



# Syndemic conditions associated with hazardous alcohol consumption among sexual minority men in San Francisco

Thye Peng Ngo<sup>a,b,\*</sup>, Taylor Cuffaro<sup>c</sup>, Glenn-Milo Santos<sup>c,d,e</sup>

<sup>a</sup> National Clinician Scholars Program at University of California, San Francisco, San Francisco, CA, United States

<sup>b</sup> San Francisco Veterans Affairs Health Care System, San Francisco, CA, United States

<sup>c</sup> School of Nursing, University of California, San Francisco, San Francisco, CA, United States

<sup>d</sup> Division of Prevention Science, School of Medicine, University of California, San Francisco, CA, United States

<sup>e</sup> Center for Public Health Research, San Francisco Department of Public Health, San Francisco, CA, United States

## HIGHLIGHTS

- Syndemic conditions significantly increase the risk of hazardous alcohol consumption.
- Odds of hazardous drinking rise with the number of syndemic conditions among sexual minority men (SMM).
- Depression, HIV/STI, and houselessness strongly predict hazardous alcohol use.

## ARTICLE INFO

### Keywords:

Hazardous alcohol consumption

Syndemic conditions

Sexual minority men

## ABSTRACT

**Background:** Hazardous alcohol consumption (HAC) is prevalent among sexual minority men (SMM). Using syndemic theory, this study aimed to identify the number of syndemic conditions, including their combinations, and their association with HAC among SMM in San Francisco.

**Method:** We conducted a secondary analysis of cross-sectional data from 246 SMM who consume alcohol. Syndemic factors included multiple substance use, depressive symptoms, HIV/STI status, and houselessness. We conducted a multivariable logistic regression to estimate the odds of HAC associated with increasing syndemic conditions. We further examined which combinations of three syndemic factors were associated with the highest odds for HAC.

**Results:** The average age was 40.7; participants were predominantly White (33.3 %) and Black/African American (29.7 %) and graduated from high school (92.7 %). The prevalence of HAC increased with the number of syndemic conditions: 13.6 % with none, 30.9 % with one, 51.9 % with two, 65.1 % with three, and 69.2 % with four conditions. A significant log-linear trend was observed, with two syndemic conditions increasing the odds of HAC over fivefold (AOR=5.05, 95 % CI=1.68–15.15), and three and four syndemic conditions increasing the odds by more than eightfold (AOR=8.82, 95 % CI=2.74–28.39; AOR=8.55, 95 % CI=2.26–32.28). The combination of depressive symptoms, HIV/STI status, and houselessness tripled the odds for HAC (OR=3.07, 95 % CI=1.34–7.04).

**Conclusion:** HAC was associated with increasing syndemics, and specific conditions (depression, HIV/STI, and houselessness) had the greatest odds of HAC. These findings underscore the need for comprehensive screening and integrated interventions targeting these co-occurring conditions to reduce HAC in this population.

## 1. Introduction

Hazardous alcohol consumption (HAC) is prevalent among sexual minority men (SMM), especially among racial and ethnic minorities

(Pérez-Romero et al., 2022; Santos et al., 2018; Wilkerson et al., 2020).

The National Survey on Drug Use and Health survey revealed that, in 2020, around 21.8 % of adults identifying as sexual minorities reported having an alcohol use disorder within the past year (Substance Abuse

\* Correspondence to: National Clinician Scholars Program at UCSF and San Francisco Veterans Affairs Health Care System, Mission Bay Campus Valley Tower, 490 Illinois Street, Floor 7, San Francisco, CA 94158, United States.

E-mail address: [ThyePeng.Ngo@ucsf.edu](mailto:ThyePeng.Ngo@ucsf.edu) (T.P. Ngo).

<https://doi.org/10.1016/j.dadr.2024.100297>

Received 31 October 2024; Accepted 1 November 2024

Available online 6 November 2024

2772-7246/Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

and Mental Health Services Administration SAMHSA, 2022). This figure contrasts with the 11.0 % prevalence observed within the general population (SAMHSA, 2021). Besides biological influences, such as age and sex, research on alcohol-related issues specific to sexual and gender minorities are influenced by their psychosocial (e.g., minority stress, drinking norms, and victimization) and environmental factors (e.g., societal attitudes and discriminatory policies) (Hughes et al., 2016). This significant disparity highlights the urgency of addressing the unique factors associated with higher rates of HAC among SMM.

The ramifications of HAC extend beyond individual health, impacting social and economic welfare among SMM. Studies have linked HAC to various adverse social outcomes, including engaging in condomless sex (Allen et al., 2015; Kahler et al., 2015; Shuper et al., 2017), having multiple sex partners (Daniels et al., 2018; Liu et al., 2016), and engaging in group sexual encounters (Grov et al., 2013; Phillips et al., 2015), increasing risk for HIV and STI transmissions among SMM. Moreover, research indicates a significant association between HAC and higher rates of incarceration among Black and Brown SMM (Zaller et al., 2017), and increased HAC observed following release from incarceration (Feelemyer et al., 2020). Additionally, the economic impact is also profound, with HAC linked to escalated healthcare expenses, diminished workforce productivity, and criminal activities, with an estimated cost of \$249 billion to the United States economy in 2010 alone (Sacks et al., 2015).

Syndemic theory, first proposed by Singer (2009), provides a framework to examine how interlinked biopsychosocial conditions are intensified by social, economic, and environmental inequities, particularly within marginalized and vulnerable communities, leading to pronounced health disparities. Although the literature using syndemic theory for HIV outcomes is extensive, syndemic studies on HAC outcomes among SMM remain scarce (Ouafik et al., 2022).

Martinez et al. (2016) examined the associations between syndemic factors—such as depression, intimate partner violence, and childhood sexual abuse—and high-risk alcohol consumption (i.e., binge and heavy drinking) among Latino men and Latina transgender women. However, their study did not fully address the risks of hazardous alcohol consumption (HAC), which goes beyond episodic heavy drinking patterns. Furthermore, although current guidelines recommend brief screening tools, such as the Single Alcohol Screening Question (SASQ) or Alcohol Use Disorders Identification Test-Consumption (AUDIT-C), the US Preventive Services Task Force (2018) suggests using more comprehensive instrument like the full AUDIT after initial screening to capture the specificity on alcohol consumption. Given the high prevalence of alcohol use and use disorder in SMM (Fish and Exten, 2020), utilizing comprehensive screening tools, such as AUDIT or AUDIT-C, may capture the full spectrum of alcohol consumption.

