Pandemic-related changes in alcohol use among LGB+ people with and without mental health and neurodevelopmental conditions: A multinational cross-sectional study

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Key words: alcohol; COVID-19; mental health; neurodevelopmental condition; pandemic; sexual minority

Abstract

Purpose

Using data from 36,981 respondents to the Global Drug Survey COVID-19 Special Edition (GDS) this study aimed to compare changes, following the first 'lockdown', in alcohol consumption between LGB+ and heterosexual respondents with and without lifetime mental health and neurodevelopmental (MHND) conditions.

Design/method/approach

Characteristics and drinking behavior of respondents to GDS who disclosed their sexual orientation, and past 30-day alcohol use were described and compared. LGB+ participants with and without MHND conditions were compared and logistic regression models identified correlates of increased drinking among LGB+ people. The impact of changed drinking on the lives of LGB+ participants with and without MHND conditions was assessed.

Findings

LGB+ participants who reported they were "not coping well at all" with the pandemic had 2-fold greater odds of reporting increased binge drinking. LGB+ participants with MHND conditions were significantly more likely than those without to report increased drinking frequency (18.7% vs 12.4%), quantity (13.8% vs 8.8%) and that changed drinking had impacted their lives.

Originality

This study, which has a uniquely large and international sample, explores aspects of alcohol use not considered in other COVID-19 alcohol use research with LGB+ people and is the first to explore alcohol use among LGB+ people with MHND conditions.

Introduction

Lesbian, gay, bisexual, and other sexual minority (LGB+) people typically drink alcohol more frequently and in greater quantities, leading to greater incidence of alcohol-related harms, than their heterosexual counterparts (Bloomfield *et al.*, 2011; Demant *et al.*, 2017; Kerr *et al.*, 2014; Lea *et al.*, 2013; Marshal *et al.*, 2008). LGB+ people are also more likely to experience mental health and neurodevelopmental (MHND) conditions relative to the general population, many of which are also associated with greater alcohol consumption, placing LGB+ people with MHND conditions at greater risk of alcohol-related harm (Bachmann and Gooch, 2018; Castillo-Carniglia *et al.*, 2020; King *et al.*, 2008; Maggio *et al.*, 2022). These health inequalities are, in part, explained by minority stress theory, which suggest that the excess psychological stress faced by sexual minorities as a consequence of anticipated or enacted discrimination, internalized stigma and identity concealment create psychosocial conditions predisposing harmful alcohol use, affective disorder and other mental health conditions (Meyer, 2003).

Chronic, excessive alcohol use brings about neuroendocrine changes altering stress reactivity such that alcohol-related cravings are triggered or exacerbated when a stressful situation (such as a pandemic) arises (Clay and Parker, 2020; Höflich *et al.*, 2019). This is corroborated by observational studies which found that, among disaster survivors, those with greater pre-event alcohol use reported a greater disaster-related increase in alcohol use (Heslin *et al.*, 2013; North *et al.*, 2011). It is therefore unsurprising that a United Kingdom-based longitudinal study found progressively increasing Alcohol Use Disorders Identification Test Consumption (AUDIT-C) questionnaire scores throughout the COVID-19 pandemic (Irizar *et al.*, 2021). Many pandemic-related stressors, including precarious employment and financial difficulty,

have disproportionately impacted LGB+ people prior to the pandemic (Moore *et al.*, 2021). For some, the latter necessitated a return to the family of origin. Leaving the "rainbow family", i.e., one's individual queer community, often exacerbates the loss of community connectedness brought about by the social restrictions ("lockdown") enforced in many countries, all contributing to a greater burden of minority stress (Bleckmann et al., 2022; Meyer, 2003).

For some LGB+ people, this exacerbation of minority stress has occurred alongside a change in alcohol use. In several studies, LGB+ participants were more likely to report increased rather than decreased alcohol consumption (Pampati *et al.*, 2021; Sanchez *et al.*, 2020; Scroggs *et al.*, 2020), with between one fifth and one third of participants reporting an increase in their alcohol consumption during the pandemic (van Bilsen *et al.*, 2021; Storer *et al.*, 2020). This has been more commonly observed among sexual minority women than other LGB+ sub-groups and qualitative studies have attributed this specifically to pandemic-related experiences of boredom or increased alcohol advertising and social pressure associated with online drinking activities (Bochicchio *et al.*, 2021; Cerezo *et al.*, 2021; MacCarthy *et al.*, 2020). However, other studies have observed a greater decrease than increase in alcohol consumption (Sousa *et al.*, 2021) or found no association between sexual minority status and the likelihood of increased alcohol consumption during the pandemic (Sanchez *et al.*, 2020; Stephenson *et al.*, 2021a, 2021b). As such, further investigation is required.

A previous Global Drug Survey (GDS) study investigated changes to various aspects of drinking behavior (such as heavy episodic drinking; HED), among people with and without MHND conditions in May-June 2020 (Davies *et al.*, 2022). Building on this

work, this study uses the same large international sample of respondents to the GDS COVID-19 Special Edition (GDS COVID-19) to provide greater clarity on changes in alcohol use among LGB+ people in the first few months of the pandemic by:

1. Comparing changes to various aspects of drinking behavior between LGB+ and heterosexual respondents
2. Identifying factors associated with changes in drinking behavior among LGB+ people
3. Describing the impact increased or decreased alcohol consumption has on the lives of LGB+ people
4. Comparing changes to various aspects of drinking behavior between LGB+ people with and without MHND conditions.

