



Full length article

Sexual minority disparities in opioid misuse, perceived heroin risk and heroin access among a national sample of US adults

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ABSTRACT

Background: Lesbian, gay and bisexual (LGB) adults have elevated use of many substances compared to heterosexual adults, yet LGB disparities in specific types of opioid misuse and perceived opioid risk have not been fully characterized.

Methods: Data on 126,463 adults (including 8241 LGB adults) were from the 2015–2017 National Survey of Drug Use and Health. Logistic regression was used to estimate lesbian/gay (L/G) and bisexual disparities (relative to same-gender heterosexuals) for: lifetime prescription pain reliever misuse, heroin use and injection heroin use; past-year opioid misuse and opioid use disorder (OUD); and perceived risk of and access to heroin. **Results:** All LGB subgroups had elevated lifetime pain reliever misuse rates relative to same-gender heterosexuals. Lifetime heroin use was elevated among LGB women and bisexual men; bisexual women had 4 times the odds of injection heroin use. LGB women and gay men had 1.4–2.4 times the odds of past-year opioid misuse; bisexual women had 2.5 times the odds of OUD. LGB women reported both lower perceived risk of trying heroin and greater perceived heroin access.

Conclusions: Lifetime and past-year opioid misuse is elevated among LGB adults. Bisexual women are particularly at-risk, uniquely exhibiting disparities on high-risk injection use and OUD. Lower perceived risk of and greater access to heroin among LGB women may play a role in the onset or continuation of opioid misuse. Opioid misuse disparities among LGB adults are of substantial concern given the resultant elevated risk for fatal and non-fatal opioid overdose.

1. Introduction

The U.S. is currently facing an opioid crisis—annual opioid overdose deaths continue to steadily climb, with approximately 49,000 reported deaths in 2017 (Centers for Disease Control and Prevention, 2018). Drug overdose is now the leading cause of death among those under age 50 (Centers for Disease Control and Prevention, 2018). Consistent with documented national disparities among lesbian, gay and bisexual (LGB) individuals with respect to alcohol use (McCabe et al., 2009; Pakula et al., 2016; Schuler et al., 2018), smoking (Cochran et al., 2013; Gonzales et al., 2016; Schuler et al., 2018), marijuana use (Demant et al., 2017; McCabe et al., 2009; Schuler et al., 2018), and illicit drug use (Demant et al., 2017; Operario et al., 2015; Schuler et al., 2018), a recent national study indicates that LGB individuals are also at elevated risk for prescription opioid misuse (Duncan et al., 2019). Yet differences in specific types of opioid misuse and opioid-specific risk factors among LGB adults have not been fully

characterized, particularly in recent years during which opioid overdose deaths involving heroin and synthetic opioids have increased and overdose deaths from opioid analgesics have plateaued (Centers for Disease Control and Prevention, 2018; Kolodny et al., 2015).

Individuals may misuse opioids to escape stress, psychological distress or mental pain, as opioid analgesics and illicit opioids mimic endogenous opioids that provide pain relief and a general calming effect (Khantzian, 1997; Sullivan et al., 2006). LGB individuals often experience higher stress levels due to minority stress, namely the stigma, prejudice and discrimination experienced by those in a marginalized social group (Meyer, 2003). Minority stress may result from interpersonal relationships or structural factors, such as institutional policies and laws (Hatzenbuehler and Link, 2014). This chronic social stress is associated with elevated risk for numerous behavioral health outcomes among LGB individuals compared to heterosexuals, including substance use (Goldbach et al., 2014; Lee et al., 2016; Mereish et al., 2017a). In addition to directly elevating risk for substance use, minority stress is

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also linked with higher rates of psychological distress and depression (Hatzenbuehler, 2009), which may subsequently contribute to substance use and misuse. Lifecourse factors may also contribute to LGB substance use disparities. LGB young adults disproportionately experience childhood abuse, familial rejection and homelessness and LGB adults disproportionately experience intimate partner violence (Friedman et al., 2011; Schneeberger et al., 2014), all factors associated with substance misuse. Opioid misuse may facilitate dissociation from pain and psychological distress associated with these types of traumatic events (Dube et al., 2003; Kecojevic et al., 2015).

Additional contributing factors to LGB disparities may include differences in substance use norms, perceived risk and access; these factors have not yet been explored with respect to opioid misuse. Given higher substance use rates among LGB individuals, substance use norms and behavior may propagate through social networks, as substance-using peers may endorse or provide access to substances to their peers. Prior studies find that lower perceived risk is associated with substance use, including use of alcohol, tobacco and marijuana (Gerking and Khaddaria, 2012; Piontek et al., 2013; Thornton et al., 2013) and opioid analgesic misuse (Arria et al., 2008; Lord et al., 2011; Rigg and Monnat, 2015; Votaw et al., 2017). An individual's social network influences access, as approximately half of individuals with past-year prescription pain reliever misuse have obtained opioids from a friend or relative for free (Center for Behavioral Health Statistics and Quality, 2017). Emerging evidence suggests that LGB youth may hold different substance use norms and have greater willingness to use peer-offered substances (Gamarel et al., 2018). However, the extent to which these findings apply to both adults and opioid misuse is unclear. Likewise, differential access to opioids between LGB and heterosexual adults has not been investigated.

