Higher prevalence of polysubstance use among older lesbian, and gay US adults

Luis M. Mestre [a,*,1], Marney A. White [a,b], Becca R. Levy [b], Krysten W. Bold [a]

[a] *Department of Psychiatry, Yale School of Medicine, New Haven, CT, USA*
[b] *Department of Social and Behavioral Sciences, Yale School of Public Health, New Haven, CT, USA*

HIGHLIGHTS

- Older gay/lesbian adults have a higher prevalence of polysubstance use than their heterosexual peers.
- Polysubstance use might be a risk factor against healthy aging of older gay/lesbian adults.
- There are different trends in polysubstance use by sexual identity across different age cohorts.
- Risk factors that are prevalent among older LGB adults must be addressed to reduce polysubstance use.

ARTICLE INFO

ABSTRACT

Introduction: Polysubstance use (i.e., the use of more than one substance) is a major public health concern in the US that disproportionately hinders those from marginalized groups by sexual identity and age. Little research has examined this concern among lesbian, gay, and bisexual (LGB) older adults, and no study has measured past-30 day polysubstance use prevalence among these groups. The objective was to examine polysubstance use among older LGB adults compared to their heterosexual same-age peers and younger LGB counterparts.
Methods: We used the National Survey of Drug Use and Health 2021 and 2022 datasets with an analytic sample of 86,254 participants. Past-30 day polysubstance use prevalence was survey-weighted and adjusted by socio-demographic factors. We constructed Weighted multinomial models to compare polysubstance use between older LGB adults (65+ years old) with their same-age heterosexual and younger LGB counterparts.
Results: Older Gay/Lesbian adults had a significantly higher polysubstance use prevalence than their heterosexual counterparts (OR = 27.94; p <0.001) while heterosexual participants showed a decline in polysubstance use with age (OR = 0.27; p < 0.001). Polysubstance use among gay/lesbian (OR = 0.67; p = 0.491) and bisexual (OR = 1.04; p = 0.969) older adults did not significantly differ from their younger counterparts.
Conclusions: Polysubstance use is a public health concern for older gay/lesbian adults. Interventions are needed to address polysubstance use for older LGB adults, including early detection of polysubstance use and prevention strategies that are age and LGB inclusive.

1. Introduction

Polysubstance use (i.e., the use of multiple substances) (Bunting et al., 2023; Connor et al., 2014) is one of the main public health concern in the US (Crummy et al., 2020). In 2019, polysubstance use represented nearly 50 % of drug overdose deaths (CDC, 2022) and was associated with a higher risk of mental illness (Czeisler et al., 2020) and all-cause mortality (Mattson et al., 2021). Due to the increasing trend of illicit substance use, it is expected that deaths related to polysubstance use will significantly increase in the US in the upcoming years (UNODC, 2022).

However, polysubstance use within the US varies by age and sexual identity; those who identify as lesbian, gay, or bisexual (LGB) (Cascalheira et al., 2023; Coulter et al., 2019; Dermody, 2018; Goldbach et al., 2014; Goodwin et al., 2022; Kecojevic et al., 2017; Lee et al., 2023; McCabe et al., 2022; Newcomb et al., 2014), or among some age cohorts (e.g., 18–29 years) (Coulter et al., 2019; Evans-Polce et al., 2020; Ford

et al., 2021; Kecojevic et al., 2017; Ou et al., 2023) are more likely to engage in polysubstance use, leading to disproportionate hinder among marginalized groups (Cascalheira et al., 2023; Coulter et al., 2019; Davy-Mendez et al., 2023; Dermody, 2018; Goodwin et al., 2022; Kecojevic et al., 2017; Lee et al., 2023; Meyer, 2003).

Those experiencing discrimination due to their sexual identity as LGB reported a higher risk of substance use, including polysubstance use (Evans-Polce et al., 2020; McCabe et al., 2010; Meyer, 2003; Rice et al., 2021). However, most of these findings about polysubstance use (Cascalheira et al., 2023; Coulter et al., 2019; Dermody, 2018; Kecojevic et al., 2017; Lee et al., 2023; McCabe et al., 2022) were conducted with young LGB adults or did not examine older age cohorts. Although studies have reported the prevalence of substance use among older LGB US adults (Ford et al., 2021; Green and Feinstein, 2012; Han et al., 2020; Hayek et al., 2022; McCabe et al., 2010, 2022), to our knowledge, only two studies measured polysubstance use among older US adults (e.g., 65+ years) (Ford et al., 2021; Ou et al., 2023) and only one considered sexual identity (Ford et al., 2021). Ford et al., 2021 found that LGB adults are more likely to engage in polysubstance use of prescribed medications within all age cohorts.

No studies to date have examined past-30 day polysubstance use prevalence among older LGB adults, as compared to their heterosexual counterparts, as well as to younger LGB cohorts. Thus, the objectives of this study are to examine the past-30 day polysubstance use among older LGB adults and to evaluate differences compared to their heterosexual and younger counterparts. We hypothesized that older LGB adults have higher rates of past-30 day polysubstance use than their heterosexual and younger counterparts and that LGB of all ages will have higher past-30 day polysubstance use.

1.1. Theoretical framework

Older LGB adults belong to generations that have experienced life events such as the HIV-AIDS crisis, same-sex marriage prohibition, and sodomy laws that increased demoralization, guilt, suicide ideation (Meyer, 1995), social stress (Muraco and Fredriksen-Goldsen, 2016), prejudice, stigma (Meyer, 2003), and higher levels of social hostility (Abatiell and Adams, 2011). According to the Stereotype Embodiment Theory (Levy, 2009), older adults, including those who are LGB, also experience stigmatization and negative stereotypes due to their age, which, when internalized, can increase their risk of having adverse health outcomes.

