking participants, “Have you ever thought that you had a problem with (either alcohol or other drug use, non-nicotine or non-alcohol-related)?” Responses included “Yes, but not now,” “Yes, and I think I still have this problem,” and “I have never had this problem.”

Data analysis

We performed logistic regression analyses to examine relationships between sexual orientation or gender category and past year binge alcohol, marijuana, or other drug use as well as prior reported problems with alcohol or other drugs (illicit or used-not-as-prescribed). Generalized linear regression models examined count data for the number of days of binge alcohol or marijuana use within the last 30 days. Negative binomial models were fitted over Poisson or quasi-Poisson approaches to account for overdispersion in each of the count variables. Likelihood ratio tests ($\alpha = 0.00$) confirmed model fit.

Gender (*i.e.*, comparing groups by created gender categories) and sexual orientation (*i.e.*, comparing groups by sexual orientation) were modeled separately with each substance use outcome. Because The PRIDE Study is an entirely SGM self-identified cohort and models testing for differences by sexual orientation or gender category were performed separately, models of gender category were adjusted for sexual minority status. Given potential differential effects of gender socialization on patterns of substance use, models testing differences in substance use by sexual orientation were adjusted for gender experience (*i.e.*, masculine, feminine, or gender expansive). In addition to models testing main effects of sexual orientation, we ran models of sexual orientation using an interaction term between sexual orientation and the gender experience variable in order to identify differences related to gender experience within sexual orientation groups. All models were adjusted for age, race, ethnicity, and sex assigned at birth.

We report adjusted odds ratio (*aOR*) and adjusted rate ratio (*aRR*) estimates for logistic and negative binomial regressions, respectively. Statistical significance was determined using a standard alpha level ($\alpha < 0.05$). Given that substance use has been better characterized among cisgender lesbian women than among other less frequently represented SGM groups described here, models of sexual orientation use lesbian individuals as the reference group; models of gender use cisgender women as the reference group.^{11,39} Overall group differences across sexual orientation or gender categories were examined using post-estimation Wald tests of adjusted main effects regression models. All covariates used in regression models had less than 5.0% missing data; results presented here are complete-case estimates of differential patterns of reported substance use. All analyses were conducted using Stata SE version 14 software.⁴⁰

Results

Sample characteristics

Of the 16,394 consented participants, nearly all ($N=16385$, 99.95%) completed demographic survey items. Analyses presented here focus on participant responses to substance use survey items that were contained in a separate, optional questionnaire that focused on a variety of other mental and behavioral health topics. The initial module sample consisted of 1833 participants, of which, 42 individuals were excluded for not meeting inclusion criteria for these analyses. One additional participant was excluded since they were categorized as a cisgender woman and identified as “Straight/Heterosexual.” Sociodemographic characteristics of the final sample ($N=1790$) are presented in Table 1.

Approximately 19% ($N=342$) of participants were gender minority, and 99% ($N=1766$) were sexual minority (Table 1). About 6.4% ($N=114$) of participants provided a written description of their sexual orientation: 66 individuals wrote “pansexual,” 3 individuals wrote “asexual,” and 1 individual wrote “bisexual.” All other responses were either a narrative description of the individual’s sexual orientation or a combination of multiple terms (e.g., “Grey-Asexual or Demisexual”). As a result, we created eight sexual orientation categories for analyses: asexual ($N=40$), bisexual ($N=213$), gay ($N=744$), lesbian ($N=233$), queer ($N=144$), heterosexual ($N=24$), pansexual ($N=66$), and another sexual orientation ($N=326$). Participants grouped as “another sexual orientation” included those who reported multiple sexual orientations ($N=311$). Due to small sample size, participants who responded “Questioning” ($N=6$) as their current sexual orientation were also grouped as “another sexual orientation.” Given that all participants who identified as heterosexual in this sample ($N=24$) were categorized as gender minority, heterosexual sexual identity was excluded from all models of sexual orientation.

Any self-reported substance use

Almost two-thirds of participants ($N=1152$; 65.9%) reported binge alcohol, marijuana, or other drug use within the last year (Table 1). Rates of specific other drug are reported in Appendix. Among gender minority participants, 71.4% ($N=35$) of transmasculine, 51.2% ($N=22$) of transfeminine, 57.1% ($N=44$) of genderqueer, and 54.3% ($N=44$) of individuals with another gender endorsed binge alcohol, marijuana, or other drug use within the last year. Among less commonly reported sexual minority groups, 66.7% ($N=96$) of queer, 53.0% ($N=35$) of pansexual, and 64.7% ($N=211$) of other-identified sexual minority individuals endorsed past year binge alcohol, marijuana, or other drug use.

Prior substance use problems

Most participants reported never having a problem with alcohol ($N=1345$, 76.1%) or other substances ($N=1477$,

Table 1. Sample Characteristics and Self-reported Substance Use of Sexual and Gender Minority Adults Participating in The PRIDE Study via iPhone Application ($N=1790$).

| Variable | Total sample ($N=1790$) N (%) [*] or Median (SD) |
|--|--|
| Demographics | |
| Age, in years | 28.17 (11.79) |
| Gender category | |
| Cisgender man | 848 (47.37) |
| Cisgender woman | 600 (33.52) |
| Gender nonbinary | 173 (9.66) |
| Genderqueer | 77 (4.30) |
| Transfeminine | 43 (2.40) |
| Transmasculine | 49 (2.74) |
| Highest level of education completed | |
| Less than high school | 28 (1.57) |
| High school diploma or equiv. | 135 (7.56) |
| Some college | 469 (26.27) |
| Bachelors degree or equiv. | 666 (37.31) |
| Advanced higher education | 487 (27.28) |
| Hispanic, Latino or of Spanish origin | 187 (10.48) |
| Individual annual gross income | |
| \$0–20,000 | 534 (32.23) |
| \$20,001–40,000 | 333 (20.10) |
| \$40,001–60,000 | 277 (16.72) |
| \$60,001–80,000 | 160 (9.66) |
| \$80,001–100,000 | 100 (6.04) |
| \$100,001+ | 253 (15.27) |
| Race | |
| Non-White | 264 (14.88) |
| African American/Black | 35 (1.97) |
| American Indian/Alaska Native | 7 (0.39) |
| Another Race | 33 (1.86) |
| Asian/Pacific Islander | 55 (3.10) |
| Mixed race | 134 (7.55) |
| White/Caucasian | 1510 (85.12) |
| Sexual orientation | |
| Another sexual orientation | 326 (18.21) |
| Asexual | 40 (2.23) |
| Bisexual | 213 (11.90) |
| Gay | 744 (41.56) |
| Lesbian | 233 (13.02) |
| Pansexual | 66 (3.69) |
| Queer | 144 (8.04) |
| Straight/Heterosexual | 24 (1.34) |
| U.S. Census Bureau region | |
| Midwest | 299 (16.86) |
| Northeast | 353 (19.91) |
| South | 505 (28.48) |
| West | 616 (34.74) |
| Substance Use | |
| Prior diagnosis of alcohol use disorder | 89 (5.03) |
| Prior diagnosis of a substance use disorder [†] | 80 (4.52) |
| Perceptions of alcohol use problems | |
| Never had alcohol use problems | 1345 (76.07) |
| Yes, but not now | 293 (16.57) |
| Yes, still have alcohol use problems | 130 (7.35) |
| Perceptions of other drug use problems | |
| I have never had this problem | 1477 (83.64) |
| Yes, but not now | 202 (11.44) |
| Yes, I still have this problem | 87 (4.93) |
| Binge alcohol use, past year | 892 (51.03) |
| Marijuana use, past year | 696 (39.82) |
| Other drug use, past year [‡] | 344 (19.68) |

Binge alcohol use was defined as five or more drinks on one occasion. Other drug use included: cocaine/crack cocaine, amphetamines/methamphetamine, opiates or prescription opiates, sedatives or prescription sedatives, hallucinogens or psychedelic mushrooms, and other recreational drugs such as MDMA/Ecstasy, GHB or ketamine.