Methods

Survey instrument

The GDS is an annual, online survey which anonymously collects data on drug use trends. A goal of GDS is to make drug use safer, regardless of country-specific legal status. The GDS COVID-19 survey was available in ten languages (Danish, Dutch, English, Finnish, French, German, Hungarian, Italian, Portuguese and Spanish) and ran for seven weeks between 3 May and 21 June 2020 aiming to understand how the pandemic impacted on people's alcohol (and other drug) use. Among other elements, the survey also explored how the pandemic impacted respondents' mental health and intimate relationships. GDS recruits a purposive sample through partnership with global media and harm reduction partners such as Zeit Online (Germany) and Vice (UK) who promote a link to an encrypted platform where potential participants can provide

consent and take part in the survey; GDS samples are therefore not representative. Most participants are young, experienced with illicit drug use and in education or employed. However, the demographics of participants using alcohol and cannabis are similar to representative samples in Australia, Switzerland and the United States (Barratt *et al.*, 2017). Moreover, while the GDS captures data from a non-probability sample, the benefit of the GDS is that it is able to access larger samples of hidden populations such as LGB+ people and are of particular use in measuring some behaviors of particular relevance to LGB+ people (i.e., alcohol use; Turban *et al*., 2022). More details on the GDS methods (including recruitment strategies) have been previously described (Barratt *et al.*, 2017; Winstock *et al*., 2022). GDS COVID-19 received ethical approval from University College London (11671/001) and is registered at RMIT University (2020-23913-11758) and The University of Queensland (2017001452).

Sample

This analytic sample comprised participants resident in countries with >250 GDS COVID-19 respondents who responded to the sexual orientation measure and reported use of alcohol in the 30 days preceding the survey.

Measures

Supplementary Table S1 provides full details of all measures from GDS COVID-19 used in this analysis.

Sexual orientation and gender identity

Sexual orientation was assessed with the following question stem “Do you consider yourself to be:” followed by response options “Straight or heterosexual”, “Lesbian, gay

or homosexual", "Bisexual", "Queer", "Different orientation" and "Don't know/prefer not to say". Since the influence of sexual minority status, not individual sexual orientations, on drinking behavior was the focus of this paper, all non-"straight or heterosexual" groups except "Don't know/prefer not to say" were collated to create an LGB+ analytic group. Gender identity was measured using a two-question approach. The first asked "What is your gender?" with response options "Male", "Female", "Non-binary" and "Different identity". Participants were then asked "What gender were you assigned at birth?" and could respond "Male" or "Female". Since sexual orientation and gender identity are distinct characteristics, sexual (LGB+) and gender minority (transgender and non-binary) participants were not aggregated in analyses (i.e., heterosexual trans and non-binary participants were not included in the LGB+ analytic group).

Alcohol

Alcohol consumption in the past thirty days was assessed using three measures informed by the first three questions of the AUDIT (Babor *et al.*, 2001). The questions measured, in days, the frequency of consumption, the total number of drinks consumed on a standard drinking day, and HED. The latter was operationalized as the number of days in the preceding thirty days that participants reported consuming in excess of five standard drinks on one occasion.

Three further measures then assessed changes in each of these alcohol consumption measures. Participants were asked to disclose if, relative to February 2020 (pre-COVID-19 social restrictions) alcohol consumption had changed with response options "Increased a lot", "Increased a little", "Stayed the same", "Decreased a little",

"Decreased a lot", "Don't know/Unsure". Participants were then asked, since February 2020, if they had started drinking earlier in the day. Those who reported that their drinking had increased or decreased overall were asked to share how this had impacted on their mental health, physical health, relationships, finances, work/study performance, and pleasure/enjoyment related to [your] drinking. Response options were "Stayed the same", "Better", "Worse" and "Not applicable". Lastly, participants were asked if they would like to use less alcohol in the subsequent thirty days and those reporting that they would were asked if they would like help to do so.

MHND conditions

Participants were asked if they had ever been diagnosed with any of depression, anxiety, panic attacks/phobias, bipolar disorder, obsessive-compulsive disorder, post-traumatic stress disorder, attention deficit hyperactivity disorder/attention deficit disorder, autism/Asperger's/autism spectrum disorder, psychotic illness/schizophrenia, or 'other'. Participants were also asked how well they were coping with the pandemic with response options "coping really well", "coping with some things and not others", "not coping well at all". Current, non-specific, mental distress was assessed using the Kessler Psychological Distress Scale (K6; Kessler *et al.*, 2002).

Statistical analyses

LGB+ and heterosexual participants' characteristics were summarized with descriptive statistics. Summary statistics described participants' age (median, 25^{th} and 75^{th} quartiles) and K6 score (mean and standard deviation). Categorical variables were described using counts and percentages. X^2 analyses (and z-tests) were applied for between-group analysis of changes to drinking behaviors of LGB+ compared with

heterosexual participants then LGB+ participants with and without a MHND condition. The same analysis was applied to responses to questions related to the impact of increased or decreased drinking on the lives of LGB+ participants. Three multi-level, multivariable binomial logistic regression models explored correlates of increases in the various aspects of drinking behavior. Participants who indicated that they 'Increased a lot' or 'Increased a little' in one category were combined and termed 'increased' and compared to respondents who endorsed other response options suggesting 'no increase': 'Stayed the same', 'Decreased a little', 'Decreased a lot'. It was not possible to categorize respondents who responded 'Don't know' so their data were omitted from the models. This analysis clustered for country of residence, entered as a random factor to account for related but not modelled confounders, such as drinking culture, variations in lockdown or social constrain rules, and availability of alcohol. Analyses were conducted in SPSS v26 ("IBM SPSS Statistics Software", 2020).