Older LGB adults have had experiences that are challenging for them due to their social position, their individual experiences, structural discrimination, and victimization that promote adverse health (Fredriksen-Goldsen et al., 2014). Due to older LGB US adults belonging to marginalized groups by sexual identity and age, this group may have a higher prevalence of polysubstance use than their younger or heterosexual counterparts. It is also possible that older bisexual adults might have an even higher polysubstance use prevalence due to also experiencing discrimination, such as invalidating or erasing bisexual sexual identity, within the LGB group throughout their lifespan (Doan Van et al., 2019; Fredriksen-Goldsen, Shiu, et al., 2017; Scherrer, 2017). Thus, there might be polysubstance use prevalence heterogeneity within the older LGB US adult population.

2. Methods

2.1. Study sample

This study analyzed the two most recent years of the National Survey of Drug Use and Health (NSDUH) dataset collected by SAMHSA (Substance Abuse and Mental Health Services Administration), a cross-sectional study that annually assesses the prevalence of substance use in the US population (Center for Behavioral Health Statistics and Quality, 2021). The inclusion criteria for the study were residents in

households or residents in noninstitutional group quarters (e.g., shelters, college dorms) (SAMHSA, 2022). The participants' names were not collected, and for web-based surveys, the website was encrypted to promote confidentiality (SAMHSA, 2022). The NSDUH 2021 and 2022 datasets have a representative sample from the US adult population. However, we did not include years prior to 2021 because the sample designs were not comparable to those earlier years (Center for Behavioral Health Statistics and Quality, 2021). The obtained sample size of US adults (i.e., older than 18 years) was (n=86,254). The population of interest in this study is older LGB adults (i.e., 65+ years), as compared to younger LGB adult cohorts and older heterosexual adults.

2.2. Measures

2.2.1. Exposures

One of the main variables of interest is sexual identity, consistent with prior studies (Coulter et al., 2019; Dermody, 2018; Lee et al., 2023; McCabe et al., 2022; Rice et al., 2021; Schuler et al., 2019). Sexual identity was assessed by the question, "*Which of the following do you consider yourself to be?*" The participant was able to self-identify as heterosexual (i.e., straight), Lesbian/Gay, Bisexual, or Don't know (i.e., Not Sure). The second main exposure of this study was age, assessed by the imputed variable *Final Edited Age*. We examined older (65+ years) and younger participants.

2.2.2. Outcome

Following Bunting et al. (2023) recommendations, we defined polysubstance use as using two or more of the following substances in the past-30 day: cigarettes, alcohol, cannabis, vaping (assessed separately as nicotine vaping, cannabis vaping, or flavor vaping only (without nicotine or substances)), cocaine, inhalants, heroin, crack, methamphetamine, sedatives misuse, tranquilizers misuse, prescription pain relievers misuse (including fentanyl), and stimulants misuse. We used the questions (Supplementary Table 1) to operationalize past-30 day polysubstance use in three categories ("0" if the participant never used any substance, "1" if only used one of the substances, and "2+" if used two or more substances) as done previously (Lee et al., 2023; McCabe et al., 2022).

2.2.3. Covariates

The covariates to adjust for the weighted prevalence of polysubstance were age group (18–29 years, 30–49, 50–64, 65+), survey year, race/ethnicity, sex, educational attainment, sexual attraction, employment status, metro/nonmetro county, household income, marital status, and medical insurance status (see Table 1 for how the covariates were measured).

2.3. Statistical analysis

We assessed the weighted prevalence using the survey weights of NSDUH 2021 and 2022, strata, and post-stratified units. We adjusted the weighted prevalence by the covariates. A survey-weighted multinomial model stratified by age (65+ years) was used to measure the odds ratio between sexual identity and polysubstance use among US adults, having as the reference groups older heterosexual adults. We included an interaction between sex and sexual identity to adjust for the differences in the LGB population by sex (McCabe et al., 2010, 2022). We conducted three different survey-weighted multinomial models with stratifications by sexual identity to measure the differences within sexual identities by age group (the stratified models included the interaction terms between age and sex). For these models, the primary comparisons were between older and younger adults (18–29 years as the reference group) within the same sexual identity group. Other age groups included were 30–49 and 50–64 years. We did all analyses in R Software.

Table 1
Descriptive Statistics, NSDUH 2021 and 2022.

