



## Sexual minority disparities in psychosocial functioning following substance use recovery among a representative sample of US adults

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### ABSTRACT

**Purpose:** Sexual minority (SM; e.g., gay, lesbian, bisexual) individuals are disproportionately impacted by alcohol and other drug (AOD) use disorders and psychosocial factors that can exacerbate AOD use disorders and hinder recovery. This study examines SM sub-group differences (monosexual [gay/lesbian] versus bisexual) regarding adaptation to recovery measured by indices of psychosocial functioning. Identifying differential needs of gay/lesbian versus bisexual individuals could improve services to better meet the needs of SM individuals in recovery. **Methods:** Using data from the National Recovery Study, a nationally representative cross-sectional sample of US adults who reported resolving an AOD problem ( $N = 2,002$ ), we compared heterosexual to monosexual and bisexual SM individuals on socio-demographic characteristics, AOD use and treatment, and psychosocial variables.

**Results:** Bisexual individuals were significantly younger than heterosexual individuals ( $p = .002$  and  $p \leq 0.001$  among men and women, respectively) and reported significantly fewer years since AOD problem resolution compared to heterosexual individuals ( $p = .004$  and  $p = .003$  among men and women, respectively). Most notably, bisexual individuals, but not gay/lesbian individuals, reported significantly lower quality of life (QOL), happiness, self-esteem, and significantly higher distress compared to heterosexual individuals.

**Conclusion:** Bisexual, but not monosexual, SM individuals in recovery from an AOD use disorder, were younger and reported worse psychosocial functioning than heterosexual individuals. Findings highlight significant differences between monosexual versus bisexual identified individuals with a notable disadvantage experienced by bisexual individuals. More needs to be learned about the challenges faced by bisexual individuals in recovery to better address their needs and support long-term AOD recovery.

### 1. Introduction

Sexual minority-identifying individuals (SM; e.g., gay, lesbian, bisexual) disproportionately experience alcohol and other drug (AOD) use disorders compared to heterosexual individuals. Specifically, SM adults are 1.6 to 3.1 times more likely than heterosexual adults to experience lifetime AOD use disorders (McCabe et al., 2013; Roxburgh et al., 2016). For example, SM individuals experience higher rates of alcohol and stimulant use disorders relative to heterosexual individuals

(Rosner et al., 2021; Schuler & Collins, 2020). Further, emerging data suggest that SMs may be more likely than heterosexual individuals to experience opioid use disorder (OUD) (Schuler et al., 2019; N. Wilson et al., 2020).

While SM-related substance use disparities are often investigated by aggregating SM categories (i.e., comparing heterosexual to SM individuals), differences between sexual identities (gay/lesbian versus bisexual) have been consistently documented in the literature. For example, bisexual and other non-monosexual individuals experience

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greater prevalence of alcohol use disorder (AUD) compared to monosexual (gay/lesbian) SM individuals (Drabble & Trocki, 2005; Feinstein & Dyar, 2017; Hughes et al., 2020; McCabe et al., 2009; Scheer, McConocha, et al., 2021; Scheer & Pachankis, 2019).

Relatedly, sex and gender differences are well documented in the substance use literature, with men being more likely to meet criteria for AOD disorders than women (Brady & Randall, 1999; White, 2020). Further, sexual identity and gender interactions have been associated with AOD use disparities. For example, SM women are approximately four times more likely to drink to intoxication and practice heavy episodic drinking than heterosexual women (Drabble et al., 2018), making AUD a prominent sexual-identity-based disparity among SM women (Hughes et al., 2016, 2020). Recently, the National Survey on Drug Use and Health (2015–2017) revealed bisexual women had elevated odds of binge drinking, marijuana use, illicit drug use, opioid misuse, and AUD compared to lesbian/gay monosexual minority women (Schuler & Collins, 2020).