Results

Sample characteristics

The survey received 59,969 responses. Participants resident in Australia, Austria, Brazil, Denmark, France, Germany, Greece, Ireland, Netherlands, New Zealand, Switzerland, United Kingdom, and United States were included in this sub-sample which comprised 36,981 people in total, of which 5,247 (14.2%) were LGB+. Their characteristics are described in Table 1.

The number of participants per country ranged from 261 (Greece) to 17,632 (Germany). The median number of participants per country was 2,041 (interquartile range: 722-2,330). LGB+ participants were younger (median: 28 years) than heterosexual counterparts (median: 34 years). LGB+ respondents were more likely to be

unemployed (31.9% vs 22.6%) and to report they were not coping well at all with the pandemic and related restrictions (5.4% vs 2.3%) compared to heterosexual respondents. LGB+ participants were twice as likely as heterosexual participants to experience one or more MHND condition and four times as likely to experience three or more MHND conditions. Higher K6 scores, indicating greater distress, were also reported among LGB+ compared to heterosexual participants ($\bar{x}$: 9.2 standard deviation (SD): 5.4 vs $\bar{x}$: 6.4 SD: 4.7).

[Table 1 near here]

Comparison of changes to alcohol use behaviors between heterosexual and LGB+ participants

A greater percentage of LGB+ participants, compared to the heterosexual participants, indicated that the number of days drinking 'increased a lot' in the preceding 30 days (15.5% vs 13.2%), and that the number of standard drinks per drinking episode (11.3% vs 9.3%) and frequency of HED (8.1% vs 6.9%) "increased a lot", relative to heterosexual participants (Table 2). Moreover, a greater proportion of LGB+ than heterosexual participants indicated they had begun to drink earlier in the day since the onset of the pandemic (35.5% vs 27.7%).

[Table 2 near here]

Correlates of increased drinking

In multi-level multivariable logistic regression models (Table 3), a curve linear relationship was observed between age and each outcome, i.e., increased frequency of

consumption, usual number of drinks and HED. While there no association with MHND status, a significant relationship was observed between current distress (K6 score) and each outcome (adjusted odds ratio (AOR) 1.04-1.07, $p<0.001$). Participants in relationships, compared to those not in a relationship, were more likely to report an increase in the frequency of drinking and usual number of drinks consumed but not in HED. Relative to living alone, living with another adult or living with a child were associated with an increase in the usual number of drinks consumed. Cis men had 1.6-fold greater odds of reporting an increase in HED and 1.2-fold greater odds of reporting an increase in number of drinks consumed, than cis women. Gender modality (i.e., trans or non-binary people compared with cisgender men) was not associated with an increase in any drinking outcome. LGB+ participants reporting they were coping with some things but not others had 1.29-1.45-fold greater odds and those not coping well at all were up to twice as likely to report increased frequency of consumption, usual number of drinks and HED (AOR 1.65-1.94, all $p<0.01$).

[Table 3 near here]

Comparison of changes to alcohol use behaviors between LGB+ participants with and without MHND conditions

LGB+ participants with MHND conditions reported that the frequency of any drinking (18.7% vs 12.4%), HED frequency (10.1% vs 6.2%) and quantity of alcohol consumed during each episode (13.8% vs 8.8%) "increased a lot" significantly more frequently than LGB+ participants living without MHND conditions (all $p<0.001$; Table 4). LGB+ participants with MHND conditions were also more likely than LGB+ participants

without MHND conditions to report drinking earlier in the day (40.1% vs 31.0%) and that they would like to drink less (44.6% vs 40.1%) in the coming 30 days.

[Table 4 near here]

Impact of change to drinking during the pandemic on LGB+ participants with and without MHND conditions

Impact of decreased drinking

LGB+ participants with MHND conditions were more likely than those without to report that decreased drinking resulted in improvements in their mental health. LGB+ people with MHND conditions were also more likely than those without to report that their pleasure/enjoyment related to drinking got worse during COVID-19 restrictions (Supplementary Table S2).

Impact of increased drinking

Among those who reported an overall increase in drinking, LGB+ participants with MHND conditions were more likely than those without to report that their mental health, physical health, relationships, finances, work/study performance and pleasure/enjoyment related to drinking got worse (Supplementary Table S3).

Discussion

Key findings

A majority of GDS COVID-19 participants reported stable employment, little psychological distress and the absence of MHND conditions. However, LGB+ participants experienced greater deprivation (precarious housing, unemployment) and

disability (MHND conditions, current mental distress and poor pandemic-related coping) than heterosexual participants.

Forty percent of this analytic sample reported increases on all of three different measures of drinking behavior (number of days drinking, number of drinks on a drinking day, frequency of HED) since the onset of pandemic-related social restrictions. Similarly, around 40% of the sample reported that they would like to drink less in the following 30 days. LGB+ people were more likely to describe a pandemic-associated increase in drinking frequency, total drinks consumed, HED and were also more likely than their heterosexual counterparts to report drinking earlier in the day. In the regression models, after accounting for all other covariates, the strongest correlate of an increase in drinking among LGB+ participants with a MHND condition was "not coping well at all", suggesting that, for some, drinking was a means to cope with pandemic and social restriction-related stressors.

