Review

Alcohol and other substance use during the COVID-19 pandemic: A systematic review

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ABSTRACT

Background: Although evidence suggests substance and alcohol use may change during the Covid-19 pandemic there has been no full review of the evidence around this.
Methods: A systematic review of all available evidence was carried out to document and interpret the frequency and severity of alcohol and other substance use during the Covid-19 pandemic and their relationship to demographic and mental health variables that may suggest further clinical implications. Peer reviewed articles in MEDLINE, Embase, PsycINFO, CINAHL complete and Sociological Abstracts were searched from December 2019 until November 2020.
Results: The search and screening identified 45 articles from 513 deduplicated records. The evidence suggests a mixed picture for alcohol use. Overall, there was a trend towards increased alcohol consumption. The proportion of people consuming alcohol during the pandemic ranged from 21.7% to 72.9% in general population samples. Unlike alcohol use, there was a clear trend towards increased use of other substances use during the COVID-19 pandemic. The proportion of people consuming other substances during the pandemic ranged from 3.6% to 17.5% in the general population. Mental health factors were the most common correlates or triggers for increased use of both alcohol and other substances.
Conclusion: There is an increased need for treatment for alcohol and other substance use related problems during the pandemic. Increased targeting and evidence-based interventions will also be important in the period which follows this pandemic, to improve the quality of life for individuals and families, but also to prevent additional costs to society and health systems.

1. Introduction

The global SARS-CoV-2 (COVID-19) pandemic has had a substantial impact on the lives of people around the world including intensifying mental health difficulties (Czeisler et al., 2020). The spread of the disease has necessitated quarantine or "lockdown" measures as the principal containment tool (Rubin and Wessely, 2020). The consequences on the mental health of individuals are multifarious and can include adverse psychological responses such as anxiety, depression, post-traumatic stress disorder, self-harm and suicide (Brooks et al., 2020; Czeisler et al., 2020; Dubey et al., 2020; Galea et al., 2020; González-Sanguino et al., 2020). These factors are likely to affect other health-related behaviours and may generate a change in the

consumption of alcohol and other substances (Carrico et al., 2020; Clay and Parker, 2020).

Prior research established that psychological distress and problematic alcohol consumption often co-occur and major factors in disordered drinking are social isolation (Fairbairn and Sayette, 2014) and stress (Clay and Parker, 2020). A review by Rehm et al. (2020) explored previous public health crises and economic crises on alcohol consumption. They suggested two opposite outcomes during the pandemic were possible: an increase in alcohol use in some populations due to the psychological distress experienced, or a decrease in use due to limited availability and financial constraints.

It has been shown that an increase in stress and anxiety will increase the motivation to use substances as a way of coping, especially during a

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disaster (Baker et al., 2004; Cepeda et al., 2010; Goldmann, and Galea, 2014). It has been suggested that increased COVID-19 associated worry and fear may influence substance use increase and initiation (Czeisler et al., 2020; Rogers et al., 2020). However, others have suggested that drug trafficking would be severely obstructed during lockdown leading to less use and substance withdrawal (Lapeyre-Mestre et al., 2020). It is also assumed that COVID-19 may impede substance use disorder treatment, increasing potential relapse (Dubey et al., 2020; Ornell et al., 2020; Vecchio et al., 2020).

Mental health conditions and alcohol and substance use disorders frequently co-occur. Data from nationwide epidemiological studies reveal that comorbidity between mental health and substance use disorders is highly prevalent (Farrell et al., 2003; Jane-Llopis and Matytsina, 2006; Lai et al., 2015). For instance, data from the British Psychiatric Morbidity Survey implied that 30% of individuals with alcohol dependence and 45% with drug dependence also had a mental health disorder, compared with 12% of non - dependent individuals (Farrell et al., 2003). Moreover, a recent systematic review demonstrated that mood and anxiety disorders were particularly prevalent in substance-use treatment clients, with the prevalence of current depression ranging from 27% to 85% and current generalised anxiety disorder ranging from 1% to 75% (Kingston et al., 2017). Alcohol use and dependence are also known risk factors for suicide (Lynch et al., 2020) and there has been a rise in suicide and attempted suicide in the past six months related to Covid-19 (Czeisler et al., 2020) and alcohol withdrawal (India restricted the sale of alcohol) (Ahmed et al., 2020a). This highlights the consequences of sudden and long-term lockdown on the ability of those dependent on substances to access these, and the potential consequences of withdrawal, both physically and psychologically.

Although evidence would suggest substance and alcohol use may change during this pandemic and this may result in hazardous or harmful use which may result in requiring emergency health care treatment, there has been no full review or synthesis of the evidence around this. In line with this, we present a systematic review of all available evidence to document and interpret the frequency and severity of alcohol and other substance use during the Covid-19 pandemic and their relationship to demographic and mental health variables that may suggest further clinical implications.

Specific objectives are to:

(a) Provide estimates of the frequency of alcohol and other substance use and whether this has changed during the pandemic; and
(b) Review existing evidence to examine risk factors associated with alcohol and other substance use during the pandemic, including the relationship to demographic and mental health variables.

2. Methods

Our review is compliant with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Mother et al., 2009). The protocol for this systematic review was registered with PROSPERO (ID: CRD42020196269).

2.1. Search strategy

Our search was conducted in August and again at the end of November 2020. Electronic searches of databases (MEDLINE, Embase, PsycINFO, CINAHL, Sociological Abstracts) were conducted using a combination of keywords relating to alcohol and other substance use during the Covid-19 pandemic. Our search was restricted to articles published in peer-reviewed journals, from December 1, 2019 to November 30, 2020. No restrictions were applied to the study designs eligible for inclusion.