^{*} N -values may not equal total N ($N=1790$) due to missing data; proportions calculated based on available participant data. (All variables consisted of less than 5% missing data).

[†]Non-alcohol or non-nicotine related.

[‡]Rates of individual other drug use within the past year reported in Appendix.

Table 2. Results of Logistic Regression for Prior Reported Alcohol or Other Drug Use Problems by Sexual Orientation or Gender Category Among Sexual and Gender Minority Adults in The PRIDE Study ($N = 1790$).

| | Alcohol | | | Other drugs | | |
|-----------------------------------|--------------|---------------------|----------------|--------------|---------------------|----------------|
| | <i>N</i> (%) | <i>aOR</i> (95% CI) | <i>p</i> Value | <i>N</i> (%) | <i>aOR</i> (95% CI) | <i>p</i> Value |
| Gender category ^{a,b} | | | 0.84 | | | 0.47 |
| Cisgender man | 209 (24.91) | 0.87 (0.42, 1.80) | 0.71 | 150 (17.88) | 0.87 (0.40, 1.89) | 0.72 |
| Cisgender woman | 137 (23.14) | ref | — | 79 (13.39) | ref | — |
| Gender nonbinary | 31 (18.24) | 0.80 (0.49, 1.29) | 0.36 | 27 (15.88) | 1.18 (0.69, 2.00) | 0.55 |
| Genderqueer | 18 (23.68) | 1.06 (0.59, 1.94) | 0.85 | 12 (15.79) | 1.13 (0.56, 2.29) | 0.74 |
| Transfeminine | 13 (30.95) | 0.99 (0.38, 2.57) | 0.99 | 9 (21.43) | 1.05 (0.37, 2.99) | 0.92 |
| Transmasculine | 15 (30.61) | 1.39 (0.68, 2.83) | 0.37 | 12 (24.49) | 2.11 (0.98, 4.53) | 0.06 |
| Sexual orientation ^{a,c} | | | 0.03 | | | 0.13 |
| Another sexual orientation | 85 (20.09) | 1.19 (0.78, 1.83) | 0.42 | 57 (17.76) | 1.31 (0.78, 2.21) | 0.31 |
| Asexual | 4 (10.26) | 0.48 (0.16, 1.43) | 0.19 | 2 (5.13) | 0.39 (0.09, 1.76) | 0.22 |
| Bisexual | 39 (18.48) | 0.70 (0.43, 1.14) | 0.15 | 36 (17.06) | 1.20 (0.68, 2.11) | 0.53 |
| Gay | 178 (24.15) | 0.68 (0.40, 1.17) | 0.17 | 125 (16.96) | 0.75 (0.40, 1.39) | 0.36 |
| Lesbian | 58 (25.44) | ref | — | 30 (13.22) | ref | — |
| Pansexual | 18 (27.69) | 1.58 (0.82, 3.04) | 0.17 | 12 (18.46) | 1.58 (0.73, 3.42) | 0.24 |
| Queer | 32 (22.54) | 1.10 (0.65, 1.86) | 0.73 | 21 (14.79) | 1.15 (0.61, 2.18) | 0.67 |

aOR: adjusted odds ratio; CI: confidence interval; SO: sexual orientation.

Bold *p* Values designate statistically significant results that were determined via regression modeling using an $\alpha < 0.05$.

^aAdjusted for age at time of survey completion (in years), sex assigned at birth (female/male), race (white/non-white), and ethnicity (Hispanic, Latinx or of Spanish origin/not).

^bAdjusted for sexual minority status (Y/N).

^cAdjusted for gender experience (masculine/feminine/gender expansive).

83.6%, Table 1); however, nearly one-third ($N = 103$, 30.1%) of gender minority individuals reported having prior alcohol or other substance use problems at some point in their life. Among asexual, queer, pansexual, or other-identified individuals, 32.1% ($N = 172$) reported prior alcohol or other substance use problems in their life.

In models testing differences by gender categories, there were no significant differences in the odds of reporting prior alcohol or other drug use problems by gender with cisgender women as the reference group (Table 2). After adjustment for sexual minority status, age, sex assigned at birth, race, and ethnicity, Wald testing indicated no overall group differences in prior substance use problems by gender (Table 2).

In models testing differences by sexual orientation, there were no significant differences in the odds of reporting either prior alcohol or other drug use problems between sexual identity groups when compared to lesbian participants as a reference. However, after adjustment for age, sex assigned at birth, race, ethnicity, and gender experience, a Wald test indicated that sexual orientation was a significant predictor of prior alcohol use problems ($\chi^2 = 13.84$, $p = 0.03$, Table 2). In models testing interactions between sexual orientation and gender experience, there were no statistically significant differences in prior alcohol use problems between groups when compared to feminine lesbian participants as reference. However, approaching statistical significance, masculine pansexual individuals had higher odds of reporting prior other drug use problems compared to feminine lesbian participants (aOR : 7.41, 95% CI: 1.00–55.56, $p = 0.05$).

Binge alcohol use

In models testing differences by gender categories, participants categorized as having another gender had lower odds of reporting binge alcohol use within the last year (aOR :

0.48, 95% CI: 0.32–0.71, $p < 0.01$, Table 3) when referenced to cisgender women. Individuals with another gender and genderqueer participants had fewer reported days of use within the previous 30 days (aRR : 0.28, 95% CI: 0.15–0.50, $p < 0.01$; aRR : 0.42, 95% CI: 0.20–0.90, $p = 0.03$, respectively, Table 4). After adjustment, Wald testing indicated there were significant group differences in past-year ($\chi^2 = 19.78$, $p < 0.01$) and previous 30-day ($\chi^2 = 30.46$, $p < 0.01$) binge alcohol use across gender categories (Table 4).