To date, the limited number of national studies examining LGB opioid disparities have primarily focused on LGB adolescents, documenting elevated rates of lifetime heroin use among LGB youth compared to heterosexual youth (Caputi et al., 2018; Lowry et al., 2017; Newcomb et al., 2014). Consistent with prior studies demonstrating heterogeneity in substance use disparities within the LGB population by gender and sexual identity (Kerridge et al., 2017; Newcomb et al., 2014; Schuler et al., 2018, 2019), these studies provide emerging, yet inconsistent, evidence regarding variation in youth heroin use. Newcomb et al. (2014) found that bisexual male youth had the highest rate of heroin use, while Lowry et al. (2017) found that rates of heroin use and injection drug use were higher among lesbian/gay youth than bisexual youth. Opioid disparities among LGB adults have been largely unexamined – only a single study has examined LGB disparities on any measure of opioid use in a national sample (Duncan et al., 2019). Using 2015 National Survey of Drug Use and Health (NSDUH) data, this study characterized LGB disparities in past-year and past-month prescription opioid misuse and past-year opioid use disorder among U.S. adults, finding significantly elevated rates of past-year and past-month prescription opioid misuse among bisexual women (Duncan et al., 2019). No national study has examined potential differences in heroin use among LGB adults compared to heterosexual adults.

To address these gaps in the literature, we examine LGB opioid-related disparities, relative to heterosexuals, in a national sample and characterize variation among LGB adults with respect to sexual identity and gender. We use 2015–2017 NSDUH data to examine LGB disparities in lifetime prescription pain reliever misuse, heroin use and injection heroin use; past-year opioid misuse and opioid use disorder (OUD); and perceived heroin risk and heroin access. This study extends work by Duncan et al. (2019) by including heroin use and lifetime prescription pain reliever use, as well as perceived risk of and access to heroin; additionally, using multiple years of data allows for more robust estimates among LGB adults. Characterizing potential LGB disparities in opioid misuse and heroin use, as well as potential variation among LGB adults, is an important step towards elucidating etiological origins of opioid misuse among LGB individuals. Our findings can inform

screening, prevention and treatment strategies to reduce opioid misuse and mortality among LGB adults.

2. Methods

2.1. Study population

Data are from the 2015, 2016 and 2017 NSDUH, an annual nationally-representative survey of drug use among the civilian, non-institutionalized US population ages 12 and older. Data were collected using computer-assisted interviewing to facilitate accurate reporting of sensitive behaviors. The sample size for the public use NSDUH data was 57,146 individuals in 2015 (70% response rate), 56,897 individuals in 2016 (68% response rate) and 56,276 individuals in 2017 (67% response rate). Survey respondents gave written informed consent and were compensated \$30. Our study sample was restricted to individuals ages 18 and older identifying as heterosexual, lesbian/gay, or bisexual (N = 126,463 total, including 8241 LGB adults). Individuals ages 12–17 were excluded, as NSDUH does not ask about sexual identity for those younger than 18, as were individuals who did not respond to the sexual identity question or answered “don't know.” This study was deemed exempt by RAND's IRB.

2.2. Measures

Sexual identity was assessed by the item, “Which one of the following do you consider yourself to be?” with response choices of “Heterosexual, that is, straight,” “Lesbian or gay,” “Bisexual,” and “Don't know.”

2.2.1. Prescription pain reliever misuse

Among individuals screening positive for lifetime use of OxyContin or other prescription pain reliever use, lifetime prescription pain reliever misuse was assessed with the item: “Have you ever, even once, used any prescription pain reliever in any way a doctor did not direct you to use it?” Past-year misuse was defined similarly with respect to the past 12 months.

2.2.2. Heroin use

Lifetime heroin use was assessed with the item: “Have you ever, even once, used heroin?” Past-year heroin use was defined as any heroin use in the past 12 months.

Lifetime injection heroin use was assessed with the item: “Have you ever, even once, used a needle to inject heroin?”

2.2.3. Opioid misuse

Individuals were categorized as having past-year opioid misuse if they endorsed either past-year heroin use or prescription pain reliever misuse. OUD was assessed based on Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) criteria. An individual was classified as having past-year OUD if they met DSM-IV abuse or dependence criteria for either prescription pain relievers or heroin in the past 12 months.

2.2.4. Perceived risk of heroin

Perceived risk of heroin was assessed with the item: “How much do people risk harming themselves physically and in other ways when they try heroin once or twice?” We used the recoded variable in the public use dataset which dichotomized responses into “great risk” versus “no risk,” “slight risk” and “moderate risk.”

2.2.5. Heroin access

Heroin access was assessed with the item: “How difficult or easy would it be for you to get some heroin, if you wanted some?” We used the recoded variable in the public use dataset which dichotomized responses into “very easy” or “fairly easy” versus “probably impossible,”

“very difficult” and “fairly difficult.”

2.2.6. Demographics

Demographics included: age (categorized as 18, 19, 20, 21, 22–23, 24–25, 26–29, 30–34, 35–49, 50–64 or 65+ years old), race/ethnicity (White, Black, Hispanic, Asian or Other), education level (less than high school, high school, some college/2 year college degree or 4 year college degree), employment (full-time, part-time, unemployed or other), household income (below federal poverty, up to 2x federal poverty or more than 2x federal poverty), health insurance indicator (insured or uninsured), marital status (married, widowed, divorced/separated or never married), living with children under age 18 (yes or no), and urbanicity (large metro area, small metro area or non-metro area).

2.3. Statistical analysis

We calculated weighted prevalence rates, stratified by sexual identity and gender, for demographic characteristics as well as opioid-related outcomes. While we report lifetime prescription pain reliever misuse and heroin use, we present aggregated past-year opioid misuse (i.e., prescription pain reliever misuse or heroin use) due to low prevalence of past-year heroin use. We used logistic regression models with gender and sexual identity indicators and their interactions to estimate gender- and sexual identity-specific odds ratios (ORs) of a given outcome. We report ORs and corresponding 95% confidence intervals (CI) comparing gay/lesbian individuals and bisexual individuals, respectively, to same-gender heterosexual peers. Separate regression models were implemented for each outcome. We present both unadjusted and demographic-adjusted OR estimates; consistent with prior studies, significant differences in demographic-adjusted analyses are interpreted as disparities among LGB adults. For both males and females, differences in disparity magnitude between bisexual and lesbian/gay individuals were assessed for each outcome with survey-adjusted Wald tests. For each regression model, the Sidak correction was used to account for multiple comparisons across LGB subgroups. All analyses accounted for NSDUH survey design; analyses were conducted in Stata version 15 using the svy suite.