Despite the availability of screening tools and growing awareness of high alcohol use in SMM, knowledge about syndemic factors associated with HAC in this population is limited. Therefore, this study addresses this gap by exploring syndemic factors and their associations with HAC among SMM who consume alcohol and providing evidence to inform clinical practice and public health strategies for this population.

This study examined the syndemic conditions associated with HAC among SMM who consume alcohol in San Francisco. The research aimed to (1) determine syndemic conditions associated with higher likelihood of HAC among SMM, (2) examine whether the greater number of syndemic factors is associated with increased odds of HAC among SMM, and (3) identify which three combined syndemic factors are most significantly associated with HAC among SMM.

## 2. Methods

### 2.1. Primary study

Data for this study were drawn from a primary study, “The SEEDS Study,” which examined heavy alcohol use patterns among SMM (Santos

et al., 2018).

#### 2.1.1. Participants and recruitment

The participants were 252 SMM using respondent-driven sampling, in which 24 participants (“seeds”) initiated the peer recruitment within their network. The seed participants were instructed to recruit up to five additional participants, who were then instructed to recruit another wave of participants until the desired sample size and equilibrium of critical variables were achieved. The eligibility criteria were (1) male sex at birth or current gender identity, (2) 18 years or older, (3) living in the San Francisco Bay Area, (4) having sex with at least one man in the past year, and (5) consuming alcohol in the past year. Informed consent was obtained after participants met the eligibility criteria and the University of California San Francisco institutional review board approved this study (IRB approval number # 14-14481).

#### 2.1.2. Data collection

The data was collected between March 2015 and July 2017. Participants completed an audio computer-assisted self-interview behavioral survey, which lasted approximately 30 minutes. The survey consisted of questions related to the participants’ demographics and socio-behavioral measures, including alcohol consumption, substance use, depressive symptoms, and sexual risk behaviors. Additional details regarding the primary study procedures and results have been presented previously (Santos et al., 2018).

### 2.2. Secondary study

#### 2.2.1. Outcome measure

HAC was measured by the 10-item Alcohol Use Disorders Identification Test (AUDIT) scores, which were calculated and dichotomized based on a cutoff of 16, indicating mid to high levels of hazardous drinking (Zones III and IV) (Babor et al., 2001). We excluded six missing data on HAC, resulting in 246 SMM who consumed alcohol in our final analysis.

#### 2.2.2. Syndemic variables

The syndemics of interest were conditions previously associated with HAC risk among SMM, including multiple substance use (Daly et al., 2021; Santos et al., 2018), positive clinical depressive symptoms (Daly et al., 2021; Marshall, Shoveller, et al., 2015), positive HIV or STI status (Sandfort et al., 2017; Santos et al., 2018), and homelessness or unstable housing (Marshall, Operario, et al., 2015).

**2.2.2.1. Multiple substance use.** Following the Centers for Disease Control and Prevention’s definition (2022), we defined multiple substance use as using more than one injection or non-injection substance at least once per week for each substance for the past six months. These substances included tobacco (cigarettes or e-cigarettes), stimulants (cocaine, methamphetamines, ecstasy), depressants (heroin, opioid, benzodiazepine), hallucinogens, cannabis (marijuana), and club drugs (gamma-hydroxybutyrate, ketamine).

**2.2.2.2. Clinically depressive symptoms.** The depressive symptoms were measured by the Center for Epidemiologic Studies Depression Scale (CES-D), which ranges from 0 to 60, with cutoff scores of 16 and higher indicating an individual is at risk for clinical depression (Lewinsohn et al., 1997; Radloff, 1977).

**2.2.2.3. Positive HIV or STI.** HIV status and sexually transmitted infection (STI) status were self-reported by participants. HIV status was dichotomized as positive or negative, and sexual transmitted illness (STI) status was dichotomized as having or not having STI in the past six months with self-report of chlamydia, gonorrhea, syphilis, and herpes.

**2.2.2.4. Houselessness.** Although the U.S. Department of Housing and Urban Development (HUD) uses the term “homelessness” (n.d.), we adopted the term “houselessness” in this study to emphasize the lack of stable housing. Participants self-reported their housing status, which included living on the street, in a shelter, or in a single-room occupancy hotel. We dichotomized houselessness, based on HUD’s definition of homelessness (n.d.), as being unhoused or unstably housed currently or in the past six months versus otherwise.

### 2.2.3. Analysis

We analyzed all data using STATA, v18 (StataCorp, 2023). We first examined the prevalence of HAC based on the number of syndemic conditions. We constructed a cumulative syndemic variable, which we divided into four categories: zero (0), one (1), two (2), three (3), and four (4) syndemic conditions. Individuals with no syndemic conditions (0) served as the reference group for comparison. Using multivariable logistic regression, we estimated the odds for HAC associated with the number of syndemics, controlling for age, race/ethnicity, and education.

We evaluated the log-linear trend to assess the dose-response relationship between the number of syndemics and HAC. Deviations from the log-linear trend were explored using orthogonal contrasts to check for a potential quadratic relationship among categories, under the assumption that these categories were uniformly distributed. Bonferroni-adjusted 95 % confidence intervals and p-values were computed for all primary analyses to control the risk of type I error due to multiple comparisons.

In the exploratory analyses, we examined the associations between various combinations of three specific syndemic conditions, compared to having none of those combinations, and HAC. The objective was to identify triads of syndemic conditions that, when co-occurring, might elevate the risk of HAC, consistent with syndemic theory. We generated four combinations of syndemics: (1) multiple substance use, depressive symptoms, and HIV/STI status; (2) multiple substance use, depressive symptoms, and houselessness; (3) multiple substance use, HIV/STI status, and houselessness; and (4) depressive symptoms, HIV/STI status, and houselessness. For each combination, individuals who did not experience that specific combination of three syndemic conditions were used as the comparison group. Using multivariable logistic regression, we estimated the odds of HAC for each syndemic combination, controlling for age, race/ethnicity, and education. Because of the potential of no observations or cases in the dataset for a particular combination, we used ‘firthlogit’ in STATA to ensure the model converges to finite estimates (Firth, 1993; Heinze and Schemper, 2002).

## 3. Results

### 3.1. Participant characteristics

As shown in Table 1, the average age was 40.7 years, ranging from 19 to 67 years, with the largest group identified as White (33.3 %), followed by Black/African American (29.7 %), Hispanic/Latino (15.5 %), and Asian/Pacific Islander (13.4 %). Most participants had completed high school (92.7 %), reported being single (62.6 %), reported an annual income of less than \$75,000 (78.6 %), had health insurance (91.6 %), and had visited a healthcare provider in the past six months (87.4 %).