In models testing differences by sexual orientation, asexual individuals had lower odds of reporting binge alcohol use within the last year (aOR : 0.27, 95% CI: 0.12–0.61, $p < 0.01$) when referenced to lesbian participants (Table 3). After adjustment, Wald testing indicated that there were significant group differences in reported past-year binge alcohol use across sexual orientations ($\chi^2 = 15.12$, $p = 0.02$, Table 3); however, no differences were found for reported previous 30-day use. Tests of interactions between sexual orientation and gender experience indicated that gender expansive bisexual individuals (aOR : 0.34, 95% CI: 0.11–0.95, $p = 0.04$), feminine asexual individuals (aOR : 0.19, 95% CI: 0.06–0.61, $p < 0.01$), gender expansive pansexual individuals (aOR : 0.32, 95% CI: 0.13–0.77, $p = 0.01$), and gender expansive individuals with another sexual orientation (aOR : 0.50, 95% CI: 0.29–0.85, $p = 0.01$) all had lower odds of reporting binge alcohol use within the past year when referenced to feminine lesbian participants.

When compared to feminine lesbian participants, masculine queer individuals (aRR : 0.17, 95% CI: 0.04–0.79, $p = 0.02$), feminine asexual individuals (aRR : 0.17, 95% CI: 0.03–0.89, $p = 0.04$), gender expansive pansexual individuals (aRR : 0.20, 95% CI: 0.05–0.74, $p = 0.02$), and gender expansive individuals with another sexual orientation (aRR : 0.24, 95% CI: 0.11–0.54, $p < 0.01$) all reported less days of binge alcohol use within the previous 30 days. Approaching statistical significance, gender expansive queer individuals also reported less days of binge alcohol use compared to

Table 3. Logistic Regression for Past Year Binge Alcohol, Marijuana, and Other Drug Use by Sexual Orientation or Gender Category Among Sexual and Gender Minority Adults in The PRIDE Study ($N = 1790$).

| | Binge alcohol use | | | Marijuana use | | | Other drug use | | |
|-----------------------------------|-------------------|---------------------|------------------|---------------|---------------------|------------------|----------------|---------------------|----------------|
| | <i>N</i> (%) | <i>aOR</i> (95% CI) | <i>p</i> Value | <i>N</i> (%) | <i>aOR</i> (95% CI) | <i>p</i> Value | <i>N</i> (%) | <i>aOR</i> (95% CI) | <i>p</i> Value |
| Gender category ^{a,b} | | | <0.01 | | | 0.06 | | | 0.07 |
| Cisgender man | 479 (57.92) | 0.85 (0.45, 1.63) | 0.63 | 329 (39.78) | 0.56 (0.29, 1.06) | 0.08 | 200 (24.18) | 1.27 (0.52, 3.13) | 0.60 |
| Cisgender woman | 282 (47.96) | ref | – | 232 (39.46) | ref | – | 99 (16.84) | ref | – |
| Gender nonbinary | 62 (6.95) | 0.48 (0.32, 0.71) | <0.001 | 64 (38.10) | 0.74 (0.50, 1.10) | 0.13 | 18 (10.71) | 0.51 (0.28, 0.93) | 0.03 |
| Genderqueer | 34 (44.74) | 0.73 (0.43, 1.24) | 0.24 | 28 (36.84) | 0.71 (0.41, 1.21) | 0.21 | 11 (14.47) | 0.79 (0.38, 1.62) | 0.52 |
| Transfeminine | 14 (33.33) | 0.40 (0.16, 1.01) | 0.05 | 16 (38.10) | 0.71 (0.29, 1.74) | 0.46 | 6 (14.29) | 0.77 (0.23, 2.63) | 0.68 |
| Transmasculine | 21 (44.68) | 0.81 (0.41, 1.60) | 0.55 | 27 (57.45) | 2.18 (1.10, 4.31) | 0.03 | 10 (21.28) | 1.34 (0.60, 3.00) | 0.48 |
| Sexual orientation ^{a,c} | | | 0.02 | | | <0.001 | | | 0.47 |
| Another sexual orientation | 153 (48.11) | 0.86 (0.58, 1.25) | 0.42 | 137 (43.08) | 1.58 (1.07, 2.33) | 0.02 | 63 (19.81) | 1.38 (0.84, 2.28) | 0.20 |
| Asexual | 10 (25.64) | 0.27 (0.12, 0.61) | <0.01 | 8 (20.51) | 0.38 (0.15, 0.96) | 0.04 | 5 (12.82) | 0.74 (0.24, 2.28) | 0.60 |
| Bisexual | 97 (45.97) | 0.68 (0.45, 1.03) | 0.07 | 81 (38.39) | 1.21 (0.79, 1.83) | 0.38 | 32 (15.17) | 0.88 (0.50, 1.54) | 0.65 |
| Gay | 419 (57.79) | 1.03 (0.64, 1.66) | 0.91 | 289 (39.86) | 1.41 (0.87, 2.28) | 0.17 | 173 (23.86) | 1.22 (0.67, 2.23) | 0.51 |
| Lesbian | 109 (48.02) | ref | – | 72 (31.72) | ref | – | 32 (14.10) | ref | – |
| Pansexual | 27 (42.19) | 0.63 (0.35, 1.15) | 0.14 | 25 (39.06) | 1.29 (0.71, 2.36) | 0.41 | 9 (14.06) | 1.02 (0.45, 2.31) | 0.97 |
| Queer | 67 (47.97) | 0.90 (0.57, 1.43) | 0.67 | 75 (53.57) | 2.52 (1.58, 4.03) | <0.001 | 26 (18.57) | 1.43 (0.78, 2.60) | 0.24 |

aOR: adjusted odds ratio; CI: confidence interval; SO: sexual orientation.

Bold *p* Values designate statistically significant results that were determined via regression modeling using an $\alpha < 0.05$.

^aAdjusted for age at time of survey completion (in years), sex assigned at birth (female/male), race (white/non-white), and ethnicity (Hispanic, Latin or Spanish origin/not).

^bAdjusted for sexual minority status (Y/N).

^cAdjusted for gender experience (masculine/feminine/gender expansive).

Table 4. Results of Negative Binomial Regression for Previous 30-day Binge Alcohol and Marijuana Use by Sexual Orientation or Gender Category among Sexual and Gender Minority Adults in The PRIDE Study ($N = 1790$).

