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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.<sup>1</sup> 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.<sup>2–10</sup>

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.<sup>10,11</sup> Transgender individuals are also more likely to use alcohol, marijuana, or other non-prescription or illicit drugs compared to non-transgender individuals.<sup>5,12</sup> According to the minority stress model,<sup>13</sup> 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.<sup>13–19</sup> Initially limited to sexual minority groups, this framework was expanded to gender minority populations<sup>20</sup> 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., cisgender<sup>1</sup>) populations.<sup>20,21</sup>

Research examining substance use across a diverse spectrum of sexual orientations and gender identities, however, remains limited.<sup>22–24</sup> Substance use studies that include sexual orientation and gender identity are typically limited to lesbian, gay, and bisexual (LGB) individuals<sup>3,4,9,17,22,25–27</sup> and use binary identity classifications (e.g., heterosexual vs. homosexual; cisgender vs. transgender).<sup>28–32</sup> 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).<sup>31,33–36</sup>

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.<sup>37</sup> 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,

<sup>1</sup>“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), transmasculine 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,<sup>38</sup> 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.<sup>11,39</sup> 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.<sup>40</sup>



## 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 ( $N=1790$ ) $N$ (%) <sup>*</sup> or Median (SD)
<b>Demographics</b>	
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)
<b>Substance Use</b>	
Prior diagnosis of alcohol use disorder	89 (5.03)
Prior diagnosis of a substance use disorder <sup>†</sup>	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 <sup>‡</sup>	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.

<sup>\*</sup> $N$ -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).

<sup>†</sup>Non-alcohol or non-nicotine related.

<sup>‡</sup>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 <sup>a,b</sup>			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 <sup>a,b,c</sup>			<b>0.03</b>			<b>0.13</b>
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  $\alpha < 0.05$ .

<sup>a</sup>Adjusted 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).

<sup>b</sup>Adjusted for sexual minority status (Y/N).

<sup>c</sup>Adjusted 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 <sup>a,b</sup>			<b>&lt;0.01</b>			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)	<b>&lt;0.001</b>	64 (38.10)	0.74 (0.50, 1.10)	0.13	18 (10.71)	0.51 (0.28, 0.93)	<b>0.03</b>
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)	<b>0.05</b>	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)	<b>0.03</b>	10 (21.28)	1.34 (0.60, 3.00)	0.48
Sexual orientation <sup>a,c</sup>			<b>0.02</b>			<b>&lt;0.001</b>			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)	<b>0.02</b>	63 (19.81)	1.38 (0.84, 2.28)	0.20
Asexual	10 (25.64)	0.27 (0.12, 0.61)	<b>&lt;0.01</b>	8 (20.51)	0.38 (0.15, 0.96)	<b>0.04</b>	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)	<b>&lt;0.001</b>	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  $\alpha < 0.05$ .

<sup>a</sup>Adjusted 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).

<sup>b</sup>Adjusted for sexual minority status (Y/N).

<sup>c</sup>Adjusted 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 <sup>a,b</sup>			<b>&lt;0.001</b>			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)	<b>&lt;0.001</b>	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)	<b>0.03</b>	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 <sup>a,c</sup>			0.09			<b>0.01</b>
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)	<b>0.03</b>
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)	<b>0.01</b>

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  $\alpha < 0.05$ .

<sup>a</sup>Adjusted 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).

<sup>b</sup>Adjusted for sexual minority status (Y/N).

<sup>c</sup>Adjusted 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.<sup>3,6,8,9,26,27,41</sup> 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.<sup>2,42–46</sup> 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.<sup>10,25</sup> 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.<sup>10,25</sup> 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.<sup>9,47,48</sup>

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.<sup>23,49–52</sup> 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.”<sup>53</sup> 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.<sup>54</sup>

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.<sup>13,20</sup> 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,<sup>55–57</sup> interpersonal violence,<sup>58</sup> victimization,<sup>55,59,60</sup> homelessness<sup>61,62</sup>) 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<sup>63,64</sup> 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.<sup>65–67</sup> 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.<sup>65,68–71</sup> 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.<sup>72</sup> 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 pain<sup>73</sup>) and for recreational use<sup>74</sup> 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.<sup>75–77</sup> 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.<sup>11,39</sup> 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.<sup>1</sup> 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.”<sup>38</sup> The distinction in binge alcohol use between men and women has recently been brought into question,<sup>78,79</sup> 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,<sup>80–83</sup> 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, Annesa Flentje, PhD. All other inquiries about data accessibility and The PRIDE Study should be directed to [support@pridestudy.org](mailto:support@pridestudy.org)

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## 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.