3. Results

3.1. Study sample characteristics

Our sample included 1410 gay men, 1221 bisexual men, 1321 lesbian/gay (L/G) women and 4289 bisexual women as well as 56,184 heterosexual men and 62,038 heterosexual women (Table 1). Race/ethnicity was similar across all groups. LGB adults, particularly bisexual women, were somewhat younger than heterosexual adults. While gay men and L/G women had higher education levels than heterosexual peers, bisexual men and women had lower education levels.

3.2. Rates of lifetime pain reliever misuse and heroin use

Rates of lifetime prescription pain reliever misuse were significantly higher among gay men (19%, adjusted odds ratio (aOR) = 1.4, 95% CI = [1.1, 1.9]) and bisexual men (17%, aOR = 1.3, 95% CI = [1.0, 1.8]) compared to heterosexual men (12%) (Table 2). Lifetime heroin use was significantly elevated among bisexual men (5.7%, aOR = 1.8, 95% CI = [1.1, 3.0]), but not gay men (2.8%), compared to heterosexual men (2.8%). Additionally, bisexual men had elevated odds of lifetime heroin use compared to gay men. Rates of lifetime injection heroin use did not differ significantly between heterosexual men (1.4%), gay men (1.3%) and bisexual men (2.5%).

Rates of lifetime prescription pain reliever misuse were significantly higher among bisexual women (25%; aOR = 2.4, 95% CI = [2.1, 2.8]) and L/G women (17%, aOR = 1.7, 95% CI = [1.3, 2.3]) compared to heterosexual women (8.7%) (Table 2). Lifetime heroin use was

significantly elevated among bisexual women (5.1%; aOR = 3.5, 95% CI = [2.6, 4.7]) and L/G women (2.6%; aOR = 1.8, 95% CI = [1.0, 3.1]) compared to heterosexual women (1.1%). Lifetime injection heroin use was significantly elevated among bisexual women (2.7%; aOR = 4.0, 95% CI = [2.7, 6.1]), but not L/G women (1.0%), compared to heterosexual women (0.5%). Additionally, bisexual women had significantly elevated odds of lifetime prescription pain reliever misuse, lifetime heroin use and lifetime injection heroin use compared to L/G women.

3.3. Rates of past-year opioid misuse and opioid use disorder

Rates of past-year opioid misuse were significantly higher among gay men (8.4%, aOR = 1.4, 95% CI = [1.0, 2.0]), but not bisexual men (8.1%), compared to heterosexual men (5.0%) (Table 3). Rates of past-year opioid use disorder did not differ significantly between heterosexual men (1.0%), gay men (1.9%), and bisexual men (2.2%). Rates of past-year opioid misuse were significantly elevated among bisexual women (13%; aOR = 2.4, 95% CI = [2.0, 2.8]) and L/G women (7%, aOR = 1.6, 95% CI = [1.1, 2.2]) compared to heterosexual women (4%). Rates of past-year opioid use disorder were significantly elevated among bisexual women (2.7%; aOR = 2.5, 95% CI = [1.7, 3.5]), but not L/G women (0.9%), compared to heterosexual women (0.6%). Additionally, bisexual women had significantly elevated odds of both past-year opioid misuse and opioid use disorder compared to L/G women.

3.4. Perceived heroin risk and heroin access

No significant differences in rates of perceiving a “great risk” in trying heroin 1–2 times were observed across bisexual men (79%), gay men (78%) and heterosexual men (86%) (Table 4). Similarly, no significant differences in rates of perceiving heroin as “fairly” or “very easy” to obtain were observed across bisexual men (19%), gay men (17%) and heterosexual men (17%). Rates of perceiving a “great risk” in trying heroin 1–2 times were significantly lower among bisexual women (84%; aOR = 0.7, 95% CI = [0.6, 0.8]) and L/G women (84%, aOR = 0.6, 95% CI = [0.5, 0.9]) compared to heterosexual women (90%). Rates of perceiving heroin as “fairly” or “very easy” to obtain were significantly higher among bisexual women (23%; aOR = 1.3, 95% CI = [1.1, 1.5]) and L/G women (24%, aOR = 1.3, 95% CI = [1.0, 1.7]) compared to heterosexual women (18%).

4. Discussion

This study is one of the first to use a nationally-representative sample of U.S. adults to characterize LGB disparities in opioid-related outcomes and the first to examine LGB heroin use disparities. When comparing LGB adults to heterosexual adults of the same gender, we find elevated rates of lifetime pain reliever misuse among all LGB subgroups, elevated lifetime heroin use among LGB women and bisexual men, and elevated past-year opioid misuse among LGB women and gay men. Furthermore, bisexual women had profoundly elevated rates of injection heroin use and OUD. The magnitude of these opioid disparities among LGB adults, particularly bisexual women, are of substantial concern given the risk for fatal and non-fatal opioid overdose associated with opioid misuse (Kolodny et al., 2015). In addition to overdose, opioid misuse is associated with other negative sequelae including elevated risk for infectious diseases, reduced labor force participation and suicidal ideation (Ilgen et al., 2016; Kolodny et al., 2015; Krueger, 2017; Schepis et al., 2019). The significant opioid-related differences among LGB adults, after adjusting for demographic and contextual factors, suggests other factors or experiences disproportionately experienced by LGB individuals, discussed below, contribute to opioid misuse risk.

Our results highlight that LGB adults are not uniformly at-risk for opioid misuse or heroin use. Specifically, while LGB women and bisexual men had elevated risk for both prescription pain reliever misuse

Table 1
Demographic characteristics of 2015–2017 NSDUH adult participants by gender and sexual identity (n = 126,463).