Alcohol consumption among SMM was prevalent, with 37.4 % consuming alcohol two to three times a week, and 39.4 % did so four or more times a week. Similarly, binge drinking was also common, with almost half of the participants (46.4 %) binge drinking at least weekly. Nearly one-fifth (19.9 %) had been hospitalized for alcohol-related issues, and 32.9 % had received alcohol-related treatment in the past. Based on the AUDIT scores, 42.2 % reported moderate to severe hazardous alcohol consumption (HAC).

Syndemic conditions within the population indicated a high prevalence of substance use, with 43.1 % using cannabis, 41.1 % using

**Table 1**

Participant characteristics, alcohol consumption patterns, and syndemic conditions among sexual minority men in San Francisco (N = 246).

Characteristics	N (%) or Mean (SD, range)
<b>Demographic</b>	
Age	40.7 (12.21, 19–67)
Race/ethnicity	
Asian/Pacific Islander	33 (13.4 %)
Black/African American	73 (29.7 %)
Hispanic/Latino	38 (15.5 %)
White	82 (33.3 %)
Mixed/Other	20 (8.1 %)
Education	
No high school diploma	18 (7.3 %)
High school diploma	51 (20.8 %)
Associate degree	82 (33.5 %)
Bachelor’s degree	61 (24.9 %)
Post-bachelor’s degree	33 (13.5 %)
Relationship	
Single	154 (62.6 %)
In a relationship	84 (34.2 %)
Other	8 (3.3 %)
Income (prior year)	
< \$75,000	187 (78.6 %)
≥ \$75,000	51 (21.4 %)
Declined to respond	8 (3.3 %)
Have health insurance	217 (91.6 %)
Visited healthcare provider past 6 months	214 (87.4 %)
<b>Alcohol Consumption and Treatment</b>	
Alcohol consumption (prior 12 months)	
Monthly or less	14 (5.7 %)
2–4 times a month	43 (17.5 %)
2–3 times a week	92 (37.4 %)
4 or more times a week	97 (39.4 %)
Binge drinking on one occasion	
Never	28 (11.4 %)
Less than monthly	58 (23.6 %)
Monthly	46 (18.7 %)
Weekly	75 (30.5 %)
Daily or almost daily	39 (15.9 %)
Hospitalized for alcohol-related issues in the past	49 (19.9 %)
Received alcohol-related treatment in the past	81 (32.9 %)
AUDIT categories	
Zone 1 (0–7)	46 (18.7 %)
Zone 2 (8–15)	96 (39.0 %)
Zone 3 (16–19)	36 (14.6 %)
Zone 4 (20–40)	68 (27.6 %)
<b>Outcome Variable</b>	
Hazardous alcohol consumption (HAC)*	104 (42.3 %)
<b>Syndemic Conditions</b>	
Substance use (at least once a week in prior 6 months)	
Tobacco or e-cigarettes	101 (41.1 %)
Stimulants	76 (30.9 %)
Depressants	29 (11.8 %)
Hallucinogens	4 (1.6 %)
Cannabis	106 (43.1 %)
Club drugs	13 (5.3 %)
Used two or more substances	99 (40.2 %)
Clinically significant depressive symptoms (past week)**	122 (49.6 %)
Sexual health	
HIV positive	68 (27.6 %)
STI positive (prior 6 months)	57 (23.2 %)
HIV or STI positive	106 (43.1 %)
Houselessness***	
Ever unhoused or unstably housed (prior 6 months)	91 (37.1 %)
Currently unhoused or unstably housed	69 (28.2 %)

\*Based on the 10-item Alcohol Use Disorders Identification Test (AUDIT) scores ≥16.

\*\*Based on the Center for Epidemiologic Studies Depression Scale (CES-D) scores ≥ 16.

\*\*\*Based on the US Department of Housing and Urban Development’s definition of homelessness.

tobacco and e-cigarettes, and 40.2 % using at least two or more substances (i.e., multiple substance use) at least once a week in the prior six months. Nearly half of the participants (49.6 %) reported clinically significant depressive symptoms in the past week. Concerning sexual health, 27.6 % and 23.2 % reported HIV and STI positive, respectively. Houselessness was also significant, with 37.1 % reported being unhoused at some point in the previous six months, and 28.2 % reported currently being unhoused.

3.2. Associations between syndemic conditions and hazardous alcohol consumption

Table 2 delineates the associations between syndemic conditions and hazardous alcohol consumption (HAC) among SMM who consume alcohol. Unadjusted analysis showed that the odds of HAC were significantly higher among SMM who used multiple substances (Unadjusted Odds Ratio [UOR]=3.60, 95 % Confidence Interval [CI]=2.11–6.15), experienced clinically depressive symptoms (UOR=3.31, 95 % CI=1.95–5.63), and experienced houselessness (UOR=3.30, 95 % CI=1.93–5.67). However, after adjusting for demographic variables such as age, race/ethnicity, and education, the odds ratios for multiple substance use and clinical depressive symptoms were slightly attenuated (AOR=3.04, 95 % CI=1.61–5.76 and AOR=2.30, 95 % CI=1.23–4.32, respectively). The most notable reduction in these effect estimates happened when education was accounted for in the adjusted model, respectively. The association between houselessness and HAC was no longer significant after the adjustment (AOR=1.26, 95 % CI=0.65–2.44). Similarly, education resulted in the most significant change in the effect of association.

3.3. Prevalence and associations on the number of syndemic conditions and hazardous alcohol consumption

The prevalence of HAC increased with the number of syndemic conditions (Table 3). Among those with no syndemic conditions, 13.6 % reported HAC, while for those with one, two, three, and four syndemic conditions, the prevalence increased to 30.9 %, 51.9 %, 65.1 %, and 69.2 %, respectively. Multivariable logistic regression analysis revealed notable associations between the number of syndemic conditions and HAC. Individuals with two syndemic conditions had an increased odds of HAC by more than fivefold (AOR=5.05, 95 % CI=1.68–15.15,  $p=0.005$ ) than those with no syndemic conditions. This association strengthened as the number of syndemic conditions increased, with individuals experiencing three syndemic conditions (AOR=8.82, 95 % CI=2.74–28.39,  $p<0.001$ ) and four syndemic conditions (AOR=8.55, 95 % CI=2.26–32.28,  $p=0.002$ ) showing even higher odds of HAC by more than eightfold.

Table 2

The associations between syndemic conditions and hazardous alcohol consumption among sexual minority men in San Francisco (N = 246).