| | Binge alcohol days | | | Marijuana days | | |
|-----------------------------------|--------------------|---------------------|------------------|------------------|---------------------|----------------|
| | Mean (IQR), SD | <i>aRR</i> (95% CI) | <i>p</i> Value | Mean (IQR), SD | <i>aRR</i> (95% CI) | <i>p</i> Value |
| Gender category ^{a,b} | | | <0.001 | | | 0.92 |
| Cisgender man | 1.54 (0–2), 3.76 | 0.93 (0.39, 2.23) | 0.87 | 2.86 (0–0), 7.65 | 1.18 (0.34, 4.17) | 0.79 |
| Cisgender woman | 0.86 (0–0), 2.62 | ref | – | 2.15 (0–0), 6.60 | ref | – |
| Gender nonbinary | 0.33 (0–0), 0.97 | 0.28 (0.15, 0.50) | <0.001 | 2.77 (0–0), 7.75 | 1.28 (0.61, 2.72) | 0.52 |
| Genderqueer | 0.46 (0–0), 1.16 | 0.42 (0.20, 0.90) | 0.03 | 2.44 (0–0), 7.13 | 1.12 (0.39, 3.19) | 0.83 |
| Transfeminine | 0.71 (0–0), 2.75 | 0.41 (0.13, 1.33) | 0.14 | 4.41 (0–0), 9.78 | 1.88 (0.33, 10.76) | 0.48 |
| Transmasculine | 1.09 (0–1), 3.30 | 1.01 (0.41, 2.48) | 0.98 | 3.55 (0–2), 8.49 | 1.68 (0.51, 5.56) | 0.40 |
| Sexual orientation ^{a,c} | | | 0.09 | | | 0.01 |
| Another sexual orientation | 0.72 (0–0), 2.17 | 0.74 (0.44, 1.27) | 0.27 | 3.01 (0–0), 7.81 | 1.86 (0.87, 4.00) | 0.11 |
| Asexual | 0.33 (0–0), 1.15 | 0.32 (0.10, 1.06) | 0.06 | 0.38 (0–0), 2.24 | 0.16 (0.03, 0.79) | 0.03 |
| Bisexual | 0.79 (0–0), 2.39 | 0.79 (0.46, 1.36) | 0.39 | 2.16 (0–0), 6.64 | 1.26 (0.56, 2.85) | 0.58 |
| Gay | 1.61 (0–2), 3.87 | 1.33 (0.69, 2.57) | 0.39 | 2.75 (0–0), 7.51 | 1.11 (0.44, 2.80) | 0.83 |
| Lesbian | 0.81 (0–0), 2.66 | ref | – | 1.42 (0–0), 5.53 | ref | – |
| Pansexual | 0.73 (0–0), 2.21 | 0.72 (0.32, 1.66) | 0.44 | 2.58 (0–0), 7.44 | 1.56 (0.49, 4.98) | 0.46 |
| Queer | 0.84 (0–0), 2.52 | 1.10 (0.60, 2.02) | 0.77 | 4.78 (0–2), 9.70 | 3.46 (1.37, 8.73) | 0.01 |

IQR: interquartile range; SD: standard deviation; *aRR*: adjusted rate ratio; CI: confidence interval.

Previous 30-day binge alcohol use [*Mean*: 1.12, *IQR*: (0,1), *SD*: 3.13]; marijuana use [*Mean*: 2.65, *IQR*: (0,0), *SD*: 7.38].

Bold *p* Values designate statistically significant results that were determined via regression modeling using an $\alpha < 0.05$.

^aAdjusted for age at time of survey completion (in years), sex assigned at birth (female/male), race (white/non-white), and ethnicity (Hispanic, Latin or Spanish origin/not).

^bAdjusted for sexual minority status (Y/N).

^cAdjusted for gender experience (masculine/feminine/gender expansive).

feminine lesbian participants (*aRR*: 0.42, 95% CI: 0.18–1.01, $p = 0.05$).

Marijuana use

Models testing differences by gender categories showed that transmasculine participants had higher odds of reporting past-year marijuana use when compared to cisgender women (*aOR*: 2.18, 95% CI: 1.10–4.31, $p = 0.03$, Table 3). However, there were no significant differences in reported marijuana use within the last 30 days across other gender categories when compared to cisgender women. After adjustment, Wald testing indicated no overall group differences in past-year or previous 30-day marijuana use across gender categories.

Models testing differences by sexual orientation showed that queer participants had higher odds of reporting past-year marijuana use compared to lesbian participants (*aOR*: 2.52, 95% CI: 1.58–4.03, $p < 0.01$, Table 3), and more reported of days of use within the last 30 days (*aRR*: 3.46, 95% CI: 1.37–8.73, $p = 0.01$, Table 4). Asexual participants had lower odds of reporting marijuana use within the last year compared to lesbian participants (*aOR*: 0.38, 95% CI: 0.15–0.96, $p = 0.04$, Table 3), and fewer reported days of use within the last 30 days (*aRR*: 0.16, 95% CI: 0.03–0.79, $p = 0.03$, Table 4). Participants with another sexual orientation also had higher odds of reporting past-year marijuana use compared to lesbian participants (*aOR*: 1.58, 95% CI: 1.07–2.33, $p = 0.02$); however, no significant differences in prior 30-day marijuana use were indicated. After

adjustment, there were group differences across sexual orientations in past-year ($\chi^2 = 25.70$, $p < 0.01$) and previous 30-day ($\chi^2 = 16.41$, $p = 0.01$) marijuana use (Tables 3 and 4, respectively).

When looking at interactions between sexual orientation and gender experience, both feminine queer individuals and feminine individuals with another sexual orientation had higher odds of reporting marijuana use within the past year compared to feminine lesbian participants (*aOR*: 2.26, 95% CI: 1.27–4.02, $p = 0.01$; *aOR*: 1.58, 95% CI: 1.02–2.46, $p = 0.04$, respectively); approaching statistical significance, feminine queer individuals also reported more days of marijuana use within the previous 30-days (*aRR*: 3.05, 95% CI: 0.98–9.43, $p = 0.05$). Feminine asexual individuals had lower odds of marijuana use within the past year compared to feminine lesbian participants (*aOR*: 0.18, 95% CI: 0.04–0.82, $p = 0.03$); however, no statistically significant differences were indicated for previous 30-day marijuana use.

Other drug use

In models testing differences by gender categories, participants with another gender had lower odds of reporting other drug use within the last year (*aOR*: 0.51, 95% CI: 0.28–0.93, $p = 0.03$, Table 3) with cisgender women as reference. After adjustment, Wald testing indicated no group differences in past-year other drug use across sexual orientation or gender categories. There were no significant differences in past-year other drug use by sexual orientation, compared to lesbian participants in either adjusted full-effect or interaction-based models.

Discussion

We described binge alcohol, marijuana, and other drug use among SGM adults, examining differences among less commonly described identity groups and found significant heterogeneity in substance use across sexual orientation and gender category. Queer and transmasculine persons had two times greater odds of reporting past-year marijuana use compared to lesbian individuals and cisgender women, respectively. Genderqueer and individuals with another gender had lower odds of reporting binge alcohol use compared to cisgender women. Asexual participants had lower odds of reporting almost all substance use outcomes compared to lesbian individuals.

To our knowledge, this is one of few studies to examine substance use differences among sexual minority individuals using less commonly described identity subgroups. This study is also the first to indicate that asexual individuals may be at lower risk of reporting substance use compared to other sexual minority groups. When looking at interactions between sexual orientation and gender experience, results indicate that gender socialization (*e.g.*, how typical gender roles inform access to and acceptability of use of different substances) may impact differential patterns of substance use across sexual minority identity groups. Individuals with less commonly described sexual identities, including asexual

and another sexual orientation, who had either a feminine or gender expansive experience of gender had lower odds of reporting past-year binge alcohol use compared to feminine lesbian participants. Both feminine queer individuals and feminine individuals with another sexual orientation had higher odds of reporting past-year marijuana use compared to feminine lesbian participants. Similar patterns were found when modeling gender exclusively. This study demonstrated substance use heterogeneity in transmasculine, transfeminine, and genderqueer individuals as well as persons with another gender. Results indicate that not all gender minority groups use substances in a similar manner.