These disparities in harmful AOD use disorders among SMs have been attributed to sexual minority stress (Brooks, 1981; Meyer, 2003), the chronic interpersonal and structural stressors SM individuals face (i.e., stigma, discrimination, and prejudice). Intersectional impacts of such minority stressors can include those related to monosexism (i.e., biphobia; the belief that one can or should only be attracted to one gender/sex) (Dyar et al., 2020; Feinstein & Dyar, 2017), sexism (Scheer, Batchelder, et al., 2021), and other identity-related stressors (e.g., racism) (English et al., 2018). Further, there is growing research demonstrating that individuals who identify as non-monosexual more frequently experience discrimination and internalized stigma compared to monosexual peers (Feinstein et al., 2023). Sexual minority stress has also been associated with multiple psychosocial challenges, including lower quality of life (QOL) (Grabski et al., 2019; Potter & Patterson, 2019), distress (Livingston et al., 2016), and lower well-being (Douglass et al., 2020; Thomeer & Reczek, 2016). Indeed, monosexism has been associated with higher levels of depressive and anxiety symptoms, above and beyond heterosexist discrimination (Chan & Leung, 2023).

While AOD use and related psychosocial disparities are well documented between SM and heterosexual individuals, little work has examined SM sub-groups in AOD recovery (Haik et al., 2022; Wagner & Baldwin, 2020). The Substance Abuse and Mental Health Services Administration (SAMHSA) defines recovery as “a process of change through which individuals improve their health and wellness, live a self-directed life, and strive to reach their full potential (Wagner & Baldwin, 2020).” Of the limited literature focused on recovery, SM individuals, compared to their heterosexual counterparts, were less likely to be employed, more likely to have a psychiatric diagnosis, and had significantly worse levels of well-being, suggesting that these psychosocial challenges may be related to inequities in sustaining recovery (Haik et al., 2022). Given the documented differences among SM sub-groups related to substance use, psychosocial challenges, and discrimination, a better understanding of demographic and psychosocial characteristics of monosexual compared to non-monosexual SM people in recovery may help identify unmet recovery needs among specific SM sub-groups.

Increasing data indicates disparities among specific SM sub-groups in relation to sexual and gender identity in AOD use and related psychosocial disparities, and yet, almost nothing has been reported regarding SM sub-group differences in AOD recovery. More research is needed to understand SM sub-group psychosocial functioning in initiating and sustaining recovery to inform recovery support services. This is essential since recovery support services only sparingly exist for SM people, and there has been minimal investigation of culturally adapted AOD interventions for SM people, and even less investigation of the differential impacts on and needs among SM sub-groups (Kidd et al., 2021). Thus, this paper compares gay/lesbian and bisexual to heterosexual individuals, gay/lesbian to bisexual individuals, and examines gender identity effects on psychosocial factors important to recovery, including community support (e.g., comfort with disclosing having resolved an

AOD problem), emotional health (e.g., as indicated by QOL, distress, happiness, and self-esteem), purpose (e.g., employment), and resources to sustain recovery (i.e., recovery capital) (“Working Definition of ‘Recovery’ by SAMHSA,” 2022). Socio-demographic and clinical characteristics were also examined.

## 2. Methods

### 2.1. Sample and procedure

The current study data comes from the National Recovery Study (NRS) (Kelly et al., 2017), comprehensively described elsewhere (Earnshaw et al., 2019; Kelly et al., 2017, 2018a). The NRS is a nationally representative sample of US adults (18+ years) who have resolved a significant AOD problem as indicated by affirmative response to the screener question: “Did you use to have a problem with drugs or alcohol, but no longer do?” Participants received NRS surveys through email and self-reported having had a past, but no longer present, problem with drugs or alcohol. Data were collected using a geodemographically representative sample of adults using address-based sampling from 97 % of all US households based on the US Postal Service’s Delivery Sequence File through the survey company GfK via their KnowledgePanel (GfK, 2013; Kelly et al., 2017).

A subset of 39,809 US adults were invited from the KnowledgePanel by GfK to participate in the NRS upon screening. Of the 39,809 screened, 25,229 responded (63.4 %), a comparable response rate to other nationally representative surveys (Centers for Disease Control and Prevention, 2013; Grant et al., 2015). Out of 25,229 respondents, 2,002 individuals answered “yes” to the screener question and completed the survey (this excludes 283 individuals who began but did not complete the survey). The median time to complete the survey was 24 min. Sampling weights created by GfK using iterative proportional fitting methods accounted for sample versus US population differences (Bataglia et al., 2009). Base weights compensated for over- or under-coverage of invited respondents’ geodemographic characteristics and systematic differential screener-question responses. We adjusted base weights so sample characteristics reflected national distributions in sex/gender, age, race/Hispanic ethnicity, education, census geographical region, household income, home-ownership status, and metropolitan area (US Census Bureau, 2015).