Syndemic Conditions	Unadjusted Odds Ratio (95 % CI)	Adjusted Odds Ratio (95 % CI) <sup>†</sup>
Multiple substance use (at least once a week in prior month)	3.60 (2.11–6.15)	3.04 (1.61–5.76)
Clinical depressive symptoms (past week)	3.31 (1.95–5.63)	2.30 (1.23–4.32)
HIV or STI positive (prior 6 month)	1.52 (0.91–2.54)	1.05 (0.59–1.90)
Houselessness (prior 6 month)	3.30 (1.93–5.67)	1.26 (0.65–2.44)

<sup>†</sup>Adjusting for age, race/ethnicity, and education  
CI: Confidence interval

Table 3

Prevalence and associations on the number of syndemic conditions and hazardous alcohol consumption among sexual minority men in San Francisco (N = 246).

Number of syndemic conditions <sup>a</sup>	Prevalence of hazardous alcohol consumption		Multivariable logistic regression on hazardous alcohol consumption	
	No (%)	Yes (%)	AOR <sup>‡</sup> , 95 % CI <sup>†</sup>	p-value <sup>‡</sup>
None (n = 44)	38 (86.4)	6 (13.6)	1.00 (ref)	–
One (n = 81)	56 (69.1)	25 (30.9)	2.24 (0.80–6.30)	0.146
Two (n = 52)	25 (48.1)	27 (51.9)	5.05 (1.68–15.15)	0.005
Three (n = 43)	15 (34.9)	28 (65.1)	8.82 (2.74–28.39)	< 0.001
Four (n = 26)	8 (30.8)	18 (69.2)	8.55 (2.26–32.28)	0.002

<sup>†</sup>Adjusted OR, controlling for age, race, and education.  
<sup>‡</sup>Evidence of linearly increasing relationship (test of log-linear trend, p-value = 0.007); no evidence of departures from log-linear trend (test for quadratic trend, p-value = 0.212).  
<sup>‡</sup>Bonferroni-adjusted.  
<sup>a</sup> Conditions included were polysubstance use, clinically significant depressive symptoms, positive HIV or STI, and houselessness or unstable housing.

3.4. Associations between combinations of syndemics and hazardous alcohol consumption

The analysis of specific syndemic combinations indicated elevated odds for HAC (Table 4). Notably, the trio of clinically depressive symptoms, HIV or STI positive, and experiencing houselessness were positively associated with the highest increased odds for HAC by more than threefold (AOR=3.07, 95 % CI=1.34–7.04,  $p=0.008$ ). The second most significant combination, namely multiple substance use, clinically depressive symptoms, and experiencing houselessness, was associated with an increased odds for HAC by 2.5-fold (AOR=2.51, 95 % CI=1.19–5.32,  $p=0.016$ ).

4. Discussion

This study elucidates the intricate relationships between syndemic conditions and HAC among SMM who consume alcohol in San Francisco. The elevated odds of HAC with increasing syndemic conditions underscore the compounding effect of these risk factors. Our finding supports existing literature that a greater number of syndemic conditions contribute to a higher risk of adverse health outcomes among SMM (e.g., HIV diagnosis) (Ouafig et al., 2022). Our study focuses on HAC as an outcome, which is consistent with Martinez et al.'s (2016) study that found three or more syndemic factors were associated with heavy drinking among Latino SMM and transgender women. Although their syndemic conditions were different from our study (e.g., childhood sexual abuse, intimate partner violence, and discrimination), the additive effect of psychosocial factors on HAC remains evident.

Table 4

Associations between combined syndemic conditions and risk for hazardous alcohol consumption<sup>a</sup>.

Combined Syndemics	Odds Ratio (OR)	95 % Confidence Interval (CI)	P-value
Combo1: S1, S2, S3	2.24	1.03–4.91	0.045
Combo2: S1, S2, S4	2.51	1.19–5.32	0.016
Combo3: S1, S3, S4	2.10	0.88–4.97	0.093
Combo4: S2, S3, S4	3.07	1.34–7.04	0.008

S1: Multiple substance use; S2: Clinically depressive symptoms; S3: HIV or STI positive; S4: Houselessness  
<sup>a</sup> Adjusted for age, race, and education.



In our study, the combination of clinically depressive symptoms, HIV or STI status, and experiencing houselessness emerged as particularly indicative of high risk for HAC. However, given the overlap in the confidence intervals for the top combinations, it is important to interpret these findings with caution. While this combination (i.e., depression, HIV/STI, and houselessness [Combo 4]) showed the highest significant association with HAC, other combinations might also present similar levels of risk (e.g., multiple substance use, depression, and HIV/STI [Combo 1]). Regardless, our finding expands on the literature that HAC among SMM is influenced independently by each syndemic condition listed above (Daly et al., 2021; Marshall, Operario, et al., 2015; Marshall, Shoveller, et al., 2015; Sandfort et al., 2017; Santos et al., 2018). For example, a recent scoping review found stressors, such as HIV status and insufficient resources for housing and food, are associated with a higher risk of psychosocial distress (e.g., depression) and subsequently lead to increased risky behaviors (e.g., alcohol and substance use) among SMM (Payton et al., 2024). The combination of the syndemic conditions in our study also supports the framework that involves multiple factorial levels that contribute to alcohol and other substance use disorders (Nydegger and Claborn, 2020), suggesting a critical nexus of individual, social, and structural factors that warrant multilevel public health interventions (Operario et al., 2022).

Additionally, our findings indicate that using multiple substances and experiencing clinical depressive symptoms increase the likelihood of HAC by more than twofold after adjusting for demographics and other covariates. Our study supports the literature on the co-use of multiple substances among sexual and gender minorities, including alcohol, is common (Goodwin et al., 2022), as well as the co-occurrence of substance use and mental health disorders (Bränström and Pachankis, 2018). Depressive symptoms also contribute to alcohol misuse among sexual and gender minorities, which potentially mediate the relationship between life stressors (e.g., discrimination or victimization) and alcohol use (Talley et al., 2016). Specific to sexual minority women, Hughes et al. (2020) found that depression was linked to higher rates of HAC and other drug use, and HAC was prospectively associated with depression, suggesting a complex bidirectional relationship between alcohol use and mental health in this population. However, we did not find studies related to multiple substance use and depression in relation to HAC among SMM, which warrants further investigation into these associations.

Although our results initially showed strong associations between experiencing houselessness and HAC, these relationships were no longer associated when adjusting for demographic variables. Our finding is consistent with a prior study by Marshall et al. (2015), who reported that while experiencing homelessness was initially associated with HAC among Veterans identified as SMM, the association was no longer significant after adjusting for demographic factors. Despite many participants reporting houselessness, 91.6 % had healthcare insurance. Our results align with recent findings that 83 % of unhoused individuals in California have insurance coverage, primarily through Medi-Cal or Medicare, though nearly a quarter still face challenges in accessing healthcare (Chen et al., 2024; Kushel et al., 2024). Furthermore, HAC is significantly more prevalent among unhoused sexual minority youths compared to housed sexual minority youths and unhoused heterosexual youths (Deal and Gonzales, 2023). The increased prevalence may be due to reduced healthcare access and inconsistent treatment of substance use disorders (Blume, 2016; Lund and Burgess, 2021).