To date, literature on this topic suggests that substance use within SGM groups is higher than heterosexual, cisgender populations.^{3,6,8,9,26,27,41} However, this literature is limited in the ways it has captured SGM status. Most prior studies fail to consider within-group heterogeneity of substance use across less commonly described sexual identities and rarely, if ever, examine substance use among non-cisgender individuals. Estimates of SGM substance use are also often based on studies that examine substance use as secondary outcomes within specialized research populations including commercial sex workers, intravenous drug users, community-based club and bar patrons, and unstably housed people.^{2,42–46} This may contribute to the potential overestimation of substance use within this population. Studies with carefully sampled populations also have limited measurement of sexual orientation and gender. Recent data from the NSDUH indicated that risk for elevated substance use was not uniform across age- and gender-specific sexual minority subgroups for a variety of substance use outcomes.^{10,25} However, sexual identity assessment only included answer choice options of “Heterosexual, that is, straight,” “Lesbian or gay,” “Bisexual,” and “Don’t Know.” Analyses have been limited to comparisons of substance use between LGB men and women and their same-gender heterosexual counterparts.^{10,25} Queer, pansexual, and asexual identity groups remain mostly unaccounted. Little research formally examines substance use differences between these subgroups and existing data is primarily descriptive.^{9,47,48}

Gender identity has also been inconsistently operationalized. Most substance use literature does not include gender minority populations, and when included, these individuals are typically grouped into a single “transgender” label or separated based on their sex assigned at birth and compared to “non-transgender” individuals.^{23,49–52} In recent years, only one nationally representative survey of U.S. adults, the 2013 National Health Interview Survey (NHIS), included additional identity options if someone responded “Something Else” as their identity. These included: “You are not straight, but identify with another label such as queer, trisexual, omnisexual, or pansexual,” or “You are transgender, transsexual, or gender variant.”⁵³ While over 2% of NHIS survey respondents reported an identity of “Something Else,” “I don’t know the answer,” or refused to respond, prevalence data for these other, less-represented identity groups were not reported. Additional identity

options are no longer included in more recent survey iterations.⁵⁴

Continued characterization of substance use among limited samples of SGM individuals fails to recognize the diversity of experiences within this community. Estimates of substance use based on improper categorization of SGM identity groups also limits our ability to design and target culturally relevant and successful substance use awareness and treatment interventions to those most at risk for elevated substance use. Our analyses show that examining substance use across more granular categories of sexual orientation and gender, including less commonly described identity subgroups, is indicated. Overall group differences in reported substance use in models of both sexual orientation and gender suggest that these identity factors may have independent relationships with different substance use outcomes. While examining the association of minority stress with substance use was outside the scope of this study, Meyer's minority stress framework suggests that SGM substance use differences may indicate differential responses to minority stress.^{13,20} Prior research suggests that, in addition to identity-based minority stressors, SGM youth experience a higher rate of mental, physical, and emotional trauma (e.g., verbal and physical abuse,^{55–57} interpersonal violence,⁵⁸ victimization,^{55,59,60} homelessness^{61,62}) compared to their heterosexual, cisgender identified peers. While present analyses focus on characterizing substance use among adult SGM individuals, it is important for future work to take into account these early exposures to stress and trauma. There are notable gaps in research^{63,64} that examine how SGM communities experience trauma over the life-course – particularly early experiences – and how that trauma may or may not be related to and informed by SGM and other identity factors, and how exposure to different forms of trauma impact access to and acceptability and use of substances as tools for coping among SGM populations.^{65–67} Future research examining substance use among less commonly described SGM populations may elucidate why certain identity groups have differential risk of substance use than others.

Given the different sociocultural circumstances in which substance use occurs, future work should also take into consideration the historical contexts, current social situations, and public and private spaces (e.g., clubs, bars, Pride Parades) in which members of SGM populations may have increased access to and be encouraged to use substances. For many, substance use may occur alongside community building and socializing with peers in spaces deemed safe for identity exploration and self-expression.^{65,68–71} Our findings underscore that multiple facets of SGM identity may be associated with substance use. Including a broader spectrum of identities in this work not only helps legitimize the diverse lived experiences of SGM community members, but also may provide a richer assessment of substance use in clinical and research venues.

For example, screening for harmful alcohol use in health-care settings has been shown to increase referral to appropriate treatment services and reduce the overall burden of

alcohol and other substance use on both individuals and communities.⁷² However, we note discrepancies in current definitions of binge alcohol use, including the lack of validation of these guidelines in both gender minority and sexual minority groups, which in turn, impacts clinical screening for harmful alcohol use within this population. Further work that characterizes alcohol use and its consequences among a more diverse representation of sexual and gender minority individuals may contribute to changes in these definitions and adapt guidelines toward more effective screening and referral to treatment within this population. In addition, as marijuana gains both legal and popular acceptance as a pharmacotherapy (e.g., for chronic pain⁷³) and for recreational use⁷⁴ throughout different regions of the U.S., it is important to consider which communities may be most at-risk of elevated marijuana use as a coping mechanism for stress and be targeted in marketing and advertising campaigns by manufacturers of commercially-available marijuana products.^{75–77} Last, as the opioid crisis continues to dominate public health focus, characterization of different forms of substance use within a broader spectrum of sexual and gender identities may provide invaluable data on communities most at-risk of drug use and would benefit from additional public health intervention, treatment, and prevention programs and services.

Study limitations

These findings should be interpreted with several limitations. First, we used data from iPhone users recruited via convenience sampling, which may limit the generalizability of these findings to all SGM adults. There was also a greater representation of young, well-educated, non-Hispanic/Latino white/Caucasian participants. Further research using a more representative sample may support the results reported here. Second, some models in this study found no substance use differences between sexual orientation or gender subgroups, using lesbian individuals or cisgender women as respective reference groups. These groups were chosen as a reference given past work that has identified these groups at particularly high risk of substance use among SGM communities.^{11,39} While several models evidenced no differences, results from post-estimation Wald testing indicated that sexual orientation and gender still had statistically significant associations with several substance use parameters. Sexual orientation was a significant predictor of self-reported prior alcohol use problems, past year binge alcohol and marijuana use, and previous 30-day marijuana use; gender category was a significant predictor of past-year and previous 30-day binge alcohol use. Third, our use of the category “other drug use” precluded our ability to assess individual substance use and the reported number of days of single or polysubstance use. Previous work, however, suggests that past-year use of these drugs for recreational purposes may correspond with an increased likelihood of a substance use disorder.¹ Fourth, alcohol use assessment was limited to binge drinking behavior (*i.e.*, 5 or more drinks on one occasion) and did not measure other quantities of alcohol

consumption. However, this decision was based on current guidelines from the National Institute of Alcohol Abuse and Alcoholism (NIAAA) that define binge alcohol use as “consumption within about 2 hours of 4 or more drinks for women and 5 or more drinks for men.”³⁸ The distinction in binge alcohol use between men and women has recently been brought into question,^{78,79} and neither NIAAA nor Substance Abuse and Mental Health Services Administration provides a clear difference in sex- or gender-based differences in binge alcohol use. There are also no binge alcohol use guidelines for gender minority groups. Therefore, the maximum criterion of 5 drinks on one occasion was used regardless of sex or gender identity. Finally, we used self-reported current sexual orientation and gender and did not measure other facets of SGM status (*e.g.*, sexual behavior/attraction or gender expression/presentation). Due to the social complexity of describing sexual and gender identity, including evolving terminologies and variation in identity factors by age, cultural background, and location over time,^{80–83} results may not be representative of all individuals of this population.