The Partners HealthCare Institutional Review Board approved all procedures. Study aims were not pre-registered; thus, results should be considered exploratory.

## 3. Measures

### 3.1. Sexual identity and other socio-demographic and clinical characteristics

Participants reported their sexual identity with response choices for “heterosexual or straight,” “gay or lesbian,” or “bisexual.” Data on sexual identity was available for 94.0 % of the sample. An additional 0.9 % reported their sexual identity as “something else” and were excluded from the analysis due to small sample size. Additional demographics were age, sex/gender (male, female, transgender female, transgender male, and other), race, education, household income, and employment status. Notably, we reported the sex/gender variable as gender and categorize participants as men and women as respondents in the sample only selected male and female response options. Participants reported a history of AUD, other SUDs, and any positive diagnoses of 16 other non-AOD use related psychiatric disorders (Dennis et al., 2002). Participants reported their arrest histories to reflect criminal justice involvement. Demographic and clinical variables were missing for less than 1 % of participants.

### 3.2. Substance use treatment history

Participants reported how long it had been since resolving their AOD problem and the number of “serious [resolve] attempts” made before they “overcame” it. Participants also reported their engagement history in the following recovery support services: 1) inpatient treatment, 2) outpatient treatment, or 3) mutual help organizations (e.g., Alcoholics Anonymous, Narcotics Anonymous). Primary-substance and age-of-onset data were missing from 11.3 % and 15.9 % of the sample, respectively. Other variables missing in more than 1 % of the sample were mutual help organization attendance (1.1 %) and number of years in recovery (2.6 %).

### 3.3. Disclosure comfort

Findings from Romo and colleagues (Romo et al., 2016) informed the disclosure comfort scale. Participants rated how comfortable they felt disclosing having resolved an AOD problem to (1) family, (2) friends, (3) co-workers, (4) someone they are meeting for the first time, (5) in a public setting (e.g., community event), and (6) in the media (e.g., newspaper article). Responses ranged from 0, “not at all comfortable” to 5, “completely comfortable.” A total mean score was calculated ( $\alpha = 0.90$ ). Item-level data were available for over 99 % of the sample, excluding disclosure to friends, which was missing for 1.1 % of the sample.

### 3.4. Quality of life

We defined quality of life (QOL) using the European Health Interview Survey – Quality of Life (Schmidt et al., 2006), a widely-used 8-item measure (including among SM samples) (Gottlieb et al., 2020; Lea et al., 2021), adapted from the World Health Organization Quality of Life—Brief Version ( $\alpha = 0.90$ ). Participants answered questions relative to their psychological, physiological, social, and environmental experiences (e.g., “How satisfied are you with your health”) on a 5-point Likert scale ranging from “not at all” to “completely.” The eight items were summed with higher scores reflecting better life quality (Schmidt et al., 2006). Data were available for 99.6 % of the sample.

### 3.5. Psychological distress

The Kessler-6 is a 6-item measure (Kessler et al., 2003) of psychiatric symptoms experienced throughout the past 30 days ( $\alpha = 0.90$ ) (Wilson et al., 2021). For example, participants answered how often in the past 30 days they felt “that everything was an effort” on a 5-point scale ranging from 0, “none of the time” to 4, “all of the time.” Data were available for 99.1 % of the sample.

### 3.6. Happiness

Participants rated their happiness on a scale from 1, “completely unhappy” to 5, “completely happy” (Meyers & Smith, 1995). This single item has been used among samples including SM individuals (Grafsky et al., 2011; Kelly et al., 2018b, 2019).

### 3.7. Self-esteem

Individuals rated the extent to which “I have high self-esteem” was true on a scale ranging from 1, “not very true of me” to 5, “very true of me.”<sup>49</sup> Data were available for 99.0 % of the sample.

### 3.8. Recovery capital

Recovery capital was assessed using the Brief Assessment of Recovery Capital (BARC-10) (Vilsaint et al., 2017), a validated 10-item abridged version of the Addiction Recovery Capital Scale ( $\alpha = 0.93$ )

(Groshkova et al., 2013), also used with SM individuals (Hanauer et al., 2019). Respondents rated statements (e.g., “There are more important things to me in life than using substances”) from 1, “strongly disagree” to 6, “strongly agree.” Higher sums demonstrate greater recovery capital. Data were available for 99.3 % of the sample.