Although HIV and STI are not significantly associated with HAC in our study, the literature shows that HAC increases the risk for HIV transmission and infection, mainly due to risky sexual behaviors (Williams et al., 2016), including sexual minority men (Hess et al., 2015). For example, Black and Latino SMM who reported HAC were more likely to engage in condomless insertive anal intercourse compared to those reported otherwise (Washington et al., 2017). However, our result resonates with a study that found no significant differences in HIV infection on HAC among SMM, even though engaging

in high-risk sexual behaviors (e.g., having multiple sexual partners and inconsistent condom use) increases the odds of HAC in this population (Wirtz et al., 2016).

#### 4.1. Limitations and future studies

We acknowledge that our small sample size may potentially limit the statistical power of this study. Additionally, the cross-sectional nature of the study design limits the ability to infer causality or observe how these syndemic conditions interact over time. Longitudinal studies would be valuable in observing the progression of these conditions and their cumulative impact on HAC over time. Furthermore, since the study was conducted in San Francisco, the findings may not be generalizable to SMM populations in different geographical locations. Therefore, repeated studies using the same syndemic factors in multiple locations are warranted. Also, the use of respondent-driven sampling could have contributed to clustering of participants with similar characteristics, including syndemic conditions, as recruitment may have reflected participants' social networks. This limitation may overrepresent certain subgroups, and future studies should aim to address this limitation through alternative sampling methods.

Lastly, we recommend using qualitative and mixed methods to gain deeper insights into the lived experiences of SMM and explore the protective and resilience factors that mitigate the risk of HAC among racial and ethnic minorities. Future work should also consider integrating other theoretical frameworks to explore syndemic conditions that intersect with HAC among SMM, including the minority stress model (Meyer, 2003), intersectionality framework (Bowleg, 2012), and intersectional stigma (Ogunbajo et al., 2022). Exploring syndemic conditions beyond individual factors, such as structural and systemic factors (e.g., LGBTQ+ policies, social support networks, healthcare accessibility, and economic stability), can provide a more comprehensive understanding of the multifaceted influences on HAC in this population.

#### 4.2. Clinical and public health implications

Given the compounding burden of co-occurring epidemics on HAC among SMM who consume alcohol, multi-level and simultaneously targeted interventions must be utilized to inform public health policies aimed at reducing hazardous drinking behaviors in this community. At the individual level, comprehensive interventions targeting co-occurring depression and HAC should be considered, including behavioral (e.g., cognitive behavior therapy) and pharmacological interventions (e.g., antidepressants), though more robust studies are needed to provide conclusive evidence about their effectiveness, especially in the SMM population (Grant et al., 2021). Additionally, clinicians should also screen and treat co-existing HIV and STIs and prevent future infections and transmissions. For example, cognitive behavior therapy and motivational interviewing have been shown to reduce alcohol intake and risky sexual behaviors among SMM (Kahler et al., 2018; Pachankis et al., 2015).

At the interpersonal and community levels, implementing peer support programs (e.g., Alcoholics Anonymous) has been recommended for those with alcohol use disorder, as well as mental health disorders (Substance Abuse and Mental Health Services Administration, 2024; Tracy and Wallace, 2016), which may benefit both "mentors" and "mentees" in reducing alcohol intake and increasing alcohol abstinence (Tracy et al., 2012). However, it is critical to consider recovery support for SMM experiencing houselessness, especially among ethnic, racial, and sexual minority youths (Hill et al., 2022). In addition to providing housing support, utilizing contingency management through positive reinforcement (e.g., voucher or money for goods) to promote healthy behaviors (e.g., scheduling a provider visit) and reduce unhealthy ones (e.g., abstaining from drugs and alcohol) may be effective in reducing alcohol and other substance use among unhoused SMM (Reback et al., 2010).

Since structural stigma (e.g., racism and anti-LGBTQ policies) is associated with hazardous alcohol consumption (HAC) (English et al., 2021), and comprehensive policy protections for sexual minorities are linked to lower odds of HAC among SMM (Drabble et al., 2021), it is crucial to advocate for supportive state and federal policies and anti-discrimination laws to protect SMM and other sexual minorities at the societal level. Also, we need policies to control and limit the marketing of alcohol by the industry to target SMM and other sexual minorities through social media, domination of community spaces, and exploitation of the communities (e.g., sponsorship of Pride events and positioning as allies) (Whiteley et al., 2023). To effectively address HAC among SMM who consume alcohol, a multilevel, syndemic-focused approach utilizing multidisciplinary teams in both clinical and public settings may be necessary.

## 5. Conclusion

This study highlights the significant associations between multiple syndemic factors and HAC among SMM who consume alcohol in San Francisco, underscoring the importance of a multifaceted and targeted approach to public health interventions. Our findings support the syndemic framework considering the compounded effect of interrelated biopsychosocial conditions on health disparities. Additionally, it identifies which combined syndemic factors are associated with HAC among SMM, emphasizing the need to address depression, HIV or STI, and homelessness in this population. Given these results, public health strategies should address individual factors and the broader social determinants of health contributing to HAC among SMM who consume alcohol.

## CRediT authorship contribution statement

**Taylor Cuffaro:** Validation, Writing – review & editing. **Glenn-Milo Santos:** Funding acquisition, Methodology, Supervision, Validation, Writing – review & editing. **Thye Peng Ngo:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

## Declaration of Competing Interest

The authors would like to acknowledge these grants to support the work: National Institutes of Health/National Institute on Alcohol Abuse and Alcoholism (K24AA029958), National Institutes of Health (DP5OD019809), and National Institute of Nursing Research (T32NR020776).