LGB+ participants with a MHND condition were more likely to report an increase on each measured aspect of drinking behavior than LGB+ participants without a MHND condition. Among LGB+ participants, the lives of those with MHND conditions were more affected by changes (overall increase or decrease) to drinking behavior. Those who decreased their use reported an improvement in their mental health, whereas those who increased their use collectively reported that this negatively impacted each measured aspect of their life.

Findings in context

While a significant proportion of the sample reported that various aspects of their alcohol use had increased in the first few months of the COVID-19 pandemic, there were comparable reports of decreased alcohol use. This is in keeping with existing LGB+ research which has reported mixed findings regarding participants' change in alcohol use. For example, one study reported an 82.6% increase in the number of standard drinks that participants reported consuming in the previous 30-days, since pandemic onset (Coakley *et al.*, 2021). Another reported that one fifth of participants disclosed greater alcohol use since the beginning of the pandemic (Reyniers *et al.*, 2020). In a study assessing harmful drinking, sexual minority adults reported a near two-fold increase in the frequency of drinking too much alcohol (Baumel *et al.*, 2021). Conversely, other studies found a net decrease in use (Fish *et al.*, 2021) or reported no association between increased alcohol use and sexual orientation (Peterson et al., 2021; Rogers et al., 2021).

Only one existing study compared heterosexual with LGB+ participants, observing that an increase in 'problem' drinking during the pandemic was more common among LGB+ than heterosexual participants (Akré *et al.*, 2021). A systematic database and Google Scholar search identified no studies which compared LGB+ participants with and without MHND conditions.

Strengths and limitations

The combination of alcohol measures used in this study have not been reported elsewhere. Indeed, no study of LGB+ participants to date reported on drinking earlier in the day or the desire to reduce alcohol use. Since nearly half of the sample reported these changes, this is an important addition to the literature. However, owing to the

unprecedented nature of the pandemic restrictions, some measures used in this study were, by necessity, unvalidated. These include measures of change in alcohol consumption, the impact of those changes, and MHND conditions. Despite the time-sensitive nature of survey delivery, all new variables were piloted and adjusted prior to use, and they appear to hold face validity.

Existing research with LGB+ participants has reported an association between increased alcohol use and pandemic-related coping (Pampati *et al.*, 2021), specifically with boredom (Bochicchio *et al.*, 2021; Cerezo *et al.*, 2021) and isolation (Bochicchio *et al.*, 2021). However, these studies have been qualitative or used samples restricted to the United States. This study is the first to report a similar finding among a much larger, international sample of LGB+ participants with MHND conditions, offering a unique perspective for a particularly vulnerable group. Clustering was used to account for country level effects that were not measured but assumed to influence respondents within a country; which may be different to respondents between countries.

As this was a cross-sectional study, causal inference cannot be inferred and the findings may be subject to recall bias (i.e., participants may have under- or over-estimated their alcohol use at different time points). The sample characteristics suggest possible volunteer and non-response biases, possibly due to the survey theme or recruitment method (Eysenbach and Wyatt, 2002; Zhao *et al.*, 2009). Despite these limtiatiuons, purposive sampling is a recognized method for acquiring large samples of minority participants, which was necessary for these analyses (Turban *et al.*, 2022). Importantly, the sample characteristics of the sample relevant to this study, such as the high levels of

mental distress and pathology reported by LGB+ participants, align with previous studies (King *et al.*, 2008).

Lastly, the team decided to present aggregated analyses for LGB+ participants. While this, importantly, preserved sub-sample size, allowing for between-group comparisons of LGB+ people with and without MHND conditions, LGB+ sub-groups display some heterogeneity with regards to health risk behavior. Important between-group differences observed elsewhere may have been missed.

Implications for research and practice

It is possible that the increase in drinking and associated change to health, relationships, finances, and work/study performance will be sustained in the long-term following COVID-19 social restrictions. There is a need to support LGB+ people, particularly those with MHND conditions, to reduce alcohol consumption and manage any ongoing pandemic-related stress. This could involve reducing barriers to existing services faced by LGB+ people with and without MHND conditions, offering psychological interventions to strengthen coping skills and developing and administering targeted alcohol reduction interventions. Existing research suggests that successful interventions are typically individual face-to-face counselling sessions informed by motivational interviewing and cognitive behavioral therapy approaches and tailored to the needs of LGB+ people (Dimova *et al.*, 2022). In future pandemics and periods of social restriction, individual and population interventions should be developed to support LGB+ people to limit their alcohol intake and maintain their mental wellbeing, taking into consideration the likelihood of LGB+ people being disproportionately isolated, underhoused and underemployed. Future research should monitor whether the increase

in drinking and associated change to health, relationships, finance and work/study performance reported here is sustained over time to determine if this harm returns to pre-pandemic baseline with or without interventions in LGB+ people with and without MHND conditions. Sexual orientation measures should be routinely incorporated in all health research to ensure that any disparities in healthcare access and health outcomes can be identified and addressed.

Conclusion

Escalated drinking behavior was reported by more LGB+ than heterosexual GDS COVID-19 participants, particularly those with a lifetime MHND diagnosis and was most strongly predicted by reports of not coping well at all with the pandemic and associated restrictions.