Covariate/Polysubstance Use Indicator	0		1		2+		Total
	n	%ᵃ	n	%ᵃ	n	%ᵃ	n
Sexual Identity	**30,722**	**37.33**	**35,050**	**41.57**	**20,482**	**21.10**	**86,254**
Heterosexual	27,811	38.30	31,549	42.34	16,109	19.36	**75,469**
Gay/Lesbian	669	24.61	991	40.75	941	34.64	**2601**
Bisexual	2014	25.40	2427	30.42	3387	44.19	**7828**
Not Sure	228	65.68	83	27.11	45	7.21	**356**
Age Group (years)							
18–29	12,394	36.16	10,684	32.61	9769	31.23	**32,847**
30–49	9937	30.97	15,053	43.38	8255	25.65	**33,245**
50–64	3649	35.92	4898	45.62	1679	18.47	**10,226**
65+	4742	49.50	4415	42.36	779	8.14	**9936**
Survey year							
2021	15,452	38.17	17,851	41.78	9566	20.05	**42,869**
2022	15,270	36.50	17,199	41.37	10,916	22.13	**43,385**
Race/Ethnicity							
Non-Hispanic White	16,328	31.90	24,014	45.40	13,250	22.71	**53,592**
Hispanic	6006	44.99	4884	37.61	2951	17.40	**13,841**
Non-Hispanic Asian	2600	57.20	1558	32.63	532	10.17	**4690**
Non-Hispanic Black	4264	45.56	3052	33.25	2240	21.19	**9556**
Non-Hispanic Other	1524	36.68	1542	33.67	1509	29.64	**4575**
Sex							
Male	12,691	33.43	15,264	42.62	10,170	23.95	**38,125**
Female	18,031	41.02	19,786	40.58	10,312	18.40	**48,129**
Education Attainment							
Less than High School	3846	50.97	2120	28.02	5388	21.01	**8125**
High School Diploma	8570	42.64	6437	34.35	5793	23.02	**20,800**
Some College or Associate Degree	8937	34.99	9800	39.90	7142	25.10	**25,879**
College Graduate	9369	30.88	16,693	53.30	5388	15.82	**31,450**
Sexual Attraction							
Only opposite sex	25,161	38.34	28,458	42.65	14,040	19.02	**67,659**
Mostly opposite sex	2175	28.22	3321	40.74	2842	31.04	**8338**
Equally opposite and same sex	1266	25.88	1522	31.27	2074	42.85	**4862**
Mostly same sex	386	28.72	477	36.22	533	35.06	**1396**
Only same sex	587	28.98	771	39.62	677	31.39	**2035**
I am not sure	1147	63.77	501	23.08	316	13.15	**1964**
Employment Status							
Without a Job	13,554	45.93	10,373	36.65	6311	17.41	**30,238**
With a Job	17,168	31.22	24,677	45.06	14,171	23.72	**56,016**
County Metropolitan area Metro/Non-Metro status							
Metro	5053	39.77	5273	39.12	3501	21.11	**13,827**
Non-Metro	25,669	36.92	29,777	41.98	16,981	21.10	**72,427**
Annual Income							
<20,000 USD	15,266	45.54	10,667	31.07	9245	23.40	**35,178**
≥20,000 USD	15,456	32.56	24,383	47.67	11,237	23.40	**51,076**
Marital Status							
Non-Married	17,744	36.73	17,271	36.00	14,866	27.27	**49,881**
Married	12,978	37.95	17,779	47.41	5616	14.65	**36,373**
Insurance Status							
Without Insurance Status	4165	39.12	3460	31.80	3290	29.08	**10,915**
With Insurance Status	26,557	37.09	31,590	42.85	17,192	20.06	**75,339**

ᵃ – Conditional Percentages are weighted

NOTE - Some conditional marginal percentages will not add to 100 % due to rounding error

3. Results

We used a complete cases approach for the analyses to remove missing data (i.e., 8037 participants or 8.62 % of the sample size). Table 1 shows that polysubstance use was more frequent among gay/lesbian and bisexual adults (44.19 % and 34.64 %, respectively) than their heterosexual counterparts (19.36 %). Most participants identified as non-Hispanic White (62.74 %), were not married (51.12 %), had a sexual attraction only to the opposite sex (83.80 %), had a job (58.52 %), were college graduates (32.60 %), lived in a county within a metropolitan area (85.78 %), had an annual income greater or equal to 20,000 USD (63.27 %), and had medical insurance (88.46 %). LGB adults represented 19.02 % among those in the age group 18–29 years while just 2.07 % among 65+ years. (Supplementary Table 2). Fig. 1 shows that past-30 day polysubstance use prevalence was the highest among bisexual adults from the age group of 30–49 years and the lowest among older heterosexual adults (i.e., 65+ years) than any other group with a defined sexual identity or age.