## References

- Allen, V.C., Myers, H.F., Ray, L., 2015. The association between alcohol consumption and condom use: considering correlates of HIV risk among Black men who have sex with men. *AIDS Behav.* 19 (9), 1689–1700. <https://doi.org/10.1007/s10461-015-1075-1>.
- Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B., Monteiro, M.G., 2001. AUDIT: The alcohol use disorders identification. Test: Guidelines for use in primary health care, 2nd ed. World Health Organization (<https://www.who.int/publications-detail-redirect/WHO-MSD-MSB-01.6a>).
- Blume, A.W., 2016. Advances in substance abuse prevention and treatment interventions among racial, ethnic, and sexual minority populations. *Alcohol Res.: Curr. Rev.* 38 (1). (<https://arcr.niaaa.nih.gov/volume/38/1/advances-substance-abuse-prevention-and-treatment-interventions-among-racial-ethnic-and#article-toc4>).
- Bowleg, L., 2012. The problem with the phrase women and minorities: intersectionality—An important theoretical framework for public health. *Am. J. Public Health* 102 (7), 1267–1273. <https://doi.org/10.2105/AJPH.2012.300750>.
- Bränström, R., Pachankis, J.E., 2018. Sexual orientation disparities in the co-occurrence of substance use and psychological distress: a national population-based study (2008–2015). *Soc. Psychiatry Psychiatr. Epidemiol.* 53 (4), 403–412. <https://doi.org/10.1007/s00127-018-1491-4>.
- Centers for Disease Control and Prevention. (2022, February 23). *Polysubstance use facts. Stop Overdose.* (<https://www.cdc.gov/stopoverdose/polysubstance-use/index.html>)
- Chen, S., Fitzpatrick, A., & Beheraj, K. (2024, August 12). *San Francisco's rate of uninsured residents comes in below national average.* Axios. (<https://www.axios.com/local/san-francisco/2024/08/12/health-insurance-rates-california-bay-area>)
- Daly, F.P., O'Donnell, K., Davoren, M.P., Noone, C., Weatherburn, P., Quinlan, M., Foley, B., Igoe, D., Barrett, P.M., 2021. Potential alcohol use disorder among MSM in Ireland—Findings from the European MSM internet survey (EMIS 2017). *Drug Alcohol Depend.* 223, 1–9. <https://doi.org/10.1016/j.drugalcdep.2021.108698>.
- Daniels, J., Struthers, H., Lane, T., Maleke, K., McIntyre, J., Coates, T., 2018. Booze is the main factor that got me where I am today": alcohol use and HIV risk for MSM in rural South Africa. *AIDS Care* 30 (11), 1452–1458. <https://doi.org/10.1080/09540121.2018.1475626>.
- Deal, C., Gonzales, G., 2023. Homelessness among sexual minority youth. *Pediatrics* 152 (6), e2023062227. <https://doi.org/10.1542/peds.2023-062227>.
- Drabble, L.A., Mericle, A.A., Gómez, W., Klinger, J.L., Trocki, K.F., Karriker-Jaffe, K.J., 2021. Differential effects of state policy environments on substance use by sexual identity: findings from the 2000–2015 National Alcohol Surveys. *Ann. LGBTQ Public Popul. Health* 2 (1), 53–71. <https://doi.org/10.1891/lgbtq-2020-0029>.
- English, D., Carter, J.A., Boone, C.A., Forbes, N., Bowleg, L., Malebranche, D.J., Talan, A. J., Rendina, H.J., 2021. Intersecting structural oppression and Black sexual minority men's health. *Am. J. Prev. Med.* 60 (6), 781–791. <https://doi.org/10.1016/j.amepre.2020.12.022>.
- Feelmyer, J., Dyer, T.V., Turpin, R.E., Brewer, R.A., Hucks-Ortiz, C., van Der Mei, W.F., Cleland, C.M., Mazumdar, M., Caniglia, E.C., Geller, A., Scheidell, J.D., Feldman, J. M., Mayer, K.H., Khan, M.R., 2020. Longitudinal associations between the disruption of incarceration and community re-entry on substance use risk escalation among Black men who have sex with men: A causal analysis. *Drug Alcohol Depend.* 213, 1–19. <https://doi.org/10.1016/j.drugalcdep.2020.108123>.
- Firth, D., 1993. Bias reduction of maximum likelihood estimates. *Biometrika* 80 (1), 27–38. <https://doi.org/10.1093/biomet/80.1.27>.
- Fish, J.N., Exten, C., 2020. Sexual orientation differences in alcohol use disorder across the adult life course. *Am. J. Prev. Med.* 59 (3), 428. <https://doi.org/10.1016/j.amepre.2020.04.012>.
- Goodwin, S.R., Moskal, D., Marks, R.M., Clark, A.E., Squeglia, L.M., Roche, D.J.O., 2022. A scoping review of gender, sex and sexuality differences in polysubstance use in adolescents and adults. *Alcohol. Alcohol.* 57 (3), 292–321. <https://doi.org/10.1093/alcalc/agac006>.
- Grant, S., Azhar, G., Han, E., Booth, M., Motala, A., Larkin, J., Hempel, S., 2021. Clinical interventions for adults with comorbid alcohol use and depressive disorders: a systematic review and network meta-analysis. *PLOS Med.* 18 (10), e1003822. <https://doi.org/10.1371/journal.pmed.1003822>.
- Grov, C., Rendina, H.J., Ventuneac, A., Parsons, J.T., 2013. HIV risk in group sexual encounters: an event-level analysis from a national online survey of MSM in the U.S. *J. Sex. Med.* 10 (9), 2285–2294. <https://doi.org/10.1111/jsm.12227>.
- Heinze, G., Schemper, M., 2002. A solution to the problem of separation in logistic regression. *Stat. Med.* 21 (16), 2409–2419. <https://doi.org/10.1002/sim.1047>.
- Hess, K.L., Chavez, P.R., Kanny, D., DiNenno, E., Lansky, A., Paz-Bailey, G., 2015. Binge drinking and risky sexual behavior among HIV-negative and unknown HIV status men who have sex with men, 20 US cities. *Drug Alcohol Depend.* 147, 46–52. <https://doi.org/10.1016/j.drugalcdep.2014.12.013>.
- Hill, C., Hsu, H., Holguin, M., Morton, M., Winetrobe, H., Rice, E., 2022. An examination of housing interventions among youth experiencing homelessness: an investigation into racial/ethnic and sexual minority status. *J. Public Health* 44 (4), 834–843. <https://doi.org/10.1093/pubmed/fdab295>.
- Hughes, T.L., Veldhuis, C.B., Drabble, L.A., Wilsnack, S.C., 2020. Research on alcohol and other drug (AOD) use among sexual minority women: a global scoping review. *PLOS ONE* 15 (3), e0229869. <https://doi.org/10.1371/journal.pone.0229869>.
- Hughes, T.L., Wilsnack, S.C., Kantor, L.W., 2016. The influence of gender and sexual orientation on alcohol use and alcohol-related problems. *Alcohol Res.: Curr. Rev.* 38 (1), 121–132.
- Kahler, C.W., Pantalone, D.W., Mastroleo, N.R., Liu, T., Bove, G., Ramratnam, B., Monti, P.M., Mayer, K.H., 2018. Motivational interviewing with personalized feedback to reduce alcohol use in HIV-infected men who have sex with men: a randomized controlled trial. *J. Consult. Clin. Psychol.* 86 (8), 645–656. <https://doi.org/10.1037/ccp0000322>.
- Kahler, C.W., Wray, T.B., Pantalone, D.W., Kruijs, R.D., Mastroleo, N.R., Monti, P.M., Mayer, K.H., 2015. Daily associations between alcohol use and unprotected anal sex among heavy drinking HIV-positive men who have sex with men. *AIDS Behav.* 19 (3), 422–430. <https://doi.org/10.1007/s10461-014-0896-7>.
- Kushel, M., Moore, T., Birkmeyer, J., Dhath, Z., Duke, M., Knight, K.R., & Ponder, K.Y. (2024). *Toward a new understanding: The California Statewide Study of People Experiencing Homelessness.* UCSF Benioff Homelessness and Housing Initiative. (<https://homelessness.ucsf.edu/our-impact/studies/california-statewide-study-people-experiencing-homelessness>)
- Lewinsohn, P.M., Seeley, J.R., Roberts, R.E., Allen, N.B., 1997. Center for epidemiologic studies depression scale (CES-D) as a screening instrument for depression among community-residing older adults. *Psychol. Aging* 12 (2), 277–287. <https://doi.org/10.1037/0882-7974.12.2.277>.
- Liu, Y., Ruan, Y., Strauss, S.M., Yin, L., Liu, H., Amico, K.R., Zhang, C., Shao, Y., Qian, H.-Z., Vermund, S.H., 2016. Alcohol misuse, risky sexual behaviors, and HIV or syphilis infections among Chinese men who have sex with men. *Drug Alcohol Depend.* 168, 239–246. <https://doi.org/10.1016/j.drugalcdep.2016.09.020>.
- Lund, E.M., Burgess, C.M., 2021. Sexual and gender minority health care disparities: barriers to care and strategies to bridge the gap. *Prim. Care: Clin. Off. Pract.* 48 (2), 179–189. <https://doi.org/10.1016/j.pcp.2021.02.007>.
- Marshall, B.D.L., Operario, D., Bryant, K.J., Cook, R.L., Edelman, E.J., Gaither, J.R., Gordon, A.J., Kahler, C.W., Maisto, S.A., McGinnis, K.A., van den Berg, J.J., Zaller, N.D., Justice, A.C., Fiellin, D.A., 2015. Drinking trajectories among HIV-infected men who have sex with men: a cohort study of United States veterans. *Drug Alcohol Depend.* 148, 69–76. <https://doi.org/10.1016/j.drugalcdep.2014.12.023>.