Conclusions

Limitations notwithstanding, this study found substance use differences by sexual orientation and gender within a large, national cohort of self-identified SGM people. Substance use varied by SGM identities, including subgroups that have not been previously represented in substance use research. Differences were observed across multiple substance use parameters, including reported prior problems with substance use and frequency of binge alcohol, marijuana, and other drug use. Given limitations in current research, these results highlight the need for future substance use research across populations, including less commonly described sexual orientations and genders. More thorough assessment and characterization of substance use within this population would help contribute to much faster and effective public health intervention, treatment, and prevention of substance use within an already marginalized community. In addition, characterizing differential patterns of substance use within this population helps recognize that the diverse, heterogeneous set of lived experiences within this community do not all contribute to the same or similar relationships to substance use. Future research in this area should take special consideration of the SGM community groups that have historically been excluded from this work including transgender, gender expansive, asexual, pansexual, and queer groups, and how concepts like sexual orientation and gender interact with one another in community settings to inform differential experiences with substance use noted here.

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Author contributions

Only the authors listed were responsible for manuscript content and its preparation. B.T.B. was responsible for primary authorship, data analysis, and preparation of this manuscript; J.O.M. and M.R.C. were responsible for editing manuscript. M.R.L. and A.F., as co-last authors, were responsible for providing data access, background information on The PRIDE Study, guidance on methodologies presented, and editing of manuscript. All authors certify this manuscript is a submission of original work and have approved the final version (including text, references, and affiliated tables) for publication. J.O.M. and M.R.L. were responsible for obtaining primary funding for The PRIDE Study.

Disclosure statement

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Data availability

For questions concerning analyses described here, please contact our corresponding author, Annessa Flentje, PhD. All other inquiries about data accessibility and The PRIDE Study should be directed to support@pridestudy.org

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References

- [1] Substance Abuse and Mental Health Services Administration. Key Substance Use and Mental Health Indicators in the United States: Results from the 2017 National Survey on Drug Use and Health. Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration; 2018. HHS Publication No. SMA 18-5058, NSDUH Series H-53. <http://www.samhsa.gov/data/>.
- [2] Benotsch EG, Zimmerman R, Cathers L, et al. Non-medical use of prescription drugs, polysubstance use, and mental health in transgender adults. *Drug Alcohol Depend.* 2013;132(1-2): 391-394.
- [3] Cochran SD, Ackerman D, Mays VM, Ross MW. Prevalence of non-medical drug use and dependence among homosexually active men and women in the US population. *Addict Abingdon Engl.* 2004;99(8):989-998.
- [4] Demant D, Hides L, Kavanagh DJ, White KM, Winstock AR, Ferris J. Differences in substance use between sexual orientations in a multi-country sample: findings from the Global Drug Survey 2015. *J Public Health (Oxf).* 2017;39(3):532-541.
- [5] Gilbert PA, Pass LE, Keuroghlian AS, Greenfield TK, Reisner SL. Alcohol research with transgender populations: a systematic review and recommendations to strengthen future studies. *Drug Alcohol Depend.* 2018;186:138-146.
- [6] Hatzenbuehler ML, Corbin WR, Fromme K. Trajectories and determinants of alcohol use among LGB young adults and their heterosexual peers: results from a prospective study. *Dev Psychol.* 2008;44(1):81-90.
- [7] Keuroghlian AS, Reisner SL, White JM, Weiss RD. Substance use and treatment of substance use disorders in a community sample of transgender adults. *Drug Alcohol Depend.* 2015;152: 139-146.
- [8] King M, Semlyen J, Tai SS, et al. A systematic review of mental disorder, suicide, and deliberate self harm in lesbian, gay and bisexual people. *BMC Psychiatry.* 2008;8(1):70.
- [9] McCabe SE, Hughes TL, Bostwick WB, West BT, Boyd CJ. Sexual orientation, substance use behaviors and substance dependence in the United States. *Addiction.* 2009;104(8): 1333-1345.
- [10] Schuler MS, Rice CE, Evans-Polce RJ, Collins RL. Disparities in substance use behaviors and disorders among adult sexual minorities by age, gender, and sexual identity. *Drug Alcohol Depend.* 2018;189:139-146.
- [11] Medley G, Lipari RN, Bose J, Cribb DS, Kroutil LA, McHenry G. Sexual orientation and estimates of adult substance use and mental health: Results from the 2015 National Survey on Drug Use and Health. <http://www.samhsa.gov/data/>. Published October 2016.
- [12] McCann E, Brown M. Vulnerability and psychosocial risk factors regarding people who identify as transgender. A systematic review of the research evidence. *Issues Ment Health Nurs.* 2018; 39(1):3-15.
- [13] Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol Bull.* 2003;129(5):674-697.
- [14] Coulter RWS, Bersamin M, Russell ST, Mair C. The effects of gender- and sexuality-based harassment on lesbian, gay, bisexual, and transgender substance use disparities. *J Adolesc Health.* 2018;62(6):688-700.
- [15] Hatzenbuehler ML, Nolen-Hoeksema S, Erickson SJ. Minority stress predictors of HIV risk behavior, substance use, and depressive symptoms: results from a prospective study of bereaved gay men. *Health Psychol off J Div Health Psychol Am Psychol Assoc.* 2008;27(4):455-462.
- [16] Livingston NA, Flentje A, Heck NC, Szalda-Petree A, Cochran BN. Ecological momentary assessment of daily discrimination experiences and nicotine, alcohol, and drug use among sexual and gender minority individuals. *J Consult Clin Psychol.* 2017; 85(12):1131-1143.
- [17] McCabe SE, Bostwick WB, Hughes TL, West BT, Boyd CJ. The relationship between discrimination and substance use disorders among lesbian, gay, and bisexual adults in the United States. *Am J Public Health.* 2010;100(10):1946-1952.
- [18] Rosario M, Schrimshaw EW, Hunter J. Disclosure of sexual orientation and subsequent substance use and abuse among lesbian, gay, and bisexual youths: critical role of disclosure reactions. *Psychol Addict Behav J Soc Psychol Addict Behav.* 2009; 23(1):175-184.
- [19] Weber G. Using to numb the pain: substance use and abuse among lesbian, gay, and bisexual individuals. *J Ment Health Couns.* 2008;30(1):31-48.
- [20] Hendricks ML, Testa RJ. A conceptual framework for clinical work with transgender and gender nonconforming clients: an adaptation of the Minority Stress Model. *Prof Psychol Res Pract.* 2012;43(5):460-467.
- [21] Gonzalez CA, Gallego JD, Bockting WO. Demographic characteristics, components of sexuality and gender, and minority stress and their associations to excessive alcohol, cannabis, and illicit (noncannabis) drug use among a large sample of transgender people in the United States. *J Primary Prevent.* 2017; 38(4):419-445.
- [22] Flentje A, Bacca CL, Cochran BN. Missing data in substance abuse research? Researchers' reporting practices of sexual orientation and gender identity. *Drug Alcohol Depend.* 2015;0: 280-284.
- [23] Reisner SL, Poteat T, Keatley J, et al. Global health burden and needs of transgender populations: a review. *The Lancet.* 2016; 388(10042):412-436.
- [24] Talley AE, Gilbert PA, Mitchell J, Goldbach J, Marshall BDL, Kaysen D. Addressing gaps on risk and resilience factors for alcohol use outcomes in sexual and gender minority populations. *Drug Alcohol Rev.* 2016;35(4):484-493.
- [25] Duncan DT, Zweig S, Hambrick HR, Palamar JJ. Sexual orientation disparities in prescription opioid misuse among U.S. adults. *Am J Prev Med.* 2019;56(1):17-26.
- [26] Hughes TL, Wilsnack SC, Kantor LW. The influence of gender and sexual orientation on alcohol use and alcohol-related problems. *Alcohol Res Curr Rev* 2016;38(1):121-132.
- [27] McCabe SE, West BT, Hughes TL, Boyd CJ. Sexual orientation and substance abuse treatment utilization in the United States: results from a national survey. *J Subst Abuse Treat.* 2013;44(1): 4-12.
- [28] Day JK, Fish JN, Perez-Brumer A, Hatzenbuehler ML, Russell ST. Transgender youth substance use disparities: results from a population-based sample. *J Adolesc Health.* 2017;61(6):729-735.
- [29] Dias S, Gama A, Fuertes R, Mendão L, Barros H. Risk-taking behaviours and HIV infection among sex workers in Portugal: results from a cross-sectional survey. *Sex Transm Infect.* 2015; 91(5):346-352.
- [30] Dragon CN, Guerino P, Ewald E, Laffan AM. Transgender medicare beneficiaries and chronic conditions: exploring fee-for-service claims data. *LGBT Health.* 2017;4(6):404-411.
- [31] Kecojevic A, Wong CF, Schragger SM, et al. Initiation into prescription drug misuse: differences between lesbian, gay, bisexual, transgender (LGBT) and heterosexual high-risk young adults in Los Angeles and New York. *Addict Behav.* 2012; 37(11):1289-1293.
- [32] Toibaro JJ, Ebensrtejin JF, Parlante Á, et al. Sexually transmitted infections among transgender individuals and other sexual identities. *Med B Aires* 2009;69(3):327-330.
- [33] Holt M, Lea T, Mao L, et al. Community-level changes in condom use and uptake of HIV pre-exposure prophylaxis by gay and bisexual men in Melbourne and Sydney, Australia: results of repeated behavioural surveillance in 2013-17. *Lancet HIV.* 2018;5(8):e448-e456.
- [34] Safika I, Johnson TP, Cho YI, Praptoraharjo I. Condom use among men who have sex with men and male-to-female transgenders in Jakarta, Indonesia. *Am J Mens Health.* 2014;8(4): 278-288.