2.2. Inclusion and exclusion criteria

We required that studies reported data relating to alcohol and other substance use measured during the Covid-19 pandemic and included studies reporting data on brief screens or individual questions for alcohol and substance use, as well as studies of for alcohol and substance use identified using longer assessment tools. The review included studies that consider both general and clinical populations of human participants (any gender and age range) and included experimental studies, control trials, cohort studies, case series reports, and qualitative studies. We excluded studies if they failed to report findings relating to alcohol and other substance use or were not published in English. Where there was insufficient information to make a judgement on the eligibility criteria, we excluded the study from the review.

2.3. Data extraction

We extracted data on descriptive features of studies, including author, date, sample size and sample characteristics (e.g., general population, patients, gender distribution), response rate and setting. Additional characteristics included research design (e.g., quantitative versus qualitative), recruitment strategy (e.g., random sampling, invitations to participate) and methods of measurement of substance and alcohol use. Data was also extracted on the patterns and characteristics of substance and alcohol use, and the associated factors, including any results of any tests of association.

Two primary members of the study team independently screened articles by abstract and title based on the above criteria. Articles were then independently read in full by the same reviewers and included or excluded based on the same criteria and risk of bias was assessed using the Cochrane Collaboration's risk of bias tool (Higgins et al., 2011) and NIH quality assessment tools National Heart, Lung, and Blood Institute (2019). Furthermore, a quantitative assessment of methodological quality was undertaken using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data (Munn et al., 2015). We did not include studies if they were deemed "high risk" and were deficient in more than five of the out of nine of the quality criteria or had a small sample size (i.e. less than 100 due to a high possibility of selection bias). Disagreements regarding the inclusion of papers were resolved through discussion and there was no unresolved conflict. The interrater agreement for across the two primary reviewers was 100%.

2.4. Quality assessment

The majority of studies were scored as low or moderate risk of bias according to our scoring criteria (98.1%, k = 52) and utilized an adequate sample size (84.9%, k = 46). Seven studies had an inadequate sample size (13.2%) and one was deemed to be high risk of bias (1.9%). All other criteria were fulfilled (See Appendix 1).

2.5. Patient and public involvement

Patient and public involvement representatives reviewed the original PROSPERO protocol and commented on a plain English summary of the review. Representatives included two lay members, a substance misuse charity employee, and a registered health care clinician.

3. Results

3.1. Search results

Once duplicate records were removed, the search produced 513 citations. Titles and abstracts were reviewed for eligibility and yielded an initial pool of 93 studies for which full-text articles were examined. This pool included studies that were not relevant to the review, including those that did not report empirical data directly related to alcohol or

substance consumption (e.g. Lapeyre-Mestre et al., 2020), data from other sources such as the media (e.g. Ahmed et al., 2020a), levels of overall spending rather than use (e.g. Arora and Grey, 2020; Colbert et al., 2020), the pathophysiological risk of Covid-19 with substance and alcohol use (Mallet et al., 2020; Wei and Shah, 2020), or data prior to 2019 (Slaunwhite et al., 2020). Eight studies did not fulfil the quality assessment requirements. Excluding these left 45 individual studies.

See Fig. 1 for PRISMA flow diagram of search results. Please note the terminology to denote the time-period of the review changes from phrases such 'pandemic', 'lockdown', 'social-distancing' or 'quarantine' depending on the terminology used within the respective study being described. Likewise, the dates of the time periods for data collection vary for different countries depending on when quarantine measures were instituted.

3.2. Characteristics of studies

Characteristics of included studies are shown in Table 1. All of the studies were quantitative with samples that varied in size from $n = 153$ to $n = 150,000$. Patients ranged widely in age with the youngest participant being 13 and the oldest 82. Where reported, the percentage of female participants ranged from 0% to 95.1%. Only $n = 9$ (20.0%) studies reported a gender other than male or female (i.e. other or non-binary).

The majority of studies employed cross-sectional designs using quantitative questionnaires ($n = 37$; 82.2%). Eight studies performed a time-series analysis comparing lockdown to the previous year (Grigoletto et al., 2020; Leichtle et al., 2020; Marais et al., 2020; Ochalek at al., 2020) or lockdown to the previous few months (Glober et al., 2020; Luca

et al., 2020; Slavova et al., 2020; Wainwright et al., 2020).

The studies were from a wide range of countries including USA ($n = 15$), China ($n = 4$), Italy ($n = 4$), Australia ($n = 3$), Canada ($n = 3$), Poland ($n = 3$), France ($n = 2$), Spain ($n = 2$), UK ($n = 2$), Argentina ($n = 1$), Austria ($n = 1$), Croatia ($n = 1$), Netherlands ($n = 1$), Romania ($n = 1$), Russia/ Belarus ($n = 1$) and Sweden ($n = 1$). The study populations included the general population, clinical cohorts (patients attending hospitals or emergency services, those involved in substance use programmes or clinical trials), twin studies, people living with HIV, men who have sex with men (MSM), individuals using medical cannabis, and physicians.