- Marshall, B.D.L., Shoveller, J.A., Kahler, C.W., Koblin, B.A., Mayer, K.H., Mimiaga, M.J., van den Berg, J.J., Zaller, N.D., Operario, D., 2015. Heavy drinking trajectories among men who have sex with men: a longitudinal, group-based analysis. *Alcohol: Clin. Exp. Res.* 39 (2), 380–389. <https://doi.org/10.1111/acer.12631>.
- Martinez, O., Wu, E., Levine, E.C., Muñoz-Laboy, M., Spadafino, J., Dodge, B., Rhodes, S. D., López Rios, J., Ovejero, H., Moya, E.M., Baray, S.C., Carballo-Diéguez, A., Fernandez, M.I., 2016. Syndemic factors associated with drinking patterns among Latino men and Latina transgender women who have sex with men in New York City. *Addict. Res. Theory* 24 (6), 466–476. <https://doi.org/10.3109/16066359.2016.1167191>.
- Meyer, I.H., 2003. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. *Psychol. Bull.* 129 (5), 674–697. <https://doi.org/10.1037/0033-2909.129.5.674>.
- Nydegger, L.A., Claborn, K.R., 2020. Exploring patterns of substance use among highly vulnerable Black women at risk for HIV through a syndemics framework: a qualitative study. *PLOS ONE* 15 (7), 1–18. <https://doi.org/10.1371/journal.pone.0236247>.
- Ogunbajo, A., Mayer, K.H., Kanki, P.J., Tsai, A.C., 2022. Intersectional stigma and hiv continuum outcomes among sexual minority men in sub-saharan africa: a conceptual framework. *Am. J. Public Health* 112 (S4), S374–S376. <https://doi.org/10.2105/AJPH.2021.306693>.
- Operario, D., Sun, S., Bermudez, A.N., Masa, R., Shangani, S., Elst, E. van der, Sanders, E., 2022. Integrating HIV and mental health interventions to address a global syndemic among men who have sex with men. *Lancet HIV* 9 (8), e574–e584. [https://doi.org/10.1016/S2352-3018\(22\)00076-5](https://doi.org/10.1016/S2352-3018(22)00076-5).
- Ouafik, M.R., Buret, L., Scholtes, B., 2022. Mapping the current knowledge in syndemic research applied to men who have sex with men: a scoping review. *Soc. Sci. Med.* 306, 115162. <https://doi.org/10.1016/j.socscimed.2022.115162>.
- Pachankis, J.E., Hatzenbuehler, M.L., Rendina, H.J., Safren, S.A., Parsons, J.T., 2015. LGB-affirmative cognitive-behavioral therapy for young adult gay and bisexual men: a randomized controlled trial of a transdiagnostic minority stress approach. *J. Consult. Clin. Psychol.* 83 (5), 875–889. <https://doi.org/10.1037/ccp0000037>.
- Payton, I.K., Starkweather, A.R., Canidate, S.S., Westmoreland, D.A., Lyon, D.E., 2024. Psychosocial distress among young men who have sex with men: A scoping review. *Journal of Psychosocial Nursing and Mental Health Services. Advance online publication*. <https://doi.org/10.3928/02793695-20240322-01>.
- Pérez-Romero, C., Guerras, J.-M., Hoyos, J., Donat, M., Barrio, G., Fuente, L., de la, Palma, D., Olalla, P.G., de, Belza, M.-J., Group, M.P., 2022. Excessive drinking among men who have sex with men recruited from web-based resources: cross-sectional questionnaire study. *JMIR Public Health Surveill.* 8 (10), e32888. <https://doi.org/10.2196/32888>.
- Phillips, G., Grov, C., Mustanski, B., 2015. Engagement in group sex among geosocial networking (GSN) mobile application-using men who have sex with men (MSM). *Sex. Health* 12 (6), 495–500. <https://doi.org/10.1071/SH15108>.
- Radloff, L.S., 1977. The CES-D scale: a self-report depression scale for research in the general population. *Appl. Psychol. Meas.* 1 (3), 385–401. <https://doi.org/10.1177/014662167700100306>.
- Reback, C.J., Peck, J.A., Dierst-Davies, R., Nuno, M., Kamien, J.B., Amass, L., 2010. Contingency management among homeless, out-of-treatment men who have sex with men. *J. Subst. Abus. Treat.* 39 (3), 255–263. <https://doi.org/10.1016/j.jsat.2010.06.007>.
- Sacks, J.J., Gonzales, K.R., Bouchery, E.E., Tomedi, L.E., Brewer, R.D., 2015. 2010 national and state costs of excessive alcohol consumption. *Am. J. Prev. Med.* 49 (5), e73–e79. <https://doi.org/10.1016/j.amepre.2015.05.031>.
- Sandfort, T.G.M., Knox, J.R., Alcalá, C., El-Bassel, N., Kuo, I., Smith, L.R., 2017. Substance use and HIV risk among men who have sex with men in Africa: a systematic review. *JAIDS J. Acquir. Immune Defic. Syndr.* 76 (2), e34. <https://doi.org/10.1097/QAI.0000000000001462>.
- Santos, G.-M., Rowe, C., Hern, J., Walker, J.E., Ali, A., Ornelaz, M., Prescott, M., Coffin, P., McFarland, W., Raymond, H.F., 2018. Prevalence and correlates of hazardous alcohol consumption and binge drinking among men who have sex with men (MSM) in San Francisco. *PLOS ONE* 13 (8), 1–23. <https://doi.org/10.1371/journal.pone.0202170>.