	Male			Female		
	Heterosexual n = 56,184	Gay n = 1410	Bisexual n = 1221	Heterosexual n = 62,038	Gay/Lesbian n = 1321	Bisexual n = 4289
Age						
18-25	14.4%	19.0%	29.9%	12.4%	20.9%	41.5%
26-34	16.1%	22.1%	20.7%	14.8%	20.6%	28.5%
35-49	25.3%	21.4%	19.5%	24.6%	23.0%	19.8%
50-64	25.7%	28.2%	18.6%	26.2%	23.5%	7.8%
65+	18.5%	9.4%	11.3%	21.9%	12.0%	2.4%
Race/ethnicity						
White	65.3%	62.0%	59.1%	64.7%	63.8%	61.3%
Black	11.0%	11.7%	10.3%	12.4%	15.7%	14.1%
Hispanic	16.0%	18.1%	20.2%	15.1%	14.3%	15.7%
Other	7.6%	8.2%	10.4%	7.9%	6.2%	8.9%
Education						
< High school	13.8%	7.9%	13.5%	11.8%	10.4%	13.0%
High school	26.8%	16.2%	24.6%	23.5%	19.5%	26.9%
Some college / 2 yr degree	29.0%	29.5%	31.6%	32.8%	35.2%	38.4%
4 yr college degree	30.5%	46.4%	30.4%	31.9%	34.9%	21.8%
Employment						
Full time	57.8%	56.4%	51.5%	41.6%	52.0%	44.3%
Part time	10.0%	13.9%	15.2%	15.9%	11.8%	19.7%
Unemployed	5.0%	6.5%	6.2%	3.7%	7.0%	9.2%
Other	27.1%	23.2%	27.1%	38.7%	29.1%	26.8%
Marital status						
Married	55.5%	15.7%	27.8%	51.5%	25.5%	24.8%
Widowed	3.0%	1.4%	2.9%	8.9%	3.2%	1.1%
Divorced/separated	12.1%	6.6%	9.0%	15.9%	11.9%	15.7%
Never married	29.3%	76.2%	60.3%	23.8%	59.4%	58.4%
Respondent's children < 18 in household						
Yes	27.4%	4.6%	16.4%	31.7%	20.1%	35.9%
Household Income						
Below federal poverty	12.2%	12.2%	18.5%	15.7%	18.8%	26.4%
Up to 2x federal poverty	18.7%	15.6%	25.4%	20.9%	19.5%	24.3%
More than 2x federal poverty	69.1%	72.2%	56.1%	63.4%	61.6%	49.3%
Has health insurance						
Yes	88.5%	89.2%	86.2%	92.2%	88.6%	86.9%
Urbanicity						
Large metro	55.6%	69.7%	61.5%	55.3%	57.1%	57.9%
Small metro	30.0%	22.6%	27.7%	30.1%	31.0%	30.4%
Non-metro	14.4%	7.8%	10.8%	14.6%	12.0%	11.7%

Note: Prevalence estimates are weighted to account for NSDUH survey design.

Table 2
Lifetime opioid misuse outcomes by gender and sexual identity: Prevalence estimates and odds ratio (OR) estimates of sexual minority disparities (relative to same-gender heterosexuals) among 2015–2017 NSDUH participants.

	Male											
	Heterosexual			Gay			Bisexual			Bisexual		
	No. (%)	No. (%)	No. (%)	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI	
Lifetime Pain Reliever Misuse	7703 (11.7%)	282 (19.1%)	224 (17.0%)	1.78*	[1.38, 2.30]	1.42*	[1.09, 1.85]	1.54*	[1.18, 2.02]	1.33*	[1.01, 1.76]	
Lifetime Heroin Use	1645 (2.8%)	41 (2.8%)	57 (5.7%)	1.00	[0.52, 1.90]	0.78*	[0.40, 1.49]	2.05*	[1.24, 3.39]	1.79*	[1.06, 3.01]	
Lifetime Injection Heroin Use	765 (1.4%)	22 (1.3%)	31 (2.5%)	0.94	[0.45, 1.97]	0.78	[0.37, 1.66]	1.91	[0.93, 3.89]	1.59	[0.76, 3.30]	
	Female											
	Heterosexual			Lesbian/Gay			Bisexual			Bisexual		
	No. (%)	No. (%)	No. (%)	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI	
Lifetime Pain Reliever Misuse	6294 (8.7%)	253 (16.8%)	1080 (24.7%)	2.11*	[1.62, 2.76]	1.71*	[1.30, 2.26]	3.43*	[2.99, 3.94]	2.44*	[2.11, 2.83]	
Lifetime Heroin Use	834 (1.1%)	45 (2.6%)	222 (5.1%)	2.33*	[1.36, 3.99]	1.78*	[1.02, 3.11]	4.68*	[3.55, 6.18]	3.53*	[2.64, 4.72]	
Lifetime Injection Heroin Use	387 (0.5%)	23 (1.0%)	109 (2.7%)	2.14*	[1.02, 4.51]	1.62*	[0.75, 3.51]	5.73*	[3.86, 8.50]	4.04*	[2.66, 6.14]	

Odds ratio estimates are in reference to same-gender heterosexuals; all odds ratio estimates weighted to account for NSDUH survey design. Adjusted odds ratio (aOR) estimates are adjusted for age, race/ethnicity, education level, employment, income, health insurance status, marital status, living with children under age 18 and urbanicity. For each outcome, p-values and 95% CIs are estimated using the Sidak correction to account for multiple comparisons across LGB subgroups.

* Significant at the 0.05 probability level.

* Significant difference between bisexual OR and lesbian/gay OR (within gender).