- [35] Wilson PA, Kahana SY, Fernandez MI, et al. Sexual risk behavior among virologically detectable human immunodeficiency virus-infected young men who have sex with men. *JAMA Pediatr.* 2016;170(2):125–131.
- [36] Yi S, Tuot S, Chhoun P, et al. Improving prevention and care for HIV and sexually transmitted infections among men who have sex with men in Cambodia: the sustainable action against HIV and AIDS in communities (SAHACOM). *BMC Health Serv Res.* 2016;16(1). doi: [10.1186/s12913-016-1857-9](https://doi.org/10.1186/s12913-016-1857-9)
- [37] Lunn MR, Capriotti MR, Flentje A, et al. Using mobile technology to engage sexual and gender minorities in clinical research. *PLoS One.* 2019;14(5):e0216282.
- [38] US Department of Health and Human Services, US Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th Edition. <https://health.gov/dietaryguidelines/2015/guidelines/>. Published December 2015.
- [39] Fish JN. Sexual orientation-related disparities in high-intensity binge drinking: findings from a nationally representative sample. *LGBT Health.* 2019;6(5):242.
- [40] StataCorp. *Stata Statistical Software*. College Station, TX: StataCorp, LP; 2015.
- [41] Hughes TL, Eliason M. Substance use and abuse in lesbian, gay, bisexual and transgender populations. *J Prim Prev.* 2002;22(3): 263–298.
- [42] Anderson-Carpenter KD, Fletcher JB, Reback CJ. Associations between methamphetamine use, housing status, and incarceration rates among men who have sex with men and transgender women. *J Drug Issues.* 2017;47(3):383–395.
- [43] Flentje A, Leon A, Carrico A, Zheng D, Dilley J. Mental and physical health among homeless sexual and gender minorities in a major urban US city. *J Urban Health.* 2016;93(6):997–1009.
- [44] Reisner SL, White JM, Mayer KH, Mimiaga MJ. Sexual risk behaviors and psychosocial health concerns of female-to-male transgender men screening for STDs at an urban community health center. *AIDS Care.* 2014;26(7):857–864.
- [45] Sanchez T, Finlayson T, Murrill C, Guilin V, Dean L. Risk behaviors and psychosocial stressors in the New York City house ball community: a comparison of men and transgender women who have sex with men. *AIDS Behav.* 2010;14(2): 351–358.
- [46] Santos G-M, Rapues J, Wilson EC, et al. Alcohol and substance use among transgender women in San Francisco: prevalence and association with human immunodeficiency virus infection. *Drug Alcohol Rev.* 2014;33(3):287–295.
- [47] Hughes T, Szalacha LA, McNair R. Substance abuse and mental health disparities: comparisons across sexual identity groups in a national sample of young Australian women. *Soc Sci Med.* 2010;71(4):824–831.
- [48] Loi B, Lea T, Howard J. Substance use, mental health, and service access among bisexual adults in Australia. *J Bisexuality.* 2017;17(4):400–417.
- [49] Beckwith CG, Kuo I, Fredericksen RJ, et al. Risk behaviors and HIV care continuum outcomes among criminal justice-involved HIV-infected transgender women and cisgender men: data from the Seek, Test, Treat, and Retain Harmonization Initiative. *PLoS One.* 2018;13(5):e0197730.
- [50] Flentje A, Heck NC, Sorensen JL. Characteristics of transgender individuals entering substance abuse treatment. *Addict Behav.* 2014;39(5):969–975.
- [51] Klein A, Golub SA. Family rejection as a predictor of suicide attempts and substance misuse among transgender and gender nonconforming adults. *LGBT Health.* 2016;3(3):193–199.
- [52] Reisner SL, White JM, Bradford JB, Mimiaga MJ. Transgender health disparities: comparing full cohort and nested matched-pair study designs in a community health center. *LGBT Health.* 2014;1(3):177–184.
- [53] Centers for Disease Control. *National Health Interview Survey 2014*. Accessed. 2014;1(7).
- [54] Ward BW, Dahlhamer JM, Galinsky AM, Joestl SS. Sexual orientation and health among U.S. adults: National Health Interview Survey, 2013. *Natl Health Stat Report.* 2014;(77):1–10.
- [55] Katz-Wise SL, Hyde JS. Victimization experiences of lesbian, gay, and bisexual individuals: a meta-analysis. *J Sex Res.* 2012; 49(2–3):142–167.
- [56] Grossman AH, D’augelli AR, Frank JA. Aspects of psychological resilience among transgender youth. *J LGBT Youth.* 2011;8(2): 103–115.
- [57] Collier KL, van Beusekom G, Bos HMW, Sandfort TGM. Sexual orientation and gender identity/expression related peer victimization in adolescence: a systematic review of associated psychosocial and health outcomes. *J Sex Res.* 2013;50(3–4):299–317.
- [58] Dank M, Lachman P, Zweig JM, Yahner J. Dating violence experiences of lesbian, gay, bisexual, and transgender youth. *J Youth Adolescence.* 2014;43(5):846–857.
- [59] Reisner SL, Greytak EA, Parsons JT, Ybarra M. Gender minority social stress in adolescence: disparities in adolescent bullying and substance use by gender identity. *J Sex Res.* 2015;52(3):243–256.
- [60] Reisner SL, Pardo ST, Gamarel KE, Hugtho JMW, Pardee DJ, Keo-Meier CL. Substance use to cope with stigma in healthcare among U.S. female-to-male trans masculine adults. *LGBT Health.* 2015;2(4):324–332.
- [61] Corliss HL, Goodenow CS, Nichols L, Austin SB. High burden of homelessness among sexual-minority adolescents: findings from a representative Massachusetts High School sample. *Am J Public Health.* 2011;101(9):1683–1689.
- [62] Keuroghlian AS, Shtasel D, Bassuk EL. Out on the street: a public health and policy agenda for lesbian, gay, bisexual, and transgender youth who are homeless. *Am J Orthopsychiatry.* 2014;84(1):66–72.
- [63] Mereish EH. Addressing research gaps in sexual and gender minority adolescents’ substance use and misuse. *J Adolesc Health.* 2018;62(6):645–646.
- [64] Kidd JD, Jackman KB, Wolff M, Veldhuis CB, Hughes TL. Risk and protective factors for substance use among sexual and gender minority youth: a scoping review. *Curr Addict Rep.* 2018; 5(2):158–173.
- [65] Parent MC, Arriaga AS, Gobble T, Wille L. Stress and substance use among sexual and gender minority individuals across the lifespan. *Neurobiol Stress.* 2019;10:100146.
- [66] Friedman MJ, Resick PA, Bryant RA, Strain J, Horowitz M, Spiegel D. Classification of trauma and stressor-related disorders in DSM-5. *Depress Anxiety.* 2011;28(9):737–749.
- [67] Goldbach JT, Tanner-Smith EE, Bagwell M, Dunlap S. Minority stress and substance use in sexual minority adolescents: a meta-analysis. *Prev Sci.* 2014;15(3):350–363.
- [68] Greenwood GL, White EW, Page-Shafer K. Correlates of heavy substance use among young gay and bisexual men: the San Francisco young men’s health study. *Drug Alcohol Depend.* 2001;61(2):105–112.
- [69] Halkitis PN, Palamar JJ. Multivariate modeling of club drug use initiation among gay and bisexual men. *Subst Use Misuse.* 2008; 43(7):871–879.
- [70] Carpiano RM, Kelly BC, Easterbrook A, Parsons JT. Community and drug use among gay men: the role of neighborhoods and networks. *J Health Soc Behav.* 2011;52(1):74–90.
- [71] Weightman BA. Commentary: towards a geography of the gay community. *J Cult Geogr.* 1981;1(2):106–112.
- [72] Babor TF, Boca FD, Bray JW. Screening, brief intervention and referral to treatment: implications of SAMHSA’s SBIRT initiative for substance abuse policy and practice. *Addiction* 2017; 112(S2):110–117.
- [73] Hill KP, Palastro MD, Johnson B, Ditte JW. Cannabis and pain: a clinical review. *Cannabis Cannabinoid Res.* 2017;2(1):96–104.
- [74] Hall W, Lynskey M. Evaluating the public health impacts of legalizing recreational cannabis use in the United States. *Addiction* 2016;111(10):1764–1773.
- [75] Philbin MM, Mauro PM, Greene ER, Martins SS. State-level marijuana policies and marijuana use and marijuana use