### 3.9. Statistical analysis

We compared socio-demographic characteristics, AOD use and treatment, other psychiatric diagnoses, and current psychosocial factors among heterosexual, lesbian/gay, and bisexual participants using unadjusted linear or multinomial logistic regression models for continuous and categorical correlates, respectively. We constructed two sets of models. First, we specified heterosexual participants as the reference group. We then constructed models to examine differences between gay/lesbian and bisexual participants. We examined whether study-participant gender identity modified observed differences among these sexual identity sub-groups. As an ancillary analysis, we tested the robustness of the significant associations between sexual identity and substance use, treatment history, and psychosocial variables using multivariable models adjusting for age, psychiatric diagnosis, and time since problem resolution. Given the low levels of missing data, we conducted a complete case analysis for all models, incorporating survey weights in Stata, Version 14.

## 4. Results

### 4.1. Differences among sexual minority sub-groups in socio-demographic and clinical characteristics

Of the original 2,002 participants who completed the survey, 1,864 (weighted  $n = 1871$ ) reported their sexual identity as heterosexual, gay/lesbian, or bisexual and were included in the analysis. Of these, 1,121 identified as male (referenced to as men below) and 749 identified as female (referred to as women below). No participants in this sample identified their gender as transgender men, transgender women, or other. Sample-wide, bisexual individuals were significantly younger than heterosexual individuals with the mean (SD) age of bisexual men being 40.46 (2.48) compared to 48.51 (0.79;  $p = .002$ ) among heterosexual men (Cohen's  $d = 4.37$ ) and the mean age among bisexual women being 37.21 (1.9) compared to 45.01 (0.76;  $p \leq 0.001$ ) among heterosexual women ( $d = 5.39$ ; Table 1).

Among men, several significant sociodemographic differences by sexual identity existed. Gay participants were significantly more likely to be unemployed than heterosexual participants (71.60 % vs. 41.65 %, respectively;  $p < .001$ ). Gay men were significantly more likely than heterosexual men to have a psychiatric diagnosis other than AOD use disorder (39.95 % vs. 23.53 %, respectively;  $p = .021$ ). No differences in race/ethnicity, household income, education level, or arrest history by sexual identity were identified.

Among women, several additional significant sociodemographic differences were identified. Bisexual women were less likely to be non-Hispanic Black (5.75 % vs. 18.55 % among heterosexual women;  $p = .045$ ). Gay/lesbian women were less likely to report a race/ethnicity other than White, Black, or Hispanic (0.54 % vs. 5.94 % among heterosexual women;  $p = .046$ ). Fewer bisexual women reported not having any college education (22.65 % vs. 53.09 % among heterosexual women;  $p = .002$ ). Gay/lesbian women were more likely to report arrest histories (67.59 % vs. 39.53 % among heterosexual women;  $p = .044$ ). Bisexual women were substantially more likely to have a psychiatric diagnosis other than AOD use disorder (73.25 %) relative to heterosexual women (42.00 %;  $p < .001$ ).

### 4.2. Substance use treatment history

Overall, bisexual individuals reported significantly fewer years since

**Table 1**  
Socio-demographics and clinical characteristics of study participants.

	Heterosexual REFERENCE	Gay	Bisexual
<b>Men, n(%)</b>	987 (87.99)	91 (8.13)	43 (3.88)
Age, M(SE)	48.51 (0.79)	50.58 (1.9)	40.46 (2.48) **
Race Ethnicity, n(%)			
White, Non-Hispanic (reference)	620 (62.75)	49 (53.73)	26 (60.41)
Black, Non-Hispanic	106 (10.74)	12 (13.30)	1 (3.26)
Hispanic	190 (19.21)	18 (19.22)	8 (18.46)
Other, Non-Hispanic	72 (7.30)	13 (13.76)	8 (17.88)
Household Income, n(%)			
Less than 50,000 USD	464 (46.96)	39 (42.65)	20 (45.23)
Employment, n(%)			
Unemployed	411 (41.65)	65 (71.60) ***	11 (24.90)
College Education, n(%)			
No College	469 (47.47)	33 (36.61)	21 (48.58)
Ever Arrested, n(%)	563 (57.37)	58 (63.50)	30 (69.11)
Psychiatric Diagnosis (excluding AUD/SUD), n(%)	232 (23.53)	37 (39.95) *	17 (39.30)
<b>Women, n(%)</b>	679 (90.62)	27 (3.64)	43 (5.74)
Age, M(SE)	45.01 (0.76)	37.19 (2.81)**	37.21 (1.9) ***
Race Ethnicity, n(%)			
White, Non-Hispanic (reference)	412 (60.81)	13 (48.71)	27 (62.94)
Black, Non-Hispanic	126 (18.55)	12 (43.61)	3 (5.75 %)*
Hispanic	100 (14.7)	2 (7.14 %)	9 (19.74)
Other, Non-Hispanic	40 (5.94)	0 (0.54 %)*	5 (11.56)
Household Income, n(%)			
Less than 50,000 USD	406 (59.79)	16 (58.42)	27 (63.34)
Employment, n(%)			
Unemployed	328 (48.40)	16 (57.93)	18 (41.22)
College Education, n(%)			
No College	360 (53.09)	15 (53.55)	10 (22.65) **
Ever Arrested, n(%)	267 (39.53)	18 (67.59) *	18 (41.97)
Psychiatric Diagnosis (excluding AUD/SUD), n(%)	285 (42.00)	15 (54.87)	32 (73.25) ***