The most common substances used by older gay/lesbian adults were alcohol (61.28 %), cigarettes (15.63 %), cannabis (7.66 %), and pre-scribed pain relievers misuse (6.71 %; see **Supplemental File 1**). Among older gay/lesbian adults the most common combinations were alcohol + cigarettes (14.40 %), alcohol + cannabis (6.79 %), alcohol + prescribed pain relievers (6.51 %), and cigarettes + prescribed pain relievers (2.99 %). These findings indicate that alcohol and cigarettes, followed by alcohol and cannabis, are the two most common combinations of substances. For younger gay/lesbian adults, the most common substances were alcohol (59.44 %), cannabis (34.57 %), nicotine vaping (16.24 %), and cannabis vaping (16.03 %). The most common co-use combinations for younger gay/lesbian were alcohol + cannabis (27.03 %), cannabis + cannabis vaping (16.03 %), alcohol + cannabis vaping (13.51 %), and alcohol + nicotine vaping (12.42 %; see
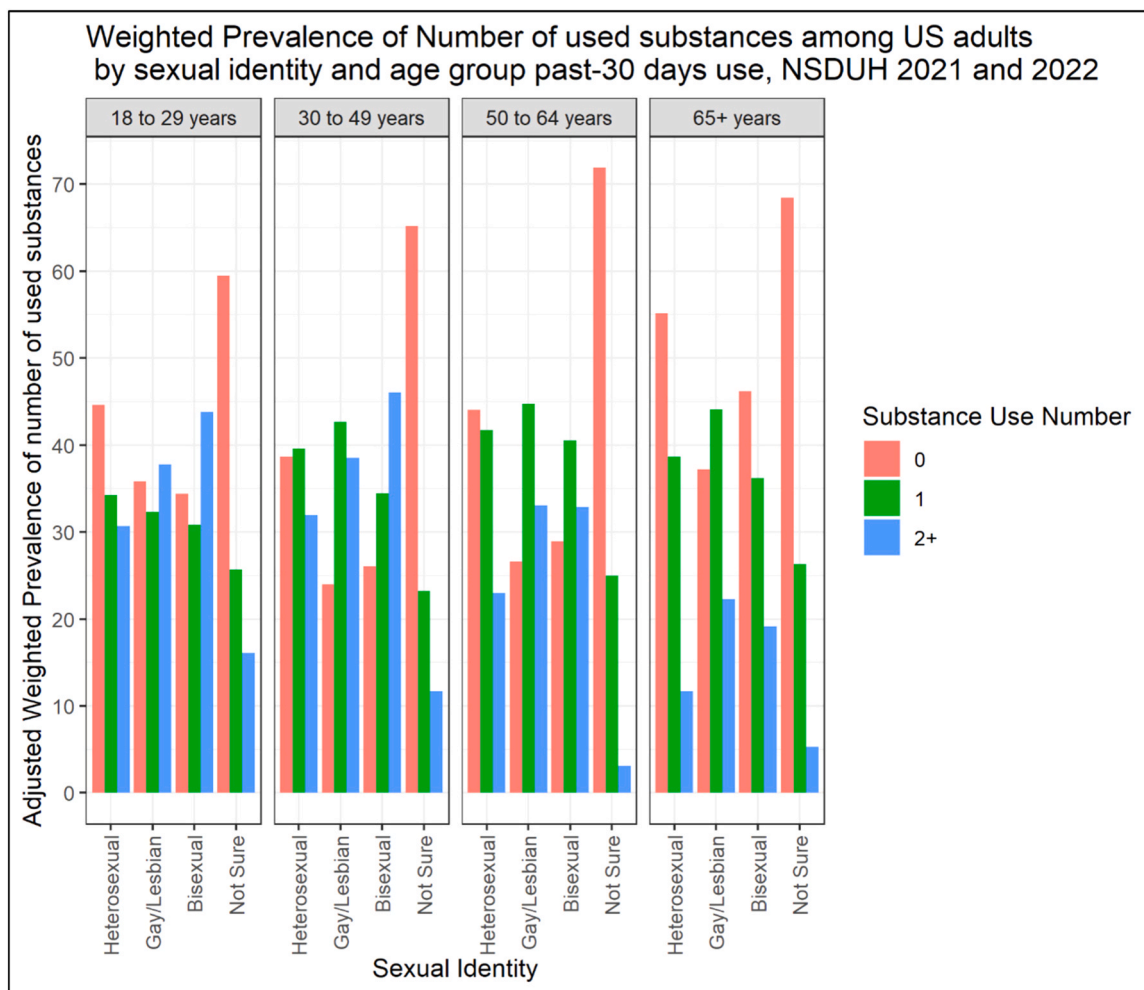
Fig. 1. Weighted Prevalence of number of substances used among US adults by sexual identity and age group past-30 day use, NSDUH 2021 and 2022.

Supplemental File 2). These findings indicated that alcohol, cannabis, and cannabis vaping and nicotine vaping are the most common co-used substances among 18–29 years gay/lesbian adults.

As predicted, when adjusted by covariates, older gay/lesbian adults were more likely to engage in past-30 day polysubstance use than their heterosexual counterparts ($\beta = 3.33$; SE = 0.80, p = <0.001*; Table 2). However, there were no significant differences in engaging in past-30 day polysubstance use among older bisexual adults ($\beta = 1.46$; SE = 0.87, p = 0.094; full model Supplementary Table 3) compared to heterosexual adults. These findings support that there is heterogeneity within LGB adults.

Table 2
Odds ratio of Polysubstance Use past-30 day among older adults, NSDUH 2021 and 2022.

Sexual Identity	Polysubstance Use indicator	β	Odds ratio (exp(β))	SE	P-value
Gay/	1	1.11	3.03	0.58	0.057
lesbian	2+	3.33	27.94	0.80	<0.001*
Bisexual	1	−0.18	0.84	0.44	0.684
	2+	1.46	4.31	0.87	0.094
Not Sure	1	1.92	6.82	0.76	0.012*
	2+	0.59	1.80	1.33	0.650

"*" p-value < 0.05
NOTE: The model was adjusted for race/ethnicity, sex, education attainment, sexual attraction, employment status, marital status, annual income, living in metro/nonmetro County Metropolitan area and Insurance Status.
NOTE: Reference group was heterosexual adults that did not use any substance.

Within sexual identities, older gay/lesbian adults ($\beta = -0.46$; SE = 0.63, p = 0.491; Table 3) and older bisexual adults ($\beta = 0.04$; SE = 0.93, p = 0.969) did not have a significant difference in past- 30-day polysubstance use compared to their younger counterparts. However, among heterosexual adults, older adults had lower rates of past-30 day polysubstance use than their younger counterparts ($\beta = -1.31$; SE = 0.11; p <0.001*). Among sexual identities, gay/lesbian ($\beta = 0.52$; SE = 0.17, p = 0.002*), bisexual ($\beta = 0.26$; SE = 0.12, p = 0.033*), and heterosexual adults ($\beta = 0.13$; SE = 0.04, p <0.001*) had a significant increase in their past-30 day polysubstance use prevalence from 2021 to 2022; see Supplementary Table 4, Supplementary Table 5, and Supplementary Table 6 for the full models.

4. Discussion

This study provides new information about polysubstance use among older LGB adults using national population data from NSDUH 2021–2022. Older gay/lesbian adults have a higher prevalence of substance use, including polysubstance use, compared to their heterosexual counterparts, similar to other studies (Ford et al., 2021; Han et al., 2020). A higher prevalence of polysubstance use is associated with higher risk of mental health illness and all-cause mortality (Roe et al., 2010; Seim et al., 2020), which can hinder healthy aging. Older heterosexual adults had a lower polysubstance use prevalence than their younger counterparts; however, older gay/lesbian adults do not have a significantly different polysubstance use prevalence than their younger counterparts. Additionally, older bisexual adults do not have a

Table 3
Summary of stratified weighted multinomial models of odds ratio of Polysubstance Use past-30 day among Older LGB persons, NSDUH 2021 and 2022.