Table 3
Past-year opioid misuse and opioid use disorder by gender and sexual identity: Prevalence estimates and odds ratio (OR) estimates of sexual minority disparities (relative to same-gender heterosexuals) among 2015–2017 NSDUH participants.

	Male										
	Heterosexual	Gay	Bisexual	Gay				Bisexual			
	No. (%)	No. (%)	No. (%)	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI
Past-year Opioid Misuse	3604 (5.0%)	135 (8.4%)	118 (8.1%)	1.73*	[1.24, 2.42]	1.40*	[1.00, 1.97]	1.65*	[1.17, 2.34]	1.27	[0.90, 1.81]
Past-year Opioid Use Disorder	746 (1.0%)	30 (1.9%)	28 (2.2%)	1.86	[0.97, 3.57]	1.48	[0.76, 2.87]	2.08*	[1.11, 3.87]	1.57	[0.83, 2.97]
	Female										
	Heterosexual	Lesbian/Gay	Bisexual	Lesbian/Gay				Bisexual			
	No. (%)	No. (%)	No. (%)	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI
Past-year Opioid Misuse	2766 (3.5%)	126 (7.0%)	605 (12.6%)	2.06**	[1.46, 2.89]	1.56**	[1.11, 2.20]	3.98**	[3.36, 4.72]	2.38**	[1.99, 2.83]
Past-year Opioid Use Disorder	495 (0.6%)	21 (0.9%)	131 (2.7%)	1.49 [‡]	[0.73, 3.05]	1.00 [‡]	[0.48, 2.09]	4.64**	[3.29, 6.54]	2.47**	[1.73, 3.53]

Odds ratio estimates are in reference to same-gender heterosexuals; all odds ratio estimates weighted to account for NSDUH survey design. Adjusted odds ratio (aOR) estimates are adjusted for age, race/ethnicity, education level, employment, income, health insurance status, marital status, living with children under age 18 and urbanicity. For each outcome, p-values and 95% CIs are estimated using the Sidak correction to account for multiple comparisons across LGB subgroups.

* Significant at the 0.05 probability level.

[‡] Significant difference between bisexual OR and lesbian/gay OR (within gender).

and heroin use, gay men only exhibited disparities with respect to prescription pain reliever misuse. Bisexual women exhibited unique risk regarding injection heroin use and OUD. The observed heterogeneity across LGB subgroups is consistent with both prior studies regarding LGB disparities in opioid misuse (Corliss et al., 2010; Duncan et al., 2019; Newcomb et al., 2014) and LGB substance use disparities more broadly (Kerridge et al., 2017; Newcomb et al., 2014; Schuler et al., 2018, 2019). In particular, our findings that bisexual women are especially at-risk for opioid misuse and heroin use are consistent with prior studies showing bisexual women are at elevated risk of other substance use behaviors (Kerridge et al., 2017; McCabe et al., 2009; Schuler et al., 2018). Notably, we find evidence of OUD disparities among bisexual women, in contrast to the prior study by Duncan et al. (2019) which did not find evidence of any LGB disparities for OUD, likely due to limited statistical power afforded by a single year of NSDUH data.

LGB-specific minority stressors likely contribute to excess opioid misuse among LGB adults (Hatzenbuehler and Pachankis, 2016; Meyer, 1995). Experiences of discrimination, marginalization and victimization may contribute to substance use risk both acutely and cumulatively

over the lifespan. A recent study of the 2015 National Youth Risk Behavior Study demonstrated that social and minority stressors (i.e., bullying; injury, threats, or feeling unsafe at school; forced sexual intercourse) were significantly associated with substance use measures among LGB youth, including heroin use and injection drug use (Lowry et al., 2017).

Furthermore, differential risk of opioid misuse and heroin use across LGB subgroups may reflect differences in minority stress experiences (Moran et al., 2018; Parra and Hastings, 2018) and demographic and lifecourse factors (Krueger and Upchurch, 2019; Schuler et al., 2018) across LGB subgroups. In particular, bisexual individuals may experience additional bisexual-specific stigma and stressors arising from the dominant binary model of sexual orientation (e.g., homosexuality or heterosexuality), including skepticism of the very existence of bisexuality, perceptions that bisexuals are confused about their sexual identity, and bisexual “invisibility” (e.g., the assumption that they are either gay/lesbian or heterosexual based on the gender of their partner) (Feinstein and Dyar, 2017; Mereish et al., 2017b). These phenomena, which may be amplified among women, may be internalized and contribute to mental distress, social isolation and substance use risk

Table 4
Perceived heroin risk and heroin access by gender and sexual identity: Prevalence estimates and odds ratio (OR) estimates of sexual minority disparities (relative to same-gender heterosexuals) among 2015–2017 NSDUH participants.

	Male										
	Heterosexual	Gay	Bisexual	Gay				Bisexual			
	No. (%)	No. (%)	No. (%)	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI
Trying heroin 1-2 times is “great risk”	46,772 (85.6%)	1104 (78.3%)	937 (79.3%)	0.61*	[0.47, 0.79]	0.78	[0.60, 1.01]	0.64*	[0.49, 0.84]	0.79	[0.60, 1.03]
Heroin “fairly/very easy” to obtain	9407 (17.0%)	226 (16.8%)	224 (19.3%)	0.99	[0.75, 1.30]	0.99	[0.75, 1.30]	1.17	[0.89, 1.55]	1.23	[0.93, 1.63]
	Female										
	Heterosexual	Lesbian/Gay	Bisexual	Lesbian/Gay				Bisexual			
	No. (%)	No. (%)	No. (%)	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI
Trying heroin 1-2 times is “great risk”	54,435 (90.4%)	1102 (83.9%)	3546 (83.7%)	0.55*	[0.41, 0.74]	0.63*	[0.46, 0.86]	0.54*	[0.47, 0.63]	0.68*	[0.58, 0.80]
Heroin “fairly/very easy” to obtain	11,080 (18.3%)	306 (23.5%)	987 (22.6%)	1.37*	[1.06, 1.77]	1.31*	[1.01, 1.70]	1.30*	[1.14, 1.49]	1.26*	[1.10, 1.45]

Odds ratio estimates are in reference to same-gender heterosexuals; all odds ratio estimates weighted to account for NSDUH survey design. Adjusted odds ratio (aOR) estimates are adjusted for age, race/ethnicity, education level, employment, income, health insurance status, marital status, living with children under age 18 and urbanicity. For each outcome, p-values and 95% CIs are estimated using the Sidak correction to account for multiple comparisons across LGB subgroups.