\*  $p \leq 0.05$ . \*\*  $p \leq 0.01$ . \*\*\*  $p \leq 0.001$ .

n (%), sample percentage.

M, mean.

SE, standard error.

USD, United States dollars.

AUD, Alcohol Use Disorder.

SUD, Substance Use Disorder.

resolving their AOD problem with the mean (SD) years for bisexual men being 7.95 (1.81) compared to 13.33 (0.49;  $p = .004$ ) among heterosexual men ( $d = 4.06$ ) and the mean years for bisexual women being 7.17 (1.30) compared to 11.30 (0.47;  $p = .003$ ) among heterosexual women ( $d = 4.23$ ; Table 2).

Bisexual men were less likely to report past 3-month mutual help group attendance (0.66 % vs. 13.38 % among heterosexual men;  $p = .003$ ). Gay men reported a significantly older age of onset for substance use (22.26 (0.89)) relative to heterosexual men (19.28 (0.29;  $p = .002$ ). No significant differences in the average number of serious quit attempts by sexual identity occurred. Additionally, when we compared monosexual (gay/lesbian) to bisexual participants, the only significant difference among men was that monosexual (gay) SM men were more likely to have attended a mutual health group in the past 3 months compared to bisexuals ( $p = .012$ ).

Gay/lesbian women were less likely to report having previously, but no longer attending, mutual help groups (9.82 %) than heterosexual women (31.07 %;  $p = .029$ ). When we compared monosexual (gay/lesbian) to bisexual participants, we identified several significant differences among women. First, monosexual SM respondents were

**Table 2**  
Substance Use and Treatment History.

	Heterosexual REFERENCE	Gay	Bisexual
<b>Men, n(%)</b>	987 (87.99)	91 (8.13)	43 (3.88)
Primary substance: Alcohol, n(%)	541 (64.29)	43 (50.85)	22 (59.52)
Primary substance: Cannabis, n(%)	120 (14.30)	4 (4.30)*	3 (9.20)
Primary substance: Opioid, n(%)	41 (4.86)	5 (5.53)	7 (17.84)
Primary substance: Other, n(%)	139 (16.54)	34 (39.32) ***	5 (13.44)
Mutual Help Attendance, n(%)			
Never Attenders (reference)	532 (55.01)	44 (48.05)	28 (63.95)
Former Attenders	306 (31.60)	40 (43.49)	15 (35.40)
Past 3-Month Attenders	130 (13.38)	8 (8.46) <sup>a</sup>	0 (0.66)**
Outpatient addiction treatment, n(%)	158 (15.96)	20 (22.37)	8 (19.11)
Inpatient or residential treatment, n(%)	151 (15.26)	18 (20.04)	4 (9.50)
Years Since AOD Problem Resolved, M(SE)	13.33 (0.49)	12.02 (1.09)	7.95 (1.81) **
Age of onset (primary substance), M(SE)	19.28 (0.29)	22.26 (0.89)**	20.65 (1.64)
Approximate serious attempts to resolve AOD, M(SE)	6.08 (0.9)	7.14 (2.56)	6.33 (3.58)
<b>Women, n(%)</b>	679 (90.62)	27 (3.64)	43 (5.74)
Primary substance: Alcohol, n(%)	321 (53.75)	7 (31.82)	23 (54.20)
Primary substance: Cannabis, n(%)	75 (12.48)	8 (32.80) <sup>a</sup>	3 (7.02)
Primary substance: Opioid, n(%)	33 (5.52)	6 (25.37)*	4 (8.37)
Primary substance: Other, n(%)	169 (28.25)	2 (10.01) <sup>a</sup>	13 (30.41)
Mutual Help Attendance, n(%)			
Never Attenders (reference)	380 (56.74)	16 (59.37)	22 (51.24)
Former Attenders	208 (31.07)	3 (9.82)* <sup>a</sup>	14 (33.33)
Past 3-Month Attenders	82 (12.20)	8 (30.82)	6 (15.44)
Outpatient addiction treatment, n(%)	117 (17.22)	3 (11.79)	10 (24.11)
Inpatient or residential treatment, n(%)	93 (13.77)	2 (8.72)	11 (25.19)
Years Since AOD Problem Resolved, M(SE)	11.30 (0.47)	8.50 (1.8)	7.17 (1.3) **
Age of onset (primary substance), M(SE)	20.60 (0.36)	17.56 (1.94)	18.83 (1.03)
Approximate serious attempts to resolve AOD, M(SE)	4.27 (0.42)	3.67 (1.12)	3.59 (0.54)