Data availability statement

Global Drug Survey is an independent research company. As such, supporting data are not available.

Acknowledgments

The authors thank each of our media and harm reduction partners and are grateful for the time given by participants to complete the survey.

Disclosure of interest

Adam Winstock is CEO of Global Drug Survey. The remaining authors report no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Table 1: GDS COVID-19 sample characteristics by sexual orientation

Measure	**Heterosexual** (N=31,734)	**LGB+** (N=5,247)
Age (Median [IQR])	34 [26,46]	28 [23,37]
Missing	*0*	*0*
Live alone		
No	25,847 (81.4%)	4,036 (76.9%)
Yes	5868 (18.5%)	1,199 (22.9%)
Unstable accommodation	19 (0.1%)	12 (0.2%)
Missing	*0*	*0*
Paid employment		
Employed and no change in income	17,764 (56.5%)	2,453 (47.1%)
Earning more	1,037 (3.3%)	231 (4.4%)
Earning less	5,514 (17.5%)	868 (16.7%)
Not employed	7,117 (22.6%)	1,661 (31.9%)
Missing	*302*	*34*
Coping		
Coping really well	16,147 (51%)	1,855 (35.4%)
Coping well with some things but not others	14,758 (46.6%)	3,101 (59.2%)
I'm not coping well at all	742 (2.3%)	281 (5.4%)
Missing	*87*	*10*
MHND condition		
No	23,239 (73.2%)	2,627 (50.1%)
Yes	8,495 (26.8%)	2,620 (49.9%)
Missing	*0*	*0*
Number of MHND conditions		
0	23,239 (73.2%)	2,627 (50.1%)
1	4,984 (15.7%)	1,058 (20.2%)
2	2,549 (8.0%)	898 (17.1%)
≥3	962 (3.0%)	664 (12.7%)
Missing	*0*	*0*
Kessler 6 ($\bar{x}$ [SD])	6.35 [4.70]	9.17 [5.40]
Missing	*1,582*	*215*

Note GDS COVID-19: Global Drug Survey COVID-10 Special Edition; IQR: interquartile range; LGB+: lesbian, gay, bisexual and other sexual minority participants; MHND: mental health or neurodevelopmental; SD: standard deviation; $\bar{x}$: mean.

Table 2: Pandemic-related changes in drinking behavior by sexual orientation

Measure	Heterosexual (N=31,734)	LGB+ (N=5,247)	$\chi 2$, p, effect size
Compared to February (2020; before COVID-19 restrictions) has the:			
number of days you drink alcohol in a typical week changed?			
Decreased a lot	2,982 (9.4%)	616 (11.8%)	
Decreased a little	4,017 (12.7%)	747 (14.3%)	
Stayed the same	9,864 (31.2%)	1,283 (24.6%)	$\chi 2$=120.16,
Increased a little	10,301 (32.6%)	1,709 (32.7%)	p<0.001, V=0.057
Increased a lot	4,183 (13.2%)	811 (15.5%)	
Don't know	252 (0.8%)	54 (1.0%)	
number of standard drinks containing alcohol that you have on a typical day changed?			
Decreased a lot	2,637 (8.3%)	536 (10.3%)	
Decreased a little	3,923 (12.4%)	767 (14.7%)	
Stayed the same	13,920 (44.0%)	1,981 (37.9%)	$\chi 2$=102.24,
Increased a little	7,915 (25.0%)	1,279 (24.5%)	p<0.001, V=0.053
Increased a lot	2,952 (9.3%)	592 (11.3%)	
Don't know	299 (0.9%)	70 (1.3%)	
number of times you had five or more drinks on a single occasion changed?			
Decreased a lot	4,693 (14.9%)	914 (17.5%)	
Decreased a little	4,078 (12.9%)	754 (14.4%)	
Stayed the same	15,331 (48.6%)	2,190 (41.9%)	$\chi 2$=84.33,
Increased a little	4,752 (15.1%)	837 (16.0%)	p<0.001, V=0.048
Increased a lot	2,181 (6.9%)	424 (8.1%)	
Don't know	523 (1.7%)	103 (2.0%)	
Drinking earlier in the day compared to February?			
No	22,887 (72.3%)	3,376 (64.5%)	$\chi 2$=134.70,
Yes	8,761 (27.7%)	1,860 (35.5%)	p<0.001, V=0.060
Overall change in drinking			
Only decreased	8,580 (27.1%)	1,593 (30.4%)	
No change	7,453 (23.5%)	890 (17.0%)	$\chi 2$=124.50,
Only increased	13,115 (41.4%)	2,236 (42.7%)	p<0.001, V=0.059
Increased and decreased	2,536 (8.0%)	519 (9.9%)	
Would you like to drink less in next 30 days?			
No	18,516 (58.5%)	3,020 (57.7%)	$\chi 2$=1.26, p<0.001,
Yes	13,134 (41.5%)	2,216 (42.3%)	V=0.006

Note LGB+: lesbian, gay, bisexual and other sexual minority participants.