- Shuper, P.A., Joharchi, N., Monti, P.M., Loutfy, M., Rehm, J., 2017. Acute alcohol consumption directly increases HIV transmission risk: a randomized controlled experiment. 1999 *J. Acquir. Immune Defic. Syndr.* 76 (5), 493–500. <https://doi.org/10.1097/QAI.0000000000001549>.
- Singer, M., 2009. Introduction to syndemics: A critical systems approach to public and community health. John Wiley & Sons, Inc. (<https://www.wiley.com/en-us/Introduction+to+Syndemics%3A+A+Critical+Systems+Approach+to+Public+and+Community+Health-p-9780470472033>).
- StataCorp. (2023). *Stata Statistical Software: Release 18* [Computer software]. StataCorp LLC. (<https://www.stata.com/new-in-stata/>).
- Substance Abuse and Mental Health Services Administration. (2021). *2020 NSDUH Annual National Report*. (<https://www.samhsa.gov/data/report/2020-nsduh-annual-national-report>).
- Substance Abuse and Mental Health Services Administration. (2022). *2020 National Survey on Drug Use and Health: Lesbian, gay, and bisexual (LGB) Adults*. (<https://www.samhsa.gov/data/report/2020-nsduh-lesbian-gay-bisexual-lgb-adults>).
- Substance Abuse and Mental Health Services Administration. (2024, May 29). *Peer support workers for those in recovery*. (<https://www.samhsa.gov/brss-tacs/recover-y-support-tools/peers>).
- Talley, A.E., Gilbert, P.A., Mitchell, J., Goldbach, J., Marshall, B.D.L., Kaysen, D., 2016. Addressing gaps on risk and resilience factors for alcohol use outcomes in sexual and gender minority populations. *Drug Alcohol Rev.* 35 (4), 484–493. <https://doi.org/10.1111/dar.12387>.
- Tracy, K., Burton, M., Miescher, A., Galanter, M., Babuscio, T., Frankforter, T., Nich, C., Rounsaville, B., 2012. Mentorship for Alcohol Problems (MAP): a peer to peer modular intervention for outpatients. *Alcohol. Alcohol.* 47 (1), 42–47. <https://doi.org/10.1093/alcac/agr136>.
- Tracy, K., Wallace, S.P., 2016. Benefits of peer support groups in the treatment of addiction. *Subst. Abus. Rehabil.* 7, 143–154. <https://doi.org/10.2147/SAR.S81535>.
- US Department of Housing and Urban Development. (n.d.). *Four categories in the homeless definition*. HUD Exchange. Retrieved December 22, 2023, from (<https://www.hudexchange.info/homelessness-assistance/coc-esg-virtual-binders/coc-esg-homeless-eligibility-four-categories>).
- US Preventive Services Task Force, 2018. Screening and behavioral counseling interventions to reduce unhealthy alcohol use in adolescents and adults: US Preventive Services Task Force recommendation statement. *JAMA* 320 (18), 1899–1909. <https://doi.org/10.1001/jama.2018.16789>.
- Washington, T.A., Patel, S.N., Meyer-Adams, N., 2017. Drinking patterns and HIV risk behaviors among Black and Latino men who have sex within Los Angeles county. *Am. J. Men. 'S. Health* 11 (4), 834–844. <https://doi.org/10.1177/1557988315605894>.
- Whiteley, D., Rickards-Hill, D., Dimova, E., Emslie, C., 2023. Performing solidarity? A scoping review of alcohol marketing to sexual and gender minorities. *Drug.: Educ., Prev. Policy* 0, 1–9. <https://doi.org/10.1080/09687637.2023.2260550>.
- Wilkerson, J.M., Di Paola, A., McCurdy, S., Schick, V., 2020. Covariates of hazardous alcohol use among sexual and gender minorities in Texas: Identifying the most vulnerable. *Addict. Behav.* 105, 1–7. <https://doi.org/10.1016/j.addbeh.2020.106327>.
- Williams, E.C., Hahn, J.A., Saitz, R., Bryant, K., Lira, M.C., Samet, J.H., 2016. Alcohol use and human immunodeficiency virus (HIV) infection: current knowledge, implications, and future directions. *Alcohol.: Clin. Exp. Res.* 40 (10), 2056–2072. <https://doi.org/10.1111/acer.13204>.
- Wirtz, A.L., Zelaya, C.E., Latkin, C., Stall, R., Peryshkina, A., Galai, N., Mogilniy, V., Dzhigun, P., Kostetskaya, I., Beyrer, C., 2016. Alcohol use and associated sexual and substance use behaviors among men who have sex with men in Moscow, Russia. *AIDS Behav.* 20 (3), 523–536. <https://doi.org/10.1007/s10461-015-1066-2>.
- Zaller, N., Yang, C., Operario, D., Latkin, C., McKirnan, D., O'Donnell, L., Fernandez, M., Seal, D., Koblin, B., Flores, S., Spikes, P., 2017. Alcohol and cocaine use among Latino and African American MSM in 6 US cities. *J. Subst. Abus. Treat.* 80, 26–32. <https://doi.org/10.1016/j.jsat.2017.06.003>.