\*  $p \leq 0.05$ . \*\*  $p \leq 0.01$ . \*\*\*  $p \leq 0.001$ .

n(%), sample percentage.

M, mean.

SE, standard error.

AOD, Alcohol and Other Drug Use Disorder.

<sup>a</sup> significant difference between monosexual SM (gay/lesbian) and bisexual responses.

significantly more likely to report cannabis as their primary substance ( $p = .044$ ) whereas bisexual women were significantly more likely to report other substances as their primary substance ( $p = .034$ ). Further, bisexual women were more likely to indicate being former attenders of mutual help groups ( $p = .040$ ).

4.3. Psychosocial factors

Overall, bisexual individuals reported significantly worse psychosocial well-being than heterosexual individuals (Table 3). Bisexual participants reported significantly lower QOL compared to heterosexual individuals ( $p = .019$  among men,  $d = 0.32$ ;  $p = .004$  among women,  $d = 0.37$ ), greater psychological distress ( $p = .006$  among men,  $d = 0.51$ ;  $p < .001$  among women,  $d = 0.60$ ), lower happiness levels ( $p = .006$  among men,  $d = 0.41$ ;  $p = .001$  among women,  $d = 0.50$ ), and lower self-esteem ( $p < .001$  among men ( $d = 0.49$ ) and women ( $d = 0.48$ ). Additionally, when we compared monosexual (gay/lesbian) to bisexual participants,



**Table 3**  
Psychosocial Factors.

	Heterosexual REFERENCE	Gay	Bisexual
<b>Men, n(%)</b>	987 (87.99)	91 (8.13)	43 (3.88)
Comfort level disclosing AOD History M(SE)			
To Family	3.99 (0.06)	3.93 (0.21)	3.63 (0.33)
To Friends	3.82 (0.07)	4.11 (0.17)	3.41 (0.33)
To Co-workers	3.25 (0.08)	3.07 (0.24)	2.54 (0.38)
To Someone Meeting for the First Time	2.74 (0.07)	2.67 (0.22)	1.99 (0.36)*
In a Public Setting	2.67 (0.07)	2.62 (0.22)	2.18 (0.29)
In the Media	2.41 (0.07)	2.34 (0.24)	1.8 (0.26)*
Quality of Life, M(SE)	29.97 (0.32)	28.99 (1.08)	27.11 (1.17)
Psychological Distress, M (SE)	4.18 (0.24)	4.60 (0.78) <sup>a</sup>	9.17 (1.78)
Happiness, M (SE)	3.78 (0.05)	3.84 (0.16)	3.17 (0.21)
Self-Esteem, M (SE)	3.64 (0.05)	3.49 (0.17)	2.93 (0.20)
Recovery Capital, M (SE)	47.27 (0.48)	46.39 (1.66)	44.61 (1.79)
<b>Women, n(%)</b>	679 (90.62)	27 (3.64)	43 (5.74)
Comfort level disclosing AOD History M(SE)			
To Family	3.74 (0.08)	3.24 (0.55)	3.49 (0.22)
To Friends	3.77 (0.07)	3.3 (0.55)	3.52 (0.22)
To Co-workers	2.73 (0.08)	2.89 (0.51)	2.61 (0.20)
To Someone Meeting for the First Time	2.35 (0.08)	2.89 (0.40)	2.42 (0.23)
In a Public Setting	2.34 (0.08)	2.71 (0.34)	2.41 (0.20)
In the Media	2.13 (0.08)	2.48 (0.37)	2.12 (0.22)
Quality of Life, M(SE)	28.54 (0.36)	27.12 (2.87)	25.6 (0.97)
Psychological Distress, M (SE)	5.21 (0.28)	6.55 (2.05)	9.35 (0.99)
Happiness, M (SE)	3.76 (0.04)	3.66 (0.31)	3.25 (0.15)
Self-Esteem, M (SE)	3.39 (0.06)	3.34 (0.35)	2.73 (0.18)
Recovery Capital, M (SE)	46.83 (0.55)	43.27 (3.68)	42.06 (1.53)