	Age Group (years)	Polysubstance Use	β	Odds ratio exp(β)	SE	p-value
Heterosexual	30–49	1	0.38	1.46	0.06	<0.001*
		2+	0.34	1.40	0.06	<0.001*
	50–64	1	0.32	1.38	0.08	<0.001*
		2+	−0.14	0.87	0.10	0.153
	65+	1	−0.09	0.91	0.08	0.231
		2+	−1.31	0.27	0.11	<0.001*
Gay/Lesbian	30–49	1	0.12	1.13	0.38	0.754
		2+	0.39	1.48	0.28	0.161
	50–64	1	−0.27	0.76	0.37	0.474
		2+	−0.58	0.56	0.37	0.115
	65+	1	0.07	1.07	0.71	0.923
		2+	−0.46	0.63	0.67	0.491
Bisexual	30–49	1	0.68	1.97	0.24	0.005*
		2+	0.49	1.63	0.24	0.036*
	50–64	1	1.18	3.25	0.35	<0.001*
		2+	0.34	1.40	0.33	0.304
	65+	1	0.56	1.75	0.50	0.266
		2+	0.04	1.04	0.93	0.969
Not Sure	30–49	1	−0.88	0.41	0.79	0.260
		2+	−2.22	0.11	1.44	0.123
	50–64	1	−0.33	0.72	1.31	0.801
		2+	−17.85	<0.001	1.09	<0.001*
	65+	1	1.41	4.10	1.17	0.230
		2+	−2.55	0.08	1.78	0.152

"*" – p-value < 0.05

NOTE: The model was adjusted for age, race/ethnicity, sex, education attainment, sexual attraction, employment status, marital status, annual income, living in metro/nonmetro County Metropolitan area and Insurance Status.

NOTE: Reference groups were adults between 18 and 29 years that did not engage in any substance use of within the same sexual identity.

significant difference in polysubstance use prevalence compared with their heterosexual or younger counterparts; these findings suggest different patterns in past-30 day polysubstance use prevalence by sexual identity across different age cohorts.

These findings confirm heterogeneity in polysubstance use prevalence within the older LGB adults; gay/lesbian adults engage more in polysubstance use than bisexual adults, a new finding compared to other studies (Doan Van et al., 2019; Evans-Polce et al., 2020; McCabe et al., 2022; Scherrer, 2017). A possible reason for these differences may be the study population; we focused on older LGB adults (65+ years), while most other studies focused only on younger LGB adults (Dermody, 2018; Kecojevic et al., 2017) or operationalized older age as 50+ years old (Lee et al., 2023; McCabe et al., 2022).

Another potential reason can be that older bisexual adults tend to have larger social networks than older gay/lesbian adults (Fredriksen-Goldsen, Shiu, et al., 2017), which is associated with more social support and lower levels of loneliness. However, NSDUH data did not include whether the participants lived alone or with people, which might explain why our results are different. These findings partially differed from our hypothesis – older gay/lesbian adults had a higher prevalence of polysubstance use than their heterosexual counterparts. However, older gay/lesbian adults had a similar prevalence and did not differ significantly compared to their younger counterparts.

Our findings also indicate that older adults who are married are significantly less likely to engage in polysubstance use (Rutter, 1996) among heterosexual and bisexual groups, though not among the gay/lesbian group. We recommend more research in this area to understand the impact of other partnerships and relationship status with polysubstance use for same-sex couples.

This study also found that past- 30 day polysubstance use increased from 2021 and 2022 among US adults. Our study further identified that this increase was disproportionately higher among LGB adults. Significant historical events such as the COVID-19 pandemic and economic recessions (Perrone et al., 2023) have been cited as driving the increasing prevalence of substance use. While these events affect all demographic groups, it is important to note that older LGB adults are at even greater risk of the deleterious impact of polysubstance use on healthy aging.

Another finding from this study was the differences among the most common polysubstance use combinations among sexual minorities within age groups. For older gay/lesbian adults, most combinations included alcohol and prescribed pain relievers, while for younger adults (18–29 years) included alcohol, cannabis, and vaping (nicotine or cannabis). Thus, there is heterogeneity within gay/lesbian adults by age groups in the used substances. Furthermore, although older gay/lesbian adults do not statistically differ in their polysubstance use rates compared to their younger counterparts, the substances used by older gay/lesbian adults may be riskier (i.e., prescribed pain relievers misuse) for their health in the short term than for their younger counterparts.

We recommend incorporating policies that are anti-discrimination (Hatzenbuehler et al., 2009) as a public health strategy (Fredriksen-Goldsen, Kim, et al., 2017) to address the prevalent risk factors among older LGB adults, such as discrimination, victimization, and less community engagement. Such policies should increase LGB-sensitive screening and mental health screening (Jessup and Dibble, 2012) to identify potential risk factors of adverse health outcomes, including engaging in polysubstance use.

Another public health strategy is through nondiscrimination policies in housing and public accommodations (Fredriksen-Goldsen et al., 2014; Hatzenbuehler et al., 2009). However, it is important to note that in this opioid misuse crisis, sexual minorities and older adults are disproportionately burdened compared to their heterosexual counterparts. Policies should consider the intersectionality of sociodemographic factors to encourage older LGB adults to interact with other individuals, including those with similar backgrounds, to promote integration and engagement in their communities. Such integration can happen through events in their communities, settings for older adults (e.g., retirement homes or communities for retirees), or other social programs.