3.3. Patterns of alcohol use

Specific patterns of alcohol use was provided in n = 35 (77.7%) of the 45 selected studies. Harmful alcohol use was identified in n = 16 (45.7%) studies by a range of longer instruments (see Table 2). As an alternative to or as well as longer instruments, n = 20 (57.1%) studies asked individual questions about self-reported frequency or/ behavioural changes in alcohol use, number of drinks or binge drinking during lockdown (e.g., Scarmozzino and Visioli, 2020). The remaining three studies used existing data and performed a time-series analysis linked to alcohol use (Grigoletto et al., 2020; Leichtle et al., 2020; Luca et al., 2020).

As Table 1 shows, the frequency of drinking is difficult to compare, and the measurement and results show wide variance across studies. During the pandemic, the proportion of individuals consuming alcohol varied across samples from 21.7% (Knell et al., 2020) to 81.4% (Romero-Blanco et al., 2020). Likewise, hazardous drinking ranged from
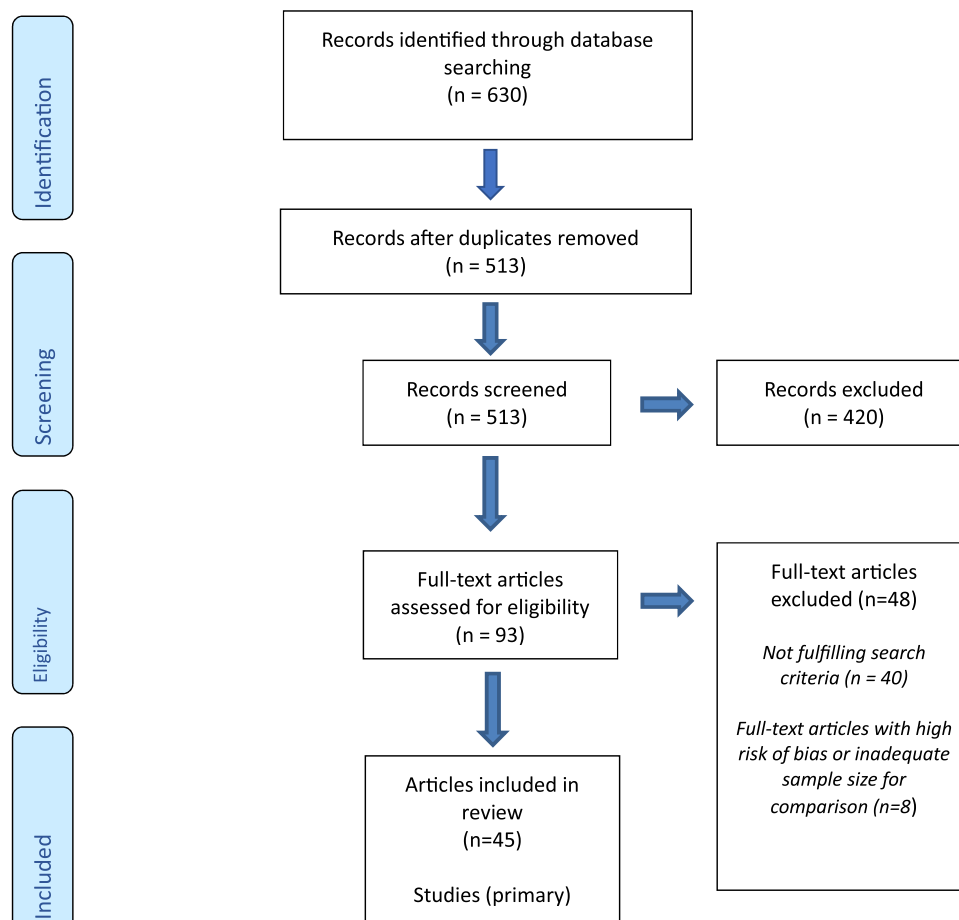

Fig. 1. PRISMA flow diagram: Flow of information through the different phases of the systematic review.

Table 1
Alcohol and substance use during the Covid-19 pandemic.