\*  $p \leq 0.05$ . \*\*  $p \leq 0.01$ . \*\*\*  $p \leq 0.001$ .

n(%), sample percentage.

AOD, Alcohol and Other Drug Use Disorder.

M, mean.

SE, standard error.

<sup>a</sup> significant difference between monosexual SM (gay/lesbian) and bisexual responses.

we only identified one significant differences among men but none among women. Specifically, bisexual men were more likely to report psychological distress than monosexual gay men ( $p = .040$ ).

In ancillary multivariate models, which controlled for age, psychiatric diagnosis, and years since AOD problem was resolved, results remained consistent except for years since AOD problem resolution was no longer significant after adjusting for age and psychiatric diagnosis.

Broadly, we found no differences by sexual identity related to comfort level disclosing AOD history to family, friends, co-workers, or in a public setting. However, several differences by sexual identity among men existed. Specifically, bisexual men reported less comfort disclosing to someone they are meeting for the first time ( $p = .040$ ) or in media ( $p$

$= .025$ ) relative to heterosexual men, yet these differences were not found among women. Additionally, bisexual women reported less recovery capital ( $p = .003$ ) than heterosexual women, which was not present among men.

In ancillary multivariate models, which controlled for age, psychiatric diagnosis, and years since AOD problem was resolved, results differed by gender. Among men, the associations between sexual identity and the disclosure variables, quality of life, and happiness were no longer significant in the adjusted models. However, psychological distress and self-esteem remained significantly different between bisexual and heterosexual participants. Among women, the associations between sexual identity and quality of life and recovery capital were no longer significant. The relationship between sexual identity and psychological distress, happiness, and self-esteem remained significant.

## 5. Discussion

This nationally representative sample of US adults with resolved AOD use disorders, revealed differences between SM and heterosexual individuals' socio-demographic characteristics, substance use treatment histories, and current QOL, functioning, and psychological well-being-related indices. Many of these differences are consistent with previously identified substance-use disparities among SMs compared to heterosexual individuals (Rosner et al., 2021; Schuler & Collins, 2020). Distinctly, our finding that bisexual but not monosexual SM individuals in AOD recovery reported worse psychosocial functioning compared to heterosexual individuals indicates a novel contribution to the literature. Our results suggest unmet psychosocial needs important to sustaining recovery among bisexual individuals relative to monosexual and heterosexual individuals.

As little work has investigated demographic differences among individuals in AOD recovery by sexual identity, this national investigation offers important insights. Specifically, bisexual individuals in recovery were significantly younger than their heterosexual counterparts, potentially indicative of the earlier onset of AOD disorders (Talley et al., 2019). Consistent with other recent findings, gay men faced greater likelihood of unemployment than heterosexual men, and gay/lesbian women were more likely to have been arrested than heterosexual women (Schuler et al., 2020). Additional research is needed to confirm the robustness of these findings across larger samples of SM individuals in AOD use recovery to further contextualize and confirm the magnitude of these observed differences, investigate causal relationships, and to facilitate better recovery support services for specific SM sub-groups.

Despite few differences in recovery-service use between heterosexual and SM individuals, bisexual men were less likely to have recently attended mutual help services than heterosexual men. Mutual-help participation has helped SM individuals (McGeough et al., 2021), but there are multiple factors that influence participation among this population and more research is needed in this regard. While the sub-group sample sizes were small and caution should be taken inferring from these findings, it is possible that observed differences may be attributable to facilitator- or other-member-catalyzed biphobia or monosexism. Additional research is needed to confirm the robustness of these estimates and better understand root causes.