Table 3: Multi-level multivariable binomial logistic regression models predicting increases in frequency of consumption, usual number of drinks, and binge drinking among LGB+ respondents to the GDS COVID-19, with participants' country included as a random effect

	Alcohol measure		
	Frequency of consumption	**Usual number of drinks**	**HED**
	AOR (95% CI)[p]	AOR (95% CI)[p]	AOR (95% CI)[p]
Age	1.10 (1.07-1.13)***	1.10 (1.07-1.13)***	1.09 (1.06-1.13)***
Age^2	1.00 (1.00-1.00)***	1.00 (1.00-1.00)***	1.00 (1.00-1.00)***
Cisgender men[a]			
Cisgender women	1.00 (0.88-1.13)[ns]	0.83 (0.73-0.95)**	0.65 (0.56-0.75)***
Transgender and non-binary	1.13 (0.87-1.45)[ns]	0.81 (0.61-1.05)[ns]	0.88 (0.66-1.17)[ns]
No MHND condition[a]			
MHND condition	1.05 (0.92-1.19)[ns]	1.08 (0.94-1.23)[ns]	1.04 (0.89-1.21)[ns]
Not in a relationship[a]			
In a relationship	1.22 (1.08-1.38)**	1.20 (1.05-1.37)**	1.06 (0.91-1.23)[ns]
Live alone[a]			
Live with adult(s) only	0.95 (0.82-1.10)[ns]	0.82 (0.70-0.96)*	0.91 (0.76-1.08)[ns]
Live with child	0.90 (0.73-1.11)[ns]	0.77 (0.62-0.96)*	0.81 (0.63-1.04)[ns]
Coping really well[a]			
Coping with some things not others	1.45 (1.26-1.66)***	1.47 (1.27-1.71)***	1.29 (1.09-1.53)**
Not coping well at all	1.65 (1.22-2.23)**	1.85 (1.37-2.52)***	1.94 (1.40-2.67)***
Kessler 6 score	1.04 (1.03-1.06)***	1.06 (1.05-1.08)***	1.07 (1.05-1.09)***
Intercept	3.08	2.79	2.23
REvar (SE)	0.05 (0.03)	0.05 (0.03)	0.09 (0.04)
ICC	0.08	0.06	0.04

Note [a]: reference category; *: p<0.05; **: p<0.01; ***: p<0.001; AOR: adjusted odds ratio; CI: confidence intervals; HED: heavy episodic drinking; ICC: interclass correlation; LGB+: lesbian, gay, bisexual and other sexual minority participants; MHND: mental health or neurodevelopmental; [ns]: not significant; [p]: probability; REvar: random effects variance; SE: standard error.

Table 4: Pandemic-related changes in drinking behavior among LGB+ people with and without a MHND condition

Measure	No MHND condition (N=2,627)	MHND condition (N=2,620)	χ2, p, effect size
Compared to February (before COVID-19 restrictions) has the:			
number of days you drink alcohol in a typical week changed?			
Decreased a lot	287 (11.0%)$_a$	329 (12.6%)$_a$	
Decreased a little	427 (16.3%)$_a$	320 (12.3%)$_b$	
Stayed the same	712 (27.2%)$_a$	571 (21.9%)$_b$	χ2=68.59, p<0.001, V=0.114
Increased a little	842 (32.2%)$_a$	867 (33.3%)$_a$	
Increased a lot	323 (12.4%)$_a$	488 (18.7%)$_b$	
Don't know	24 (0.9%)$_a$	30 (1.2%)$_a$	
number of standard drinks containing alcohol that you have on a typical day changed?			
Decreased a lot	253 (9.7%)$_a$	283 (10.8%)$_a$	
Decreased a little	433 (16.6%)$_a$	334 (12.8%)$_b$	χ2=64.10, p<0.001,
Stayed the same	1,071 (41.0%)$_a$	910 (34.9%)$_b$	V=0.111
Increased a little	590 (22.6%)$_a$	689 (26.4%)$_b$	
Increased a lot	231 (8.8%)$_a$	361 (13.8%)$_b$	
Don't know	36 (1.4%)$_a$	34 (1.3%)$_a$	
number of times you had five or more drinks on a single occasion changed?			
Decreased a lot	452 (17.3%)$_a$	462 (17.7%)$_a$	
Decreased a little	423 (16.2%)$_a$	331 (12.7%)$_b$	χ2=53.48, p<0.001,
Stayed the same	1,152 (44.2%)$_a$	1,038 (39.7%)$_b$	V=0.101
Increased a little	380 (14.6%)$_a$	457 (17.5%)$_b$	
Increased a lot	161 (6.2%)$_a$	263 (10.1%)$_b$	
Don't know	41 (1.6%)$_a$	62 (2.4%)$_b$	
Drinking earlier in the day compared to February?			
No	1,809 (69.0%)$_a$	1,567 (59.9%)$_b$	χ2=47.81, p<0.001, V=0.096
Yes	811 (31.0%)$_a$	1,049 (40.1%)$_b$	
Overall change in drinking			
Only decreased	846 (32.3%)$_a$	747 (28.6%)$_b$	
No change	499 (19.0%)$_a$	391 (15.0%)$_b$	χ2=41.81, p<0.001, V=0.089
Only increased	1,008 (38.4%)$_a$	1,228 (47.0%)$_b$	
Increased and decreased	270 (10.3%)$_a$	249 (9.5%)$_a$	
Would you like to drink less in next 30 days?			
No	1,571 (59.8%)$_a$	1,449 (55.3%)$_b$	χ2=10.78, p<0.001, V=0.045
Yes	1,051 (40.1%)$_a$	1,165 (44.6%)$_b$	

Note each superscript letter (a,b) indicates a group which differs significantly from any group not denoted with the same superscript letter, at the level $p < 0.05$; MHND: mental health or neurodevelopmental.