- disorder among a nationally representative sample of adults in the United States, 2015–2017: sexual identity and gender matter. *Drug Alcohol Depend.* 2019;204:107506.
- [76] Hall W, Stjepanović D, Caulkins J, et al. Public health implications of legalising the production and sale of cannabis for medicinal and recreational use. *The Lancet.* 2019;394(10208):1580–1590.
- [77] Barry RA, Glantz S. A public health framework for legalized retail marijuana based on the US experience: avoiding a new tobacco industry. *PLoS Med.* 2016;13(9):e1002131.
- [78] Dawson DA. Defining risk drinking. *Alcohol Res Health.* 2011; 34(2):144–156.
- [79] Goldstein RB, Dawson DA, Chou SP, Grant BF. Sex differences in prevalence and comorbidity of alcohol and drug use disorders: results from wave 2 of the national epidemiologic survey on alcohol and related conditions. *J Stud Alcohol Drugs.* 2012; 73(6):938–950.
- [80] Rosario M, Schrimshaw EW, Hunter J. Ethnic/racial differences in the coming-out process of lesbian, gay, and bisexual youths: a comparison of sexual identity development over time. *Cultur Divers Ethnic Minor Psychol.* 2004;10(3):215–228.
- [81] Rosario M, Schrimshaw EW, Hunter J, Braun L. Sexual identity development among lesbian, gay, and bisexual youths: consistency and change over time. *J Sex Res.* 2006;43(1): 46–58.
- [82] Ross MW, Essien EJ, Williams ML, Fernández-Esquer ME. Concordance between sexual behavior and sexual identity in street outreach samples of four racial/ethnic groups. *Sex Transm Dis.* 2003;30(2):110.
- [83] Saewyc EM, Bauer GR, Skay CL, et al. Measuring sexual orientation in adolescent health surveys: evaluation of eight school-based surveys. *J Adolesc Health off Publ Soc Adolesc Med.* 2004; 35(4):345.e1–15.

Appendix

Table A1. Rates of Individual Other Drug Use Within the Past Year Among Select sexual and gender minority adults participating in The PRIDE Study via iPhone Application ($N = 1790$).

| Category of other drug use | Total sample ($N = 1790$) $N(\%)^*$ |
|--|--|
| Powder/crack cocaine | 98 (5.62) |
| Amphetamines/methamphetamine | 46 (2.63) |
| Club drugs (e.g., MDMA/ecstasy, GHB, ketamine) | 106 (6.06) |
| Opiates or prescription opiates (e.g., heroin, Oxycontin, Vicodin) | 105 (6.01) |
| Sedatives (e.g., Xanax, Valium, Ativan) | 130 (7.43) |
| Hallucinogens (e.g., LSD/acid, psychedelic mushrooms) | 69 (3.95) |

*Individual substance use outcomes consisted of less than 5% missing data and proportions were calculated based on available participant data.