* Significant at the 0.05 probability level.

(Friedman et al., 2014; Katz-Wise et al., 2017). Additionally, rates of mental health problems, suicidality, interpersonal violence and sexual assault are also significantly elevated among bisexual women relative to other sexual identity groups (Ross et al., 2018; Salway et al., 2018; Turell et al., 2018).

This study also provides novel evidence that LGB women reported both lower perceived risk of heroin and greater access to heroin relative to heterosexual women; these factors may contribute to observed heroin use disparities among LGB women. While lower perceived risk and increased access to a given substance have been linked to increased initiation risk (Arria et al., 2008; Lord et al., 2011; Votaw et al., 2017), our cross-sectional data does not allow us to determine to what extent the perceptions of risk contribute to subsequent heroin use or are a result of prior use. Previous studies have found that perceived risk decreases after initiation for marijuana use but not alcohol or tobacco use (Grevenstein et al., 2015). Perceptions of risk have been found to be responsive to interventions aimed at shifting perceived risk and perceived social norms regarding substance use (Giannotta et al., 2014; Longshore et al., 2007; McCambridge and Strang, 2004). Future research should seek to explicate etiological origins of heterogeneity in substance use risk among LGB individuals, necessitating longitudinal assessment of minority stress experiences and other social/context risk factors. If lower perceived risk of heroin is determined to be a precipitating factor for opioid misuse among LGB individuals, interventions aimed at increasing perceived risk may be effective at reducing LGB opioid disparities.

4.1. Limitations

Our findings must be viewed within the context of the study's limitations. Sexual identity and opioid misuse are self-reported and may be subject to measurement error due to social desirability bias or recall bias. Perceived risk and perceived access are only asked about heroin and not other prescription or illicit opioids. As the NSDUH excludes incarcerated or homeless individuals, results may underestimate the true magnitude of opioid-related disparities among LGB adults. We note that we are not estimating the "causal effect" of sexual identity; rather, we interpret differences in our adjusted results as indicative of disparities, representing differences not strictly explained by variation in general demographic and contextual factors associated with substance misuse. We acknowledge that some covariates we adjust for may be mediators in the relationship between sexual identity and opioid misuse or have reciprocal associations with opioid misuse.

5. Conclusions

Despite these limitations, our finding that LGB adults, particularly bisexual women, are at significantly higher risk than heterosexuals for prescription opioid misuse and heroin use has substantial public health implications due to the accompanying elevated risk of fatal and non-fatal opioid overdose. Prevention and treatment efforts that are both inclusive and targeted are needed to reduce current opioid disparities among LGB adults. Healthcare clinics that serve sizeable LGB populations should offer robust and inclusive resources regarding screening and treatment for opioid misuse. In addition to the gold standard of medication-assisted therapy and psychotherapy, recent recommendations for treating OUD in LGBT populations include LGBT-tailored psychotherapy, trauma-informed care, and comprehensive and integrated care addressing other physical and mental health needs (Girouard et al., 2019). More broadly, reducing LGB disparities in opioid misuse and other substance use will also necessitate continued social change to reduce minority stress burden experienced by LGB individuals due to their sexual identity.

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Contributors

MSS conceptualized the study, performed analyses, and led manuscript writing. AWD and BDS contributed to interpretation of results as well as manuscript revisions. All authors have read, contributed to, and approved the final version of the manuscript.