Supplementary Table S1: Global Drug Survey COVID-19 Special Edition survey instrument

Survey questions	Response options
Country	
Which country do you currently live in?	Select from list
Age	
How old are you?	16 - >85
Gender	
What is your gender?	• Male • Female • Non-binary • Different identity
What gender were you assigned at birth?	• Male • Female
Relationships	
Are you currently in an adult intimate relationship? *By adult intimate relationship we mean a husband/wife, partner or boyfriend/girlfriend for longer than one month.*	• Yes, with 1 partner • Yes, with 2 or more partners No
Living situation	
Including yourself, how many people current live in your household?	• 1 (I live alone) • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • 10 • >10 • Not applicable/No fixed address/ unstable accommodation
Do you currently live with a child?	Check yes or no
Employment	
Are you currently in paid employment?	• Yes, full-time • Yes, part-time/ casual • No
Financial situation	

Has the amount of money you have left after expenses changed compared with before the COVID-19 restrictions? *If your household shares finances, consider the financial situation of your household*.	• No change • I/We have more now • I/We have less now
Mental health and neurodevelopmental conditions	
Have you ever been diagnosed with?	• Depression • Anxiety, panic attacks or phobias • Bipolar disorder • Obsessive compulsive disorder • Post traumatic stress disorder • ADHD/ADD • Autism, Asperger's or Autism Spectrum Disorder (ASD) • Psychotic illness/Schizophrenia • Other mental health or developmental condition • None of the above
Kessler 6	
During the past 30 days, about how often did you feel nervous?	• All of the time • Most of the time • Some of the time • A little of the time • None of the time
During the past 30 days, about how often did you feel hopeless?	• All of the time • Most of the time • Some of the time • A little of the time • None of the time
During the past 30 days, about how often did you feel restless or fidgety?	• All of the time • Most of the time • Some of the time • A little of the time • None of the time
During the past 30 days, about how often did you feel restless or so depressed that nothing could cheer you up?	• All of the time • Most of the time • Some of the time • A little of the time • None of the time

During the past 30 days, about how often did you feel that everything was an effort?	• All of the time • Most of the time • Some of the time • A little of the time • None of the time
During the past 30 days, about how often did you feel worthless?	• All of the time • Most of the time • Some of the time • A little of the time • None of the time
Coping	
How have you been coping with changes related to the COVID-19 pandemic?	• I'm coping really well • I'm coping with some things but not others • I'm not coping well at all
Alcohol	
In the last 30 days, on how many days did you drink alcohol?	• 1-30
Compared to February—before the COVID-19 restrictions, has the number of days you drink alcohol in a typical week changed?	• Increased a lot • Increased a little • Stayed the same • Decreased a little • Decreased a lot • Don't know/Unsure
In the last 30 days, how many standard drinks containing alcohol did you have on a typical day?	• 1 or 2 • 3 or 4 • 5 or 6 • 7 to 9 • 10 or more
Compared to February—before the COVID-19 restrictions, has the number of standard drinks containing alcohol that you have on a typical day changed?	• Increased a lot • Increased a little • Stayed the same • Decreased a little • Decreased a lot • Don't know/Unsure
In the last 30 days, on how many days did you have five or more drinks on a single occasion?	• 1-30

Compared to February—before the COVID-19 restrictions, has the number of times you had five or more drinks on a single occasion changed?	• Increased a lot • Increased a little • Stayed the same • Decreased a little • Decreased a lot • Don't know/Unsure
Compared to February—before the COVID-19 restrictions, have you started drinking earlier in the day?	• Yes • No
Would you like to drink less in the next 30 days?	• Yes • No
You have told us that your drinking has increased. Which of the following reasons apply to you?	• I have more time to drink • I am more bored • I have more money to purchase alcohol • I am more stressed by what's going on (feel more anxious) • I am feeling (more) lonely • I am feeling (more) depressed • I am spending more time drinking with my partner or household • I am drinking more to cope with being with my partner or household more • I am drinking more as a reward for coping with what's going on • I am taking part in more online social events that involve drinking • I have larger amounts than usual at home because I stocked up • I am having difficulties accessing other drugs • Other reasons • The increase is only slight and not a big deal to me
You have told us that your drinking has decreased. Which of the following reasons apply to you?	• I have less access to the settings where I usually drink • I have less contact with people who I usually drink with • It has been more difficult for me to get alcohol

	• I have less time now I am at home (remote working / childcare / domestic tasks) • I can't afford to drink as much • I don't feel like drinking as much in a pandemic • I am using this time to get more healthy • I am spending more time with partner/family • I am spending more time volunteering / supporting my community • I don't like drinking at home or when I am not out with friends • I feel less stressed/more balanced • Other reasons • The decrease is only slight and not a big deal to me
You've told us that your drinking has changed since February—before the COVID-19 restrictions. How do you think this change in alcohol use has impacted upon the following?	
Mental health	• Stayed the same • Better • Worse • Not applicable
Physical health	• Stayed the same • Better • Worse • Not applicable
Relationships	• Stayed the same • Better • Worse • Not applicable
Finances	• Stayed the same • Better • Worse • Not applicable
Work/study performance	• Stayed the same • Better • Worse • Not applicable
Pleasure/enjoyment related to your drinking	• Stayed the same

- Better
- Worse
- Not applicable

Supplementary Table S2: Impact of decreased drinking in May-June 2020 on the lives of LGB+ GDS COVID-19 participants with and without mental health conditions