We also recommend to promote trust among healthcare services through inclusivity of older LGB adults in healthcare settings such as training healthcare professionals in understanding the minority stress model (Bailey et al., 2022), promoting identity affirmation for older LGB adults (Fredriksen-Goldsen et al., 2015) and education and advocacy campaigns to address homophobia (Bailey et al., 2022; Doan Van et al.,

2019; Evans-Polce et al., 2020; Fredriksen-Goldsen et al., 2015; Fredriksen-Goldsen, Shiu, et al., 2017; McCabe et al., 2010; Rice et al., 2021; Scherrer, 2017), and ageism (Levy, 2022a, 2022b). Such education and advocacy campaigns could include using inclusive language (e. g., "spouse or partner" instead of wife/husband (Doan Van et al., 2019; Levy, 2009; McCabe et al., 2010; Schuler et al., 2019), and positive-related words associated with aging (Levy, 2022b)).

This study has multiple strengths; it is the first to measure the past-30 day weighted prevalence of polysubstance use among older LGB US adults and the differences between older LGB adults and their heterosexual and younger counterparts. The NSDUH 2021 and 2022 are large and recent datasets representative of the US population, which strengthens the external validity of the results obtained in this study to the population of older LGB adults. Many studies targeting older LGB adults used community-based surveys, which have limited generalizability or need more data due to older LGB adults being a hard-to-reach population (Fredriksen-Goldsen and Kim, 2017).

However, this study has some limitations. We have some missing data in this study. However, given that our missing data is lower than 10 % and our data is cross-sectional, the risk of biased results is minimal (Hawthorne et al., 2005). NSDUH did not assess other gender identities beyond male or female (e.g., transgender, or non-binary). In addition, NSDUH did not assess perceived discrimination (McCabe et al., 2010). NSDUH only assessed fentanyl among those who reported prescribed pain relievers. Thus, many people using fentanyl from other venues may not have identified it as a prescription pain medication and there is a potential underestimation of fentanyl use. In some cases, some demographic groups defined by sexual identity and age had a small sample size. Additional limitations are the substance use measure is self-report and does not assess simultaneous polysubstance use. The cohort effect between generations was not assessed in this study due to NSDUH being a cross-sectional study design. NSDUH did not assess other forms of partnerships such as common-law relationships, civil unions, plural relationships, or open relationships, which are more common among same-sex couples than opposite-sex couples.

5. Conclusions

These results indicate that polysubstance use might be a risk factor against healthy aging among older gay/lesbian adults; we found increasing rates of polysubstance use among LGB adults from 2021 to 2022 and different trends in past-30 day polysubstance use prevalence by sexual identity across different age cohorts. Future work should use longitudinal data that can assess stigma among sexual minorities, history of mental illness, and perceived discrimination due to age and sexual identity to identify predictors of polysubstance use among older LGB populations. Future studies should also include measures to assess resiliency, coping, and self-esteem to assess potential strengths that LGB individuals bring into older age that help them cope with and resist age discrimination. Furthermore, future studies should also examine how polysubstance use among older LGB adults is impacted by laws and policies that affirm or deny certain rights (e.g., same-sex marriage and adoption).

CRediT authorship contribution statement

Becca Levy: Writing – review & editing, Writing – original draft, Conceptualization. **Krysten Bold**: Writing – review & editing, Writing – original draft, Supervision. **Luis Mestre**: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation, Conceptualization. **Marney White**: Writing – review & editing, Writing – original draft.

Financial disclosure statement

Data sharing statement

The NSDUH dataset from 2021 and 2022 is available on a public repository (URL: SAMHSA - Substance Abuse and Mental Health Services Administration).

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.

Acknowledgements

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.dadr.2024.100281.

References

Abatiell, P., Adams, M., 2011. LGBT aging: a question of identity. Gerontologist *51* (6), 880–884. https://doi.org/10.1093/geront/gnr113.

Bailey, D., Calasanti, T., Crowe, A., di Lorito, C., Hogan, P., de Vries, B., 2022. Equal but different! Improving care for older LGBT+ adults. Age Ageing *51* (6), afac142. https://doi.org/10.1093/ageing/afac142.

Bunting, A.M., Shearer, R., Linden-Carmichael, A.N., Williams, A.R., Comer, S.D., Cerdá, M., Lorvick, J., 2023. Are you thinking what I'm thinking? Defining what we mean by "polysubstance use.. *0*(0). Am. J. Drug Alcohol Abus. 1–7. https://doi.org/10.1080/00952990.2023.2248360.

Cascalheira, C.J., Nelson, J., Flinn, R.E., Zhao, Y., Helminen, E.C., Scheer, J.R., Stone, A. L., 2023. High-risk polysubstance use among LGBTQ+ people who use drugs in the United States: an application of syndemic theory. Int. J. Drug Policy *118*, 104103. https://doi.org/10.1016/j.drugpo.2023.104103.

CDC. (2022). *Polysubstance Use Facts.* ⟨https://www.cdc.gov/stopoverdose/polysubstance/index.html⟩

Center for Behavioral Health Statistics and Quality. (2021). *National Survey on Drug Use and Health 2020 (NSDUH-2020-DS0001) | SAMHDA*. ⟨https://www.datafiles.samhsa.gov/dataset/national-survey-drug-use-and-health-2020-nsduh-2020-ds0001⟩

Connor, J.P., Gullo, M.J., White, A., Kelly, A.B., 2014. Polysubstance use: diagnostic challenges, patterns of use and health. Curr. Opin. Psychiatry *27* (4), 269. https://doi.org/10.1097/YCO.0000000000000069.