References

- Arria, A.M., Caldeira, K.M., Vincent, K.B., O'Grady, K.E., Wish, E.D., 2008. Perceived harmfulness predicts nonmedical use of prescription drugs among college students: interactions with sensation-seeking. *Prev. Sci.* 9, 191–201.
- Caputi, T.L., Smith, L.R., Strathdee, S.A., Ayers, J.W., 2018. Substance use among lesbian, gay, bisexual, and questioning adolescents in the United States, 2015. *Am. J. Public Health* 108, 1031–1034.
- Center for Behavioral Health Statistics and Quality, 2017. 2016 National Surveys on Drug Use and Health: Detailed Tables. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Centers for Disease Control and Prevention, 2018. Wide-ranging Online Data for Epidemiologic Research (WONDER). Centers for Disease Control and Prevention, Atlanta, GA.
- Cochran, S.D., Bandiera, F.C., Mays, V.M., 2013. Sexual orientation-related differences in tobacco use and secondhand smoke exposure among US adults aged 20 to 59 years: 2003–2010 National Health and Nutrition Examination Surveys. *Am. J. Public Health* 103, 1837–1844.
- Corliss, H.L., Rosario, M., Wypij, D., Wylie, S.A., Frazier, A.L., Austin, S.B., 2010. Sexual orientation and drug use in a longitudinal cohort study of U.S. Adolescents. *Addict. Behav.* 35, 517–521.
- Demant, D., Hides, L., Kavanagh, D.J., White, K.M., Winstock, A.R., Ferris, J., 2017. Differences in substance use between sexual orientations in a multi-country sample: findings from the Global Drug Survey 2015. *J. Public Health (Oxf)* 39, 532–541.
- Dube, S.R., Felitti, V.J., Dong, M., Chapman, D.P., Giles, W.H., Anda, R.F., 2003. Childhood abuse, neglect, and household dysfunction and the risk of illicit drug use: the adverse childhood experiences study. *Pediatrics* 111, 564–572.
- Duncan, D.T., Zweig, S., Hambrick, H.R., Palamar, J.J., 2019. Sexual orientation disparities in prescription opioid misuse among U.S. Adults. *Am. J. Prev. Med.* 56, 17–26.
- Feinstein, B.A., Dyar, C., 2017. Bisexuality, minority stress, and health. *Curr. Sex. Health Rep.* 9, 42–49.
- Friedman, M.R., Dodge, B., Schick, V., Herbenick, D., Hubach, R., Bowling, J., Goncalves, G., Krier, S., Reece, M., 2014. From bias to bisexual health disparities: attitudes toward bisexual men and women in the United States. *LGBT Health* 1, 309–318.
- Friedman, M.S., Marshal, M.P., Guadamuz, T.E., Wei, C., Wong, C.F., Saewyc, E., Stall, R., 2011. A meta-analysis of disparities in childhood sexual abuse, parental physical abuse, and peer victimization among sexual minority and sexual nonminority individuals. *Am. J. Public Health* 101, 1481–1494.
- Gamarel, K.E., Mereish, E.H., Colby, S.M., Barnett, N.P., Hayes, K., Jackson, K.M., 2018. Sexual minority disparities in substance use willingness among youth. *Subst. Use Misuse* 53, 170–175.
- Gerking, S., Khaddaria, R., 2012. Perceptions of health risk and smoking decisions of young people. *Health Econ.* 21, 865–877.
- Giannotta, F., Vigna-Taglianti, F., Rosaria Galanti, M., Scatigna, M., Faggiano, F., 2014. Short-term mediating factors of a school-based intervention to prevent youth substance use in Europe. *J. Adolesc. Health* 54, 565–573.
- Girouard, M.P., Goldhammer, H., Keuroghlian, A.S., 2019. Understanding and treating opioid use disorders in lesbian, gay, bisexual, transgender, and queer populations. *Subst. Abuse* Epub ahead of print.
- Goldbach, J.T., Tanner-Smith, E.E., Bagwell, M., Dunlap, S., 2014. Minority stress and substance use in sexual minority adolescents: a meta-analysis. *Prev. Sci.* 15, 350–363.
- Gonzales, G., Przedworski, J., Henning-Smith, C., 2016. Comparison of health and health risk factors between lesbian, gay, and bisexual adults and heterosexual adults in the United States: results from the national health interview survey. *JAMA Intern. Med.* 176, 1344–1351.
- Grevenstein, D., Nagy, E., Kroeninger-Jungaberle, H., 2015. Development of risk perception and substance use of tobacco, alcohol and cannabis among adolescents and emerging adults: evidence of directional influences. *Subst. Use Misuse* 50, 376–386.
- Hatzenbuehler, M.L., 2009. How does sexual minority stigma "get under the skin"? A psychological mediation framework. *Psychol. Bull.* 135 (5), 707–730.
- Hatzenbuehler, M.L., Link, B.G., 2014. Introduction to the special issue on structural stigma and health. *Soc. Sci. Med.* 103, 1–6.
- Hatzenbuehler, M.L., Pachankis, J.E., 2016. Stigma and minority stress as social determinants of health among lesbian, gay, bisexual, and transgender youth: research evidence and clinical implications. *Pediatr. Clin. North Am.* 63, 985–997.
- Ilgel, M.A., Bohnert, A.S., Ganoczy, D., Bair, M.J., McCarthy, J.F., Blow, F.C., 2016.