Measure	No MHND condition	MHND condition	χ2, p, effect size
You've told us your drinking has increased since February. How has this impacted your:			
Mental health			
Worse	83 (9.9%)$_a$	112 (15.1%)$_b$	
Stayed the same	592 (70.5%)$_a$	429 (57.7%)$_b$	χ2=28.87, p<0.001, V=0.135
Better	127 (15.1%)$_a$	151 (20.3%)$_b$	
Not applicable	38 (4.5%)$_a$	52 (7.0%)$_b$	
Physical health			
Worse	44 (5.3%)$_a$	59 (8.0%)$_b$	
Stayed the same	503 (60.0%)$_a$	400 (53.9%)$_b$	χ2=9.35, p=.025, V=0.077
Better	263 (31.4%)$_a$	248 (33.4%)$_a$	
Not applicable	28 (3.3%)$_a$	35 (4.7%)$_a$	
Relationships			
Worse	93 (11.1%)$_a$	90 (12.2%)$_a$	
Stayed the same	596 (71.1%)$_a$	510 (69.1%)$_a$	χ2=0.86, p=.835, V=0.023
Better	77 (9.2%)$_a$	73 (9.9%)$_a$	
Not applicable	72 (8.6%)$_a$	65 (8.8%)$_a$	
Finances			
Worse	31 (3.7%)$_a$	48 (6.5%)$_b$	
Stayed the same	469 (56.3%)$_a$	350 (47.2%)$_b$	χ2=17.79, p<0.001, V=0.106
Better	294 (35.3%)$_a$	290 (39.1%)$_a$	
Not applicable	39 (4.7%)$_a$	53 (7.2%)$_b$	
Work/study performance			
Worse	77 (9.2%)$_a$	73 (9.9%)$_a$	
Stayed the same	617 (73.5%)$_a$	484 (65.8%)$_b$	χ2=17.25, p=0.001, V=0.105
Better	81 (9.6%)$_a$	78 (10.6%)$_a$	
Not applicable	65 (7.7%)$_a$	101 (13.7%)$_b$	
Pleasure/enjoyment related to drinking			
Worse	251 (29.9%)$_a$	265 (35.6%)$_b$	
Stayed the same	457 (54.4%)$_a$	355 (47.7%)$_b$	χ2=8.67, p=0.034, V=0.074
Better	97 (11.5%)$_a$	84 (11.3%)$_a$	
Not applicable	35 (4.2%)	40 (5.4%)$_a$	

Note GDS COVID-19: Global Drug Survey COVID-19 Special Edition; LGB+: lesbian, gay, bisexual or other sexual minority; MHND: mental health or neurodevelopmental.

Supplementary Table S3: Impact of increased drinking in May-June 2020 on the lives of LGB+ GDS COVID-19 participants with and without mental health conditions

Measure	No MHND condition	MHND condition	χ2, p, effect size
You've told us your drinking has decreased since February. How has this impacted your:			
Mental health			
Worse	194 (23.6%)$_a$	377 (35.5%)$_b$	
Stayed the same	546 (66.5%)$_a$	566 (53.2%)$_b$	$\chi2$=42.83, p<0.001,
Better	71 (8.6%)$_a$	88 (8.3%)$_a$	V=0.149
Not applicable	10 (1.2%)$_a$	32 (3.0%)$_b$	
Physical health			
Worse	322 (39.1%)$_a$	472 (44.4%)$_b$	
Stayed the same	447 (54.3%)$_a$	524 (49.3%)$_b$	$\chi2$=6.64, p=0.085,
Better	39 (4.7%)$_a$	42 (4.0%)$_a$	V=0.059
Not applicable	15 (1.8%)$_a$	25 (2.4%)$_a$	
Relationships			
Worse	76 (9.3%)$_a$	145 (13.7%)$_b$	
Stayed the same	604 (74.1%)$_a$	748 (70.8%)$_a$	$\chi2$=11.88, p<0.01,
Better	94 (11.5%)$_a$	98 (9.3%)$_a$	V=0.079
Not applicable	41 (5.0%)$_a$	66 (6.2%)$_a$	
Finances			
Worse	106 (13.0%)$_a$	208 (19.7%)$_b$	
Stayed the same	623 (76.6%)$_a$	745 (70.7%)$_b$	$\chi2$=15.06, p<0.01,
Better	53 (6.5%)$_a$	62 (5.9%)$_a$	V=0.089
Not applicable	31 (3.8%)$_a$	39 (3.7%)$_a$	
Work/study performance	N=816	N=1,056	
Worse	172 (21.1%)$_a$	268 (25.4%)$_b$	
Stayed the same	559 (68.5%)$_a$	614 (58.1%)$_b$	$\chi2$=33.35, p<0.001,
Better	33 (4.0%)$_a$	36 (3.4%)$_a$	V=0.131
Not applicable	52 (6.4%)$_a$	138 (13.1%)$_b$	
Pleasure/enjoyment related to drinking			
Worse	150 (18.3%)$_a$	256 (24.2%)$_b$	
Stayed the same	477 (58.1%)$_a$	510 (48.2%)$_b$	$\chi2$=19.77, p<0.001,
Better	180 (21.9%)$_a$	266 (25.1%)$_a$	V=0.102
Not applicable	14 (1.7%)$_a$	27 (2.5%)$_a$	

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