Coulter, R.W.S., Ware, D., Fish, J.N., Plankey, M.W., 2019. Latent classes of polysubstance use among adolescents in the United States: intersections of sexual identity with sex, age, and race/ethnicity. LGBT Health *6* (3), 116–125. https://doi.org/10.1089/lgbt.2018.0149.

Crummy, E.A., O'Neal, T.J., Baskin, B.M., Ferguson, S.M., 2020. One is not enough: understanding and modeling polysubstance use. Front. Neurosci. *14*, 569. https://doi.org/10.3389/fnins.2020.00569.

Czeisler, M.É., Lane, R.I., Petrosky, E., Wiley, J.F., Christensen, A., Njai, R., Weaver, M. D., Robbins, R., Facer-Childs, E.R., Barger, L.K., Czeisler, C.A., Howard, M.E., Rajaratnam, S.M.W., 2020. Mental health, substance use, and suicidal ideation during the COVID-19 pandemic-United States, June 24-30, 2020. Morb. Mortal. Wkly. Rep. 69 (32), 1049–1057. https://doi.org/10.15585/mmwr.mm6932a1.

Davy-Mendez, T., Sarovar, V., Levine-Hall, T., Lea, A.N., Leibowitz, A.S., Luu, M.N., Flamm, J.A., Hare, C.B., Smith, J.D., Iturralde, E., Dilley, J., Silverberg, M.J., Satre, D.D., 2023. Racial, ethnic, and age disparities in the association of mental health symptoms and polysubstance use among persons in HIV care. PLOS ONE *18* (11), e0294483. https://doi.org/10.1371/journal.pone.0294483.

Dermody, S.S., 2018. Risk of polysubstance use among sexual minority and heterosexual youth. Drug Alcohol Depend. *192*, 38–44. https://doi.org/10.1016/j.drugalcdep.2018.07.030.

Doan Van, E.E., Mereish, E.H., Woulfe, J.M., Katz-Wise, S.L., 2019. Perceived discrimination, coping mechanisms, and effects on health in bisexual and other non-monosexual adults. Arch. Sex. Behav. *48* (1), 159–174. https://doi.org/10.1007/s10508-018-1254-z.

Evans-Polce, R.J., Veliz, P.T., Boyd, C.J., Hughes, T.L., McCabe, S.E., 2020. Associations between sexual orientation discrimination and substance use disorders: differences by age in US adults. Soc. Psychiatry Psychiatr. Epidemiol. *55* (1), 101–110. https://doi.org/10.1007/s00127-019-01694-x.

Ford, J.A., Schepis, T.S., McCabe, S.E., 2021. Poly-prescription drug misuse across the life course: prevalence and correlates across different adult age cohorts in the U.S. Int. J. Drug Policy *88*, 103017. https://doi.org/10.1016/j.drugpo.2020.103017.

Fredriksen-Goldsen, K.I., Kim, H.-J., McKenzie, G.L., Krinsky, L., Emlet, C.A., 2017. Plan of action for real-world translation of LGBTQ health and aging research. LGBT Health *4* (6), 384–388. https://doi.org/10.1089/lgbt.2017.0185.

Fredriksen-Goldsen, K.I., Kim, H.-J., 2017. The science of conducting research With LGBT older adults- an introduction to aging with pride: national health, aging, and sexuality/gender study (NHAS). Gerontologist *57* (suppl_1), S1–S14. https://doi.org/10.1093/geront/gnw212.

Fredriksen-Goldsen, K.I., Kim, H.-J., Shiu, C., Goldsen, J., Emlet, C.A., 2015. Successful aging among LGBT older adults: physical and mental health-related quality of life by age group. Gerontologist *55* (1), 154–168. https://doi.org/10.1093/geront/gnu081.

Fredriksen-Goldsen, K.I., Shiu, C., Bryan, A.E.B., Goldsen, J., Kim, H.-J., 2017. Health equity and aging of bisexual older adults: pathways of risk and resilience. J. Gerontol.: Ser. B 72(3), 468–478. https://doi.org/10.1093/geronb/gbw120.

Fredriksen-Goldsen, K.I., Simoni, J.M., Kim, H.-J., Lehavot, K., Walters, K.L., Yang, J., Hoy-Ellis, C.P., 2014. The health equity promotion model: reconceptualization of lesbian, gay, bisexual, and transgender (LGBT) health disparities. Am. J. Orthopsychiatry *84* (6), 653–663. https://doi.org/10.1037/ort0000030.

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* (3), 350–363. https://doi.org/10.1007/s11121-013-0393-7.

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.

Green, K.E., Feinstein, B.A., 2012. Substance use in lesbian, gay, and bisexual populations: an update on empirical research and implications for treatment. Psychol. Addict. Behav. *26* (2), 265–278. https://doi.org/10.1037/a0025424.

Han, B.H., Miyoshi, M., Palamar, J.J., 2020. Substance use among middle-aged and older lesbian, gay, and bisexual adults in the United States, 2015 to 2017. J. Gen. Intern. Med. *35* (12), 3740–3741. https://doi.org/10.1007/s11606-020-05635-2.

Hatzenbuehler, M.L., Keyes, K.M., Hasin, D.S., 2009. State-level policies and psychiatric morbidity in lesbian, gay, and bisexual populations. Am. J. Public Health *99* (12), 2275–2281. https://doi.org/10.2105/AJPH.2008.153510.

Hawthorne, G., Hawthorne, G., Elliott, P., 2005. Imputing cross-sectional missing data: comparison of common techniques. Aust. N. Z. J. Psychiatry *39* (7), 583–590. https://doi.org/10.1080/j.1440-1614.2005.01630.x.

Hayek, S.E., Geagea, L., Bourji, H.E., Kadi, T., Talih, F., 2022. Prevention strategies of alcohol and substance use disorders in older adults. Clin. Geriatr. Med. *38* (1), 169–179. https://doi.org/10.1016/j.cger.2021.07.011.