Our most notable findings showed consistently worse current life quality, functioning, and psychological well-being outcomes among bisexual but not gay individuals, compared to heterosexual individuals. Specifically, bisexual individuals reported significantly lower current QOL, happiness, and self-esteem, and significantly higher distress than heterosexual individuals. While some of these findings were no longer significant in models that adjusted for age, psychiatric diagnoses, and years in recovery, many of these findings remained indicating differences in the adjusted variables did not fully account for these differences. Together, these results suggest potentially significant unmet recovery needs among bisexual individuals. These findings may be related to the higher proportions of AOD use disorders among bisexual

individuals, consequential to not only sexual-minority stress and discrimination from heterosexual individuals but also “monosexism” (the belief that one can or should only be attracted to one gender/sex) and bi-negativity (negative attitudes toward bisexuality) from monosexual gay/lesbian and heterosexual communities (Dyar & Feinstein, 2018). Minority stress theory and the psychological mediation framework suggest that unique stigmatized-identity-related stressors, such as monosexism, can lead to poorer mental health and subsequent maladaptive coping strategies, including AOD use (Hatzenbuehler, 2009; Meyer, 2003). Additional research is needed to improve existing recovery services to better meet bisexual needs.

## 6. Limitations

The study has several limitations. Primarily, the results report alcohol, cannabis, opioid, and other as primary substance response options, precluding differentiation of stimulants from other drugs (e.g., GHB, benzodiazepines, etc.). Further, the survey was not designed specifically to investigate SM disparities. Thus, it did not include gender categories consistent with current guidelines (National Institutes of Health, 2023) in the response options for assessing gender identity, but rather included sex-based terms (male and female). Moreover, many relevant mechanistic variables thought to drive AOD use and treatment utilization disparities among SMs (e.g., minority stressors, trauma) (Hatzenbuehler, 2009; Hawn et al., 2020; Meyer, 2003; Smith et al., 2016; Stangl et al., 2019) were also not examined. Also, although the sample was large and we could explore monosexual and bisexual SM-participant differences compared to heterosexual individuals and comparisons between gay/lesbian and bisexual individuals, sample sizes within these sub-groups were nevertheless quite small; thus, reliability and robustness of these results needs confirmation in future research. Approximately 7 % of the sample was missing sexual-identity responses, potentially underestimating the SM-population size. The proportion of missing data were relatively low across other variables (<3%) except for age of regular substance use onset (15.9 % missing) and primary substance (11.3 %). Additionally, it is possible that several of the significant relations found at  $p < .05$  level are spurious, having emerged by chance due to repeat testing. Further research should be conducted to replicate and further characterize the associations identified in this exploratory analysis.

## 7. Conclusion

Noting these limitations, we conclude these findings suggest demographic and psychosocial differences across important SM sub-categories among people in AOD use recovery. While more work is needed to better contextualize and understand observed differences herein, our results indicate a pattern suggesting AOD use-recovering bisexual individuals experience lower QOL, functioning, and psychological well-being, possibly reflecting unmet psychosocial needs. Such implications suggest a need for concerted efforts to facilitate and support recovery among bisexual people with histories of AOD use disorder. Given the identified differences between monosexual SM and bisexual individuals in this sample, support services that are explicitly inclusive of bisexual people, including expansion and evaluation of the existing supports serving SM people more broadly, may be needed to increase the likelihood of ongoing recovery and enhanced psychosocial wellbeing among all SM people in recovery.

## Disclaimer

The content of this work is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. The NIH had no role in study design, data collection and analysis, decision to publish, or preparation of the article.

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## CRediT authorship contribution statement

**Abigail W. Batchelder:** Conceptualization, Methodology, Resources, Supervision. **M. Claire Greene:** Data curation, Formal analysis, Methodology, Visualization. **Jillian R. Scheer:** Conceptualization, Writing – review & editing. **Jacklyn Foley:** Writing – original draft, Writing – review & editing. **Hyo Jin Jenny Shin:** Visualization. **Kyrié M. Koehn:** Writing – original draft, Writing – review & editing. **John F. Kelly:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data will be made available on request.

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