	Authors & date of publication	Sample size (n) Country & Region	Study type & research design (e.g. quantitative, clinical trial)	Recruitment strategy (E.g. waiting room, A & E)	Age	Gender	Alcohol/ substance (i. e. non- prescribed drug etc)	Alcohol & substance use measure (s) (e.g. Validated scale/ interview)	Proportion reporting use (%)	Additional significant analyses (health/ mental health/ demographics)	Covariates with alcohol and substance use
1	Ahmed et al. (2020)	1074 China (50% in Wuhan)	Quantitative Cross sectional	Via social media (We Chat) Ethical approval February 2020	Mean= 33.5 years	Female = 46.8% Male= 53.2%	Alcohol	AUDIT (Chinese version)	Hazardous drinking= 29.1% (increase) Harmful drinking= 9.5% (increase) Alcohol dependency= 1.6% (increase)	Gender	Significant interaction of gender to alcohol abuse ($\chi2 = 19.796$, p < 0.001, effect size= 0.135) Ratio of harmful users and dependent users for males were six times higher than females
2	Avery et al., (2020)	3971 USA	Quantitative Cross sectional	Twins (including 909 same-sex pairs; 77% MZ, 23% DZ) from the Washington State Twin Registry (WSTR) March to April 2020	Mean= 50.4 years	Female = 69.2% Male= 30.8%	Alcohol	Self-report changes in alcohol consumption	Do not use alcohol = 35.5% Use more= 14.3% Use the same= 39.4% Use less= 10.9% About 14% of the respondents reported an increase in alcohol use	Stress Anxiety	Association between both stress and anxiety and increased alcohol use, where twins with higher levels of stress and anxiety were more likely to report an increase in alcohol consumption
3	Ballivian et al., (2020)	1336 Predominately Buenos Aires, Argentina	Quantitative Cross sectional	Private clinic data base of people living with HIV Clients invited via WhatsApp or email	Range 18–82 Mean= 45.8	Male= 66.8% Female= 33.2%	Drug use	One question asking "Have you used drugs during quarantine"	Drug use= 75.5% Substance abuse care interruption= 1.3%	Age Sex Social support	Hierarchical logistic regression showed that being male (b=0.39; CI 1.12–1.97; P = 0.006), younger (b=0.02; CI 1.01–1.03 P = 0.002) and having lower social support (b=−0.22; CI 0.69–0.93 P = 0.003) predicted drug use during quarantine
4	Boehnke et al., (2020)	353 USA	Quantitative Cross sectional	Individuals who reported current medical cannabis use recruited through Amazon Mechanical Turk April and May of 2020	Mean = 37.0 years	Female= 55.5% Male= 43.9% Other= 0.6%	Medical cannabis Alcohol Other substances (Opioids, Amphetamines, sedatives, synthetic cannabiboids, prescripton medication, stimulants, sleep aids)	Self-report changes in cannabis and other substance use and reasons for the change.	75% used cannabis both medicinally and recreationally 49% used cannabis daily or more frequently Over a third of participants increased cannabis use while 25% decreased cannabis use 25% decreased use 35% increased use 40% reported no change Over half (52%) of participants either started using or increased use of medications or substances because of the COVID-19 pandemic, most commonly alcohol and sleep aids Alcohol was the substance most commonly started	Cannabis access and availability Anxiety about COVID-19 Boredom Increased symptom burden fewer responsibilities	Participants without access to legal cannabis were more likely to report decreased frequency of cannabis use (t (351) = 2.16, p = 0.032, d = 0.24) than those with legal cannabis access Those who increased cannabis use did so because of anxiety about COVID-19 (68%), boredom (47%), and increased symptom burden (42%) Those who decreased cannabis use did so because cannabis products were less available (67%), anxiety about COVID-19 (26%), and fewer responsibilities (18%)

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Table 1 (*continued*)

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									(16%) or increased (31%) Approximately 40% of participants who increased or started use of medications/substances (other than cannabis) reported doing so because of changed access to medical cannabis		Those starting medications/substances had a higher level of education, t (351) = 3.73, p < 0.001, d = 0.43 were younger, t(351) = 2.02, p = 0.044, d = 0.22, and reported worse mental/ emotional health, t (351) = 2.2, p = 0.025, d = 0.24
5	Chodkiewicz et al. (2020)	443 Poland	Quantitative	Online by the "Snowball" method obtained via Facebook in April and May 2020	Mean= 31.9 years	Female= 78.6% Male= 21.4%	Alcohol Recreational Drugs- (e.g. Marijuana, Amphetatmies, Legal Highs) Sedatives or sleeping pills	AUDIT BRIEFCOPE One question to ask if consumption has changed during lockdown (same, less, more)	Alcohol use= 72.9% Hazardous drinking= 28.2% Harmful drinking= 0.7% Possible addiction= 0.9% Non prescribed sedatives or sleeping pills= 6.3% Recreational drugs= 3.6% 31.2% changed alcohol use because of the pandemic; 17.4% less use, 13.8% more use: former group were younger 2.5% changed recreational drug use because of the pandemic; 1.1% less use, 1.4% more use Those drinking more during the pandemic were found to be drinking more intensively before the pandemic started	Age Relationship status Children present Suicidality Somatic illness Alcohol addiction in family Coping	Subjects declaring low alcohol consumption were significantly younger (at a mean of about 26 years) than the rest (mean above 30 years) Significantly more participants drank more intensively in the pandemic who were in a relationship (7.74%) compared to those who were single (4.78%). P = <0.001 Of those participants with offspring, 8.88% declared drinking more than before the pandemic, whilst 15.72% drank less. In those without children, 5% drank more now than before the pandemic P = <0.001 Individuals who had current suicidal thoughts (10.7%) were more likely to drink more alcohol than before the pandemic than those without such thoughts (p = 0.024) Individuals with somatic illness (11.3%) drank less than those who were healthy (p = 0.006). Individuals with alcohol addiction in their families consumed significantly less alcohol than those respondents from families without alcohol problem

Table 1 (*continued*)