Jessup, M.A., Dibble, S.L., 2012. Unmet mental health and substance abuse treatment needs of sexual minority elders. J. Homosex. *59* (5), 656–674. https://doi.org/10.1080/00918369.2012.665674.

Kecojevic, A., Jun, H.-J., Reisner, S.L., Corliss, H.L., 2017. Concurrent polysubstance use in a longitudinal study of US youth: associations with sexual orientation. Addiction *112* (4), 614–624. https://doi.org/10.1111/add.13681.

Lee, J., Evans-Polce, R.J., Ahlquist, J., Parker, M.A., 2023. Polysubstance use by sexual identity among US adults, 2021. Prev. Med. *177*, 107729 https://doi.org/10.1016/j.ypmed.2023.107729.

Levy, B.R. (2009). Stereotype Embodiment: A Psychosocial Approach to Aging. ⟨https://journals.sagepub.com/doi/epub/10.1111/j.1467-8721.2009.01662.x⟩

Levy, B.R., 2022b. The role of structural ageism in age beliefs and health of older persons. JAMA Netw. Open *5* (2), e2147802. https://doi.org/10.1001/jamanetworkopen.2021.47802.

Levy, B.R. (2022a). Breaking the Age Code: How Your Beliefs About Aging Determine How Long and Well You Live. HarperCollins.

Mattson, C.L., Tanz, L.J., Quinn, K., Kariisa, M., Patel, P., Davis, N.L., 2021. Trends and geographic patterns in drug and synthetic opioid overdose deaths—United States, 2013–2019. Morb. Mortal. Wkly. Rep. *70* (6), 202–207. https://doi.org/10.15585/mmwr.mm7006a4.

McCabe, S.E., Bostwick, W.B., Hughes, T.L., West, B.T., Boyd, C.J., 2010. The relationship between discrimination and substance use disorders among lesbian, gay, and bisexual adults in the United States. Am. J. Public Health *100* (10), 1946–1952. https://doi.org/10.2105/AJPH.2009.163147.

McCabe, S.E., Engstrom, C.W., Kcomt, L., Evans-Polce, R., West, B.T., 2022. Trends in Binge Drinking, Marijuana Use, Illicit Drug Use, and Polysubstance Use by Sexual Identity in the United States (2006–2017). Subst. Abus. *43* (1), 194–203. https://doi.org/10.1080/08897077.2021.1913696.

Meyer, I.H., 1995. Minority Stress and Mental Health in Gay Men. J. Health Soc. Behav. *36* (1), 38–56. https://doi.org/10.2307/2137286.

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.

Muraco, A., Fredriksen-Goldsen, K.I., 2016. Turning points in the lives of lesbian and gay adults age 50 and over. Adv. Life Course Res. *30*, 124–132. https://doi.org/10.1016/j.alcr.2016.06.002.

Newcomb, M.E., Ryan, D.T., Greene, G.J., Garofalo, R., Mustanski, B., 2014. Prevalence and patterns of smoking, alcohol use, and illicit drug use in young men who have sex with men. Drug Alcohol Depend. *141*, 65–71. https://doi.org/10.1016/j.drugalcdep.2014.05.005.

Ou, T.-S., Hurber, L., Macy, J., Bray, B., & Lin, H.-C. (2023). Stressful Life Events and Patterns of Polysubstance Use Among U.S. Late Middle-Aged and Older Adults: A Latent Class Analysis. https://doi.org/10.1177/07334648231165256

Perrone, D., Fischer, R., Florek, J., 2023. COVID-19-related shifts in polysubstance use. Subst. Use Misuse *58* (11), 1314–1323. https://doi.org/10.1080/10826084.2023.2181034.

Rice, C.E., Fish, J.N., Russell, S.T., Lanza, S.T., 2021. Sexual Minority-related Discrimination across the Life Course: findings from a National Sample of Adults in the United States. J. Homosex. *68* (2), 252–268. https://doi.org/10.1080/00918369.2019.1648083.

Roe, B., Beynon, C., Pickering, L., Duffy, P., 2010. Experiences of drug use and ageing: health, quality of life, relationship and service implications. J. Adv. Nurs. *66* (9), 1968–1979. https://doi.org/10.1111/j.1365-2648.2010.05378.x.

Rutter, M., 1996. Transitions and turning points in developmental psychopathology: as applied to the age span between childhood and mid-adulthood. Int. J. Behav. Dev. *19* (3), 603–626. https://doi.org/10.1080/016502596385712.

SAMHSA. (2022). *2021 National Survey on Drug Use and Health (NSDUH): Methodological Summary and Definitions*. Center for Behavioral Statistics and Quality.

Scherrer, K.S., 2017. Stigma and special issues for bisexual older adults. Annu. Rev. Gerontol. Geriatr. *37* (1), 43–57. https://doi.org/10.1891/0198-8794.37.43.

Schuler, M.S., Dick, A.W., Stein, B.D., 2019. Sexual minority disparities in opioid misuse, perceived heroin risk and heroin access among a national sample of US adults. Drug Alcohol Depend. *201*, 78–84. https://doi.org/10.1016/j.drugalcdep.2019.04.014.

Seim, L., Vijapura, P., Pagali, S., Burton, M.C., 2020. Common substance use disorders in older adults. Hosp. Pract. *48* (sup1), 48–55. https://doi.org/10.1080/21548331.2020.1733287.

UNODC. (2022). World Drug Report 2022. In World Drug Report 2022. United Nations publication. //www.unodc.org/unodc/en/data-and-analysis/world-drug-report-2022.html