- Opioid dose and risk of suicide. *Pain* 157, 1079–1084.
- Katz-Wise, S.L., Mereish, E.H., Woulfe, J., 2017. Associations of bisexual-specific minority stress and health among cisgender and transgender adults with bisexual orientation. *J. Sex Res.* 54, 899–910.
- Keckojevic, A., Wong, C.F., Corliss, H.L., Lankenau, S.E., 2015. Risk factors for high levels of prescription drug misuse and illicit drug use among substance-using young men who have sex with men (YMSM). *Drug Alcohol Depend.* 150, 156–163.
- Kerridge, B.T., Pickering, R.P., Saha, T.D., Ruan, W.J., Chou, S.P., Zhang, H., Jung, J., Hasin, D.S., 2017. Prevalence, sociodemographic correlates and DSM-5 substance use disorders and other psychiatric disorders among sexual minorities in the United States. *Drug Alcohol Depend.* 170, 82–92.
- Khantzian, E.J., 1997. The self-medication hypothesis of substance use disorders: a re-consideration and recent applications. *Harv. Rev. Psychiatry* 4, 231–244.
- Kolodny, A., Courtwright, D.T., Hwang, C.S., Kreiner, P., Eadie, J.L., Clark, T.W., Alexander, G.C., 2015. The prescription opioid and heroin crisis: a public health approach to an epidemic of addiction. *Annu. Rev. Public Health* 36, 559–574.
- Krueger, A.B., 2017. Where Have All the Workers Gone? An Inquiry Into the Decline of the US Labor Force Participation Rate. The Brookings Institute, Washington, D.C.
- Krueger, E.A., Upchurch, D.M., 2019. Are sociodemographic, lifestyle, and psychosocial characteristics associated with sexual orientation group differences in mental health disparities? Results from a national population-based study. *Soc. Psychiatry Psychiatr. Epidemiol.* 54 (6), 755–770.
- Lee, J.H., Gamarel, K.E., Bryant, K.J., Zaller, N.D., Operario, D., 2016. Discrimination, mental health, and substance use disorders among sexual minority populations. *LGBT Health* 3, 258–265.
- Longshore, D., Ellickson, P.L., McCaffrey, D.F., St Clair, P.A., 2007. School-based drug prevention among at-risk adolescents: effects of ALERT plus. *Health Educ. Behav.* 34, 651–668.
- Lord, S., Brevard, J., Budman, S., 2011. Connecting to young adults: an online social network survey of beliefs and attitudes associated with prescription opioid misuse among college students. *Subst. Use Misuse* 46, 560.
- Lowry, R., Johns, M.M., Robin, L.E., Kann, L.K., 2017. Social stress and substance use disparities by sexual orientation among high school students. *Am. J. Prev. Med.* 53, 547–558.
- McCabe, S.E., Hughes, T.L., Bostwick, W.B., West, B.T., Boyd, C.J., 2009. Sexual orientation, substance use behaviors and substance dependence in the United States. *Addiction* 104, 1333–1345.
- McCambridge, J., Strang, J., 2004. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. *Addiction* 99, 39–52.
- Mereish, E.H., Goldbach, J.T., Burgess, C., DiBello, A.M., 2017a. Sexual orientation, minority stress, social norms, and substance use among racially diverse adolescents. *Drug Alcohol Depend.* 178, 49–56.
- Mereish, E.H., Katz-Wise, S.L., Woulfe, J., 2017b. Bisexual-specific minority stressors, psychological distress, and suicidality in bisexual individuals: the mediating role of loneliness. *Prev. Sci.* 18, 716–725.
- Meyer, I.H., 1995. Minority stress and mental health in gay men. *J. Health Soc. Behav.* 36, 38–56.
- Meyer, I.H., 2003. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol. Bull.* 129, 674–697.
- Moran, T.E., Chen, C.Y., Tryon, G.S., 2018. Bully victimization, depression, and the role of protective factors among college LGBTQ students. *J. Community Psychol.* 46, 871–884.
- Newcomb, M.E., Birkett, M., Corliss, H.L., Mustanski, B., 2014. Sexual orientation, gender, and racial differences in illicit drug use in a sample of US high school students. *Am. J. Public Health* 104, 304–310.
- Operario, D., Gamarel, K.E., Grin, B.M., Lee, J.H., Kahler, C.W., Marshall, B.D., van den Berg, J.J., Zaller, N.D., 2015. Sexual minority health disparities in adult men and women in the United States: national Health and Nutrition Examination Survey, 2001–2010. *Am. J. Public Health* 105, e27–34.
- Pakula, B., Shoveller, J., Ratner, P.A., Carpiano, R., 2016. Prevalence and co-occurrence of heavy drinking and anxiety and mood disorders among gay, lesbian, bisexual, and heterosexual Canadians. *Am. J. Public Health* 106, 1042–1048.
- Parra, L.A., Hastings, P.D., 2018. Integrating the neurobiology of minority stress with an intersectionality framework for LGBTQ+latinx populations. *New Dir. Child Adolesc. Dev.* 161, 91–108.
- Piontek, D., Kraus, L., Bjarnason, T., Demetrovics, Z., Ramstedt, M., 2013. Individual and country-level effects of cannabis-related perceptions on cannabis use. A multilevel study among adolescents in 32 European countries. *J. Adolesc. Health* 52, 473–479.
- Rigg, K.K., Monnat, S.M., 2015. Comparing characteristics of prescription painkiller misusers and heroin users in the United States. *Addict. Behav.* 51, 106–112.
- Ross, L.E., Salway, T., Tarasoff, L.A., MacKay, J.M., Hawkins, B.W., Fehr, C.P., 2018. Prevalence of depression and anxiety among bisexual people compared to gay, lesbian, and heterosexual individuals: a systematic review and meta-analysis. *J. Sex Res.* 55, 435–456.
- Salway, T., Ross, L.E., Fehr, C.P., Burley, J., Asadi, S., Hawkins, B., Tarasoff, L.A., 2018. A systematic review and meta-analysis of disparities in the prevalence of suicide ideation and attempt among bisexual populations. *Arch. Sex. Behav.* 48, 89–111.
- Schepis, T.S., Simoni-Wastila, L., McCabe, S.E., 2019. Prescription opioid and benzodiazepine misuse is associated with suicidal ideation in older adults. *Int. J. Geriatr. Psychiatry* 34, 122–129.
- Schneeberger, A.R., Diel, M.F., Muenzenmaier, K.H., Huber, C.G., Lang, U.E., 2014. Stressful childhood experiences and health outcomes in sexual minority populations: a systematic review. *Soc. Psychiatry Psychiatr. Epidemiol.* 49, 1427–1445.
- Schuler, M.S., Rice, C.E., Evans-Polce, R.J., Collins, R.L., 2018. Disparities in substance use behaviors and disorders among adult sexual minorities by age, gender, and sexual identity. *Drug Alcohol Depend.* 189, 139–146.
- Schuler, M.S., Stein, B.D., Collins, R.L., 2019. Differences in substance use disparities across age groups in a national cross-sectional survey of lesbian, gay, and bisexual adults. *LGBT Health* 6, 68–76.
- Sullivan, M.D., Edlund, M.J., Zhang, L., Unutzer, J., Wells, K.B., 2006. Association between mental health disorders, problem drug use, and regular prescription opioid use. *Arch. Intern. Med.* 166, 2087–2093.
- Thornton, L.K., Baker, A.L., Johnson, M.P., Lewin, T., 2013. Perceived risk associated with tobacco, alcohol and cannabis use among people with and without psychotic disorders. *Addict. Behav.* 38, 2246–2251.
- Turell, S.C., Brown, M., Herrmann, M., 2018. Disproportionately high: an exploration of intimate partner violence prevalence rates for bisexual people. *Sex. Relation. Ther.* 33, 113–131.
- Votaw, V.R., Wittenauer, J., Connery, H.S., Weiss, R.D., McHugh, R.K., 2017. Perceived risk of heroin use among nonmedical prescription opioid users. *Addict. Behav.* 65, 218–223.