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											(p = 0.04) Subjects who drank more alcohol were significantly less likely to derive any positive benefits from their stress coping strategies during the pandemic situation (positive reframing) (P < 0.001)
6	Czeisler et al., (2020)	5470 USA	Quantitative Cross sectional	Representative online panel surveys x 3 using quota sampling in June 2020	Range 18 + years with highest percentage in age group 25–44	Female= 50.9% Male= 48.9% Other= 0.9%	Substance use (Alcohol, Legal or illegal drugs, or prescription drugs taken in a way not recommended by a doctor)	Started or increased substance use to cope with pandemic-related stress or emotions	Started or increased substance use= 13.3%	Age Ethnicity Unpaid caregivers for adults	Substance increase most reported in persons aged 18–24 (24.7%); prevalence decreased progressively with age; those of Hispanic (21.9%) or Black (18.4%) ethnicity; employed (17.9%) and essential workers (24.7%) Unpaid caregivers for adults had 3.33 times the odds of increased use (CI= 1.75–6.31; p < 0.001)
7	Đogaš et al., (2020)	3027 Croatia	Quantitative Cross sectional	Social media, snowball sampling from author contacts from April-May 2020	Mean= 40	Female= 79.7%	Alcohol	Self-report frequency of alcohol use	The proportion of respondents of both sexes who did not drink alcohol increased from 19.1% to 32.1% The proportion of respondents of both sexes who drank once monthly decreased from 31.9% to 22.3% alongside those that drank up to 3 drinks weekly from 32.3% to 27.2% The proportion of respondents who drank up to 7 drinks per week increased from 12.9% to 13.3%; up to 15 drinks per week increased 2.7–3.4% and more than 15 drinks weekly increased from 1.1% to 1.7%	Gender	Similar patterns were seen in both males and females with the greatest increase in those that drank more than 15 drinks weekly in males from 3.5% to 5.6%
8	Dumas et al., (2020)	1054 Canada	Quantitative Online survey	Advertisement posted on Instagram and emailed to	Range= 14–18 Mean= 16.68	Female= 76.0% Male=	Alcohol and cannabis use	Self-reported frequency of alcohol use, binge drinking,	Overall, the percentage who used alcohol did not change from pre-COVID	Gender Peer reputation concerns	The increase in the frequency of alcohol use was significant for females

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Table 1 (*continued*)

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			individuals already completing a survey for the author in April 2020		21.9% Nonbinary= 1.2%		cannabis use, and vaping in the 3 weeks before and directly after social distancing practices had taken effect The social context in which they used substances (alone, virtually with friends, with physically present friends, with physically present parents)	to post COVID (28.6%– 30.4%, p = 0.23) Overall, the frequency of alcohol use (average number of alcohol-using days) increased significantly (0.76–0.96, p = 0.020) The percentage who binge drank dropped significantly (15.7%– 9.8%; 5.9% decrease, p < 0.01) but there were no significant frequency changes; 0.41–0.33, p = 0.25 Overall, the percentage of cannabis use decreased (17.0%–13.8%; 3.2% decrease, p < 0.001) and yet, the frequency of cannabis use (average number of cannabis using days) increased significantly from pre-COVID to post-COVID (0.94–1.10, p = 0.01) Although the greatest percentage of adolescents was engaging in solitary substance use (49.3%), many were still using substances with peers via technology (31.6%) and face to face (23.6%)	Popularity Depression Fear of COVID-19	(0.77–0.96; p = 0.03) and not males when the analysis was separated by gender In girls only, the percentage of cannabis use decreased (3% decrease, p < 0.01) and yet, the frequency of cannabis use (average number of cannabis using days) increased significantly from pre-COVID to post-COVID (0.9–1.10, p = 0.01) Concerns for how social distancing would affect peer reputation was a significant predictor of face-to-face substance use with friends amongst adolescents with low self-reported popularity and a significant predictor of solitary substance use among average and high popularity teens Adjustment predictors, including depression and fear of the infectivity of COVID-19, predicted using solitary substance use during the pandemic
9 Glober et al., (2020)	~4894 USA	Quantitative Time series comparison	Drug overdoses in one urban emergency medical services (EMS) system in Indiana March 2020 compared to 122 days before and July 2020	NR	NR	Drugs (Opioids)	Urban emergency medical services Calls For Service (CFS) for suspected overdose, CFS in which Naloxone was administered, and fatal overdose data from the County Coroners Office	Overdose CFS and EMS naloxone administration showed an increase with the social isolation of the Indiana stay-at-home order, but a continued increase after the stay-at-home order was terminated Despite a mild 4% increase in all EMS CFS, overdose CFS increased 43% and CFS with naloxone administration increased 61% after the	NR	Nothing significant

Table 1 (*continued*)

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10	Grigoletto et al., (2020)	221 Italy	Quantitative Time series	All data from University children's hospital and university adult hospital in Trieste in weeks immediately before and after lockdown release-April and May 2020	Range 13–24 Mean = 17.0 (20.0 in previous year)	Male= 68.0%	Alcohol	Emergency department (ED) visits for alcohol intoxication	stay-at-home order Deaths from drug overdoses increased by 47% 221 ED visits (compared to 506 in previous year) The frequency of visits rose from 0.88% during the last part of lockdown to 11.3% after lockdown release When compared to the same time period in 2019, despite a lower number of accesses to ED, the absolute number of patients presenting with severe alcohol intoxication increased (25 vs. 15) In relative terms, a significant greater proportion of ED visits immediately after reopening were related to alcohol abuse, namely, 11.31% in the Year 2020 versus 2.96% in the Year 2019 32% presented with a combined intake of alcohol and drugs, mainly cannabinoids	Psychomotor agitation Mental health issues Past history of substance abuse or psychiatric disorder	The relative frequency of ED arrivals related to psychomotor agitation or other mental health issues was not significantly increased after lockdown release. More than half the patients admitted for severe alcohol intoxication after the end of lockdown had a past history of substance abuse or psychiatric disorder
11	Gritsenko et al., (2020)	939 Russia/Belarus	Quantitative Cross sectional	NR	Mean= 21.8	Female= 80.8% Male= 19.2%	Substance use (Alcohol, Cannabis Prescription drugs and Pain relief)	Self-report of the influence of COVID-19 on substance use.	Those who reported last month substance use before COVID 19 report their use increased as a COVID-19 consequence Pre-covid: Substance use rates 58.2% alcohol, 1.7% cannabis, 1.5% Ritalin, 13.8% pain relievers and 6.5% sedatives Among substance users, the following increases were reported: 29.6% alcohol, 27.3% cannabis, 16.7% Ritalin or similar substance, 18.2% pain relievers, and 23.5%	COVID related emotional (fear) responses Last month binge drinking Gender Nationality Religiosity Depression Exhaustion Loneliness Nervousness Anger	Respondents who reported increased alcohol use had higher fear scores ($t_{495} = 2.512$; p = 0.012) Respondents who reported increased alcohol use, compared to those who did not, had higher levels of depression (67.2% vs. 51.6%; p = 0.005), exhaustion (46.5% vs. 35.2%; p = 0.026), loneliness (65.1% vs. 48.8%; p = 0.002), nervousness (73.2% vs. 53.4%; p < 0.001), and anger (55.9% vs. 41.2;

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Table 1 (*continued*)

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									sedatives Those under quarantine/ strict self-isolation conditions had a significantly higher rate of alcohol use than those not restricted (34.3% vs. 24.6%; p = 0.017) Last month binge drinking because of COVID-19 was reported by 7.1% of the survey respondents		p = 0.004) Last month binge drinking because of COVID-19—Russian more than Belarusian (8.2% vs. 2.7%; p = 0.009), male more than female (18.0% vs. 4.5%; p < 0.001), and secular more than religious (10.3% vs. 5.0%; p = 0.005) students
12	Håkansson, (2020)	2016 Sweden	Quantitative Cross sectional	Web panel of market survey company, *Userneeds* April-May 2020	Range 18 + with highest percentage in age group 50–64	Female= 49.0% Male= 51.0%	Alcohol use	One question which asked whether they consumed more alcohol than prior to the pandemic, less alcohol than during the pandemic, unchanged, or "don't drink at all, neither now nor before"	Compared to pre-pandemic alcohol intake: 8% reported an increase in alcohol intake 10% reported a decrease in alcohol intake 65% reported no change in alcohol intake. 17% reported drinking no alcohol either before or during the pandemic	Gambling	Gambling more was significantly associated with higher alcohol consumption (OR 2.68; CI 1.44–4.99)
13	Hawke et al., (2020)	622 Canada	Quantitative Cross sectional	Youth participants across four existing clinical and community cohorts (276 in a clinical and 346 in a community sample) were emailed a link to the survey in April 2020	Range 14–28 Mean = 20.6	Male= 27.2% Female= 64.9% Another gender= 8.0%	Substance use (Alcohol and drugs)	National Institute of Mental Health-developed CoRonavIruS Health Impact Survey (CRISIS) tool	Substance use was significantly lower over time (p < 0.0001) and higher in the clinical sample (p < 0.0001) Substance use was higher in the clinical sample On a 1–5 scale (where 1 is not at all and 5 regularly), the clinical sample rated substance use at an average of 1.79 prior to COVID-19 and 1.72 in the past 2 weeks In the community sample, these rates were 1.39 prior to COVID-19 and 1.32 in the past 2 weeks 23.2% of youth in the clinical sample and 3.0% of the community sample met the criteria for a substance use disorder	NR	NR
14	Kim et al., (2020)	182 UK	Quantitative Cross sectional	Patients with pre-existing alcohol disorders registered	Median age 57 years	Male= 73.0%	Alcohol use	AUDIT	24% reported an increase in their alcohol intake, with a mean increase in	Contact with clinic/ specialist nurse	Contact with an alcohol nurse was a positive predictor of relapse and

Table 1 (*continued*)

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			since 2017 in the alcohol clinic of St Mary's Hospital, London May-June 2020		Female= 27.0%			the AUDIT score of 57·6% and a mean weekly consumption of 82·5 units (SD 78). 19% reported a decrease in their alcohol intake 38% patients were classified as abstinent before lockdown, and within this subgroup, 17% relapsed during lockdown and a 226% mean increase in the AUDIT score from before lockdown, with a mean weekly consumption of 48·8 units (SD 63) Of 62% individuals who were previously drinking before the lockdown, 12% became newly abstinent since the beginning of lockdown		improving new abstinence. Univariate analysis revealed that those who had contact with a specialist nurse were more likely to become newly abstinent, compared with those who did not have contact (two [100%] of two vs two [12%] of 17; p = 0·035; OR 1·118, 95% CI 0.032–0.432)
15 Knell et al., (2020)	1809 USA	Quantitative Cross sectional	Recruitment via a digital flyer through the investigators' social media platforms (e.g., Facebook, Twitter, Instagram) in April and May 2020	Most: 39.8% in the 35–49 group	Female= 67.4% Male= 32.6%	Alcohol and marijuana use	Self-report using items adapted from the BRFSS Participants reported their lifetime and past month use of each of the substances (marijuana, alcohol, and tobacco) and if the pandemic was related to any changes in substance use	Marijuana use: 48.6% formerly engaged and 12.7% current use Increased use 36.5% Decreased use 10.4% Stayed the same 53.0% Alcohol consumption: 21.7% reporting consuming one alcoholic drink per day on average Increased use 38.5% Decreased use 11.9% Stayed the same 49.6% Participants primarily reported alcohol and marijuana use remained the same	Age Education Number of children Employment Disability BMI Depression	Changes in marijuana use were associated with symptoms of depression: Those with moderate- to severe- symptoms of depression had significantly higher odds (OR = 3.15 (95% CI = 1.58–6.25) of increasing marijuana use compared to those with no symptoms of depression Changes in alcohol consumption were related to age, educational status, BMI, number of children, and depression scores. Specifically, those aged 35–49 years (OR = 0.49 (95% CI = 0.30–0.78) and 50 years and older (OR = 0.46 (95% CI = 0.28–0.77), college graduates (OR = 0.46 (95% CI = 0.30–0.71), those who are overweight/ obese (OR =

Table 1 (*continued*)

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											0.62 (95% CI = 0.43–0.90) had significantly lower odds of decreased alcohol consumption compared to their counterparts Alternatively, those in the oldest age group (age 50 years or more) had 0.46 times the relative odds (OR = 0.54 (95% CI = 0.38–0.78) of increasing alcohol consumption compared to those aged 18–34 years, after controlling for other relevant factors. While those with children (OR = 1.58 (95% CI = 1.19–2.09) and those with a moderate to severe depression symptom severity score (OR = 2.24 (95% CI= 2.41–4.64) had significantly higher odds of an increase in alcohol consumption compared to those with none to mild depression symptom severity score
16	Lechner et al., (2020)	1958 USA	Quantitative Cross sectional	Students who endorsed alcohol use in the past 30 days were recruited through email to participate in March 2020	Mean- 24.9%	Female= 80.0%	Alcohol	Time-line Follow-Back Interview (TLFB)	Participants consumed a range of 0–63 standard drinks (M = 3.48, SD = 5.45) and a range of 0–7 drinking days (M = 1.36, SD = 1.55) in the first week of the assessment period and a range of 0–98 standard drinks (M = 5.01, SD = 6.86) and a range of 0–7 drinking days (M = 1.94, SD = 1.84) in the second week Alcohol use increased significantly following COVID-19 related campus closure (b=0.369, 95% CI= 0.316, 0.423, p,0.001)	Depression Anxiety Social support	Higher psychological distress was associated with higher alcohol consumption overall: depression (b = 0.027, 95% CI = 0.017, 0.037, p < 0.001), and anxiety (b = 0.026, 95% CI = 0.014, 0.038, p < 0.001) Those with more social support, consumed less alcohol overall b = −0.009, 95% CI = −0.015, − 0.002, p = 0.013 Individuals experiencing higher levels of symptoms of depression and anxiety reported greater increases in alcohol consumption

Table 1 (*continued*)

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									over time as compared to individuals with fewer symptoms (b = 0.012, 95% CI = 0.006, 0.017, p = 0.011; b = 0.013, 95% CI = 0.004, 0.023, p = 0.004, respectively)		NR
17	Leichtle et al., (2020)	1317 USA	Quantitative Time series comparison	Records of Patients admitted to trauma centre (March 2019 & 2019 compared to March 2020)	Mean= 47.0 (pre COVID-19) and 46.0 (COVID-19)	Female= 35.2% (pre COVID-19) and 31.9% (COVID-19)	Alcohol Other substance	Trauma centre 'activations' related to alcohol and other substances	After the implementation of COVID restrictions, a larger proportion of trauma patients suffered from chronic alcohol abuse and continued to present with disease-related injuries Chronic alcohol abuse: Pre-Covid (6.8%), after Covid restrictions (15.5%), P < 0.01 Chronic substance abuse: Pre-Covid (7.3%), after Covid restrictions(9.7%), P < 0.31	NR	NR
18	López-Bueno et al., 2020	2741 Spain	Quantitative Cross sectional	Survey launched on social media March-April 2020	Mean= 34.2	Female= 51.8% Male= 48.2%	Alcohol	Any alcohol consumption Question "how often do you drink alcohol-Usually, moderate and never"	Overall, 49.9% participants reported alcohol consumption during Covid-19 confinement Previous to Covid-19: 70.5% Week 1 of lockdown: 53.4% Week 2 of lockdown: 46.5% Week 3 of lockdown: 43.3% Consumption of alcohol decreased during lockdown	NR	NR
19	Luca et al., (2020)	3140 Pre Covid: 2173 and Covid: 967 Romania	Quantitative Time series comparison	Psychiatric hospital admissions in two psychiatric hospitals in Iasi and Galati related to alcohol pre Covid (Jan-Feb 2020) and Covid (March-May 2020)	NR	Iasi: Males= 54.7% & 57.1% Females 45.3% & 42.9% Galati: 51.4% & 59.5% Females 48.3% & 40.5%	Alcohol	Psychiatric hospital admissions related to alcohol	Iasi: Admissions related to alcohol increased from 3.68% to 6.1% of total Galati: Admissions related to alcohol increased from 23.54% to 36.89% of total	NR	NR
20	Marais et al., (2020)		One-week Audit	One-week Audit of Emergency	2019: Mean= 36.0		Illicit drugs: Cannabis	Patient presented to Emergency	2019: 6.9% presentations met the definition of an	NR	NR

Table 1 (*continued*)

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		2019:1396 2020: 1038 Australia	April 2019 and April 2020	Department Information System (EDIS) for Illicit drug presentations (IDRP) in April 2020		2019: Male= 62.5% Female= 37.5%	Heroin Methamphetamine Amphetamine, Cocaine Synthetic cannabanoids GHB MDMA	Department either directly or indirectly as a result of using an illicit drug.	IDRP (approx. 14 patients a day) Methamphetamine was the most commonly used illicit drug by 59 (61.5%) of the cohort, representing 4.2% of all ED attendances Other drug presentations were: Cannabis: 19.8% Heroin: 13.5% Amphetamine/speed: 11.5% Unknown: 7.3% MDMA: 5.2% Synthetic cannabinoids: 3.1% Cocaine: 1.0% GHB: 1.0% Three patients required ICU admission 2020: 7.7% presentations met the definition of an IDRP Methamphetamine was the most commonly used illicit drug by 50 (62.5%) of the cohort, representing 4.8% of all ED attendances While there was an absolute decrease in IDRP's, in relative terms there was an increase		
21	Martinotti et al., 2020	153 Italy	Quantitative	Outpatient and residential inpatients individuals with ongoing or previous SUD and/ or gambling problems across 7 different Italian regions March to May 2020	Mean= 39.8	Male= 77.7% Female= 22.2%	Substance use Cocaine Alcohol THC Heroin Benzos Ketamine Prescription Opiods MDMA Methamphetamine	Primary substance of abuse Level of craving and how much craving and habits had changed during lockdown Changes in consumption	Most subjects (n = 66, 43.1%) indicated cocaine as the principal substance of abuse, followed by alcohol (n = 39, 25.5%) and THC (n = 24, 15.7%) Primary Substance use: Cocaine= 43.1% Alcohol-25.5% THC= 15.7% Heroin= 5.9% Benzodizepine = 0.7% Ketamine 0.7%	Comorbid psychiatric condition	43.8% participants reported a comorbid psychiatric condition, especially mood disorders (depression and bipolar disorder) or anxiety Moderate/severe depressive symptoms= 22.9%, Moderate/severe anxiety symptoms= 30.1%, Irritability= 31.6%

Table 1 (*continued*)

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									Prescription= 0.7% Reports of craving were low Reports of difficulty in finding the substance		Post-traumatic stress = 5.4%
22	McPhee et al., (2020)	833 USA	Quantitative Cross-sectional	Sample from Amazon M Turk who had consumed alcohol on > 1 occasions per month in the past year May 2020	Mean= 40.8	Male = 64.7%	Alcohol	AUDIT DMQ-R Indices of recent alcohol use were assessed with the National Institutes on Alcohol Abuse and Alcoholism (NIAAA) Recommended Alcohol Questions Solitary drinking frequency	Overall, participants reported typical quantities, frequency, and time spent drinking post-social-distancing that were commensurate with pre-social-distancing values However, participants reported significantly more binge episodes and solitary drinking post-social-distancing	Depression Coping COVID-related distress Ethnicity	Mediation analyses suggested a significant indirect effect of reduced environmental reward with drinking quantity/ frequency via increased depressive symptoms and coping motives, and a significant indirect effect of COVID-related distress with alcohol quantity/ frequency via coping motives for drinking Generally, non-white participants seemed to be at higher risk for higher drinking levels, riskier drinking patterns, and greater affective distress, when compared to white participants
23	Newby et al., (2020)	5070 Australia	Quantitative Cross Sectional	Participants were recruited for the online survey via social media posts, with Facebook advertisements targeting all users in March and April 2020	Most: 47.2% in 45–64 group	Female= 85.8% Male= 12.9% Non Binary= 0.8% Other identity= 0.2%	Alcohol	Modified AUDIT-C in past month	Hazardous drinking= 52.7%	Self-Isolation Mental health	People in self-isolation reported lower alcohol consumption (3.02) than those who were not self-isolating (3.25): t (4826) = −3.02, p = 0.001 Participants with a mental health diagnosis had lower rates of hazardous drinking, and lower rates of inactivity-48.6% v 54.6% (X2 = 52.52 p < 0.001)
24	Ochalek et al., (2020)	329 USA	Quantitative Time series analysis	Patients with opioid overdoses, were identified from electronic medical records from the Virginia Commonwealth University Hospital from March 1 to June 30, 2019, and	Means= 42.2 years and 44.0 years	Female= 30% and 27% Male= 70% and 73%	Opioids	Numbers of nonfatal, unintentional opioid-related opioid overdoses presenting to an urban emergency department during the early months of the pandemic relative to the previous year	The total number of nonfatal opioid overdose visits increased from 102 between March and June 2019–227 between March and June 2020	Gender Ethnicity	Among patients who presented with a nonfatal opioid overdose in March through June 2019 and March through June 2020, 71 (70%) and 165 (73%) were male, 64 (63%) and 181 (80%) were Black, and 45 (44%) and 91 (40%) were uninsured, respectively

Table 1 (*continued*)

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25	Panno et al., (2020)	1519 Italy	Quantitative Cross-sectional	from March 1 to June 30, 2020 Online representative survey distributed online to All Italian regions March to May 2020	Mean= 28.5	Female= 76.0% Male= 24.0%	Alcohol	CAGE	Problematic alcohol use: 7.1% The psychological impact of COVID-19 was independently associated with alcohol problems ($\beta = 0.058$, $p = 0.043$) Illegal drugs used during lockdown= 4.2%	Covid related distress Gender Smoking Impulsivity Food addiction	COVID-19 related distress remained independently associated with CAGE total score ($\beta = 0.058$; $p = 0.043$) Male gender ($\beta = 0.090$; $p = 0.001$), being a smoker ($\beta = 0.140$; $p < 0.001$), higher impulsivity ($\beta = 0.133$; $p < 0.001$), and higher food addiction scores ($\beta = 0.062$; $p = 0.028$) were independently associated with the CAGE total score
26	Rodriguez, Litt, and Stewart (2020)	754 USA	Quantitative Cross Sectional	National survey April 2020	Mean= 41.7	Female= 50.0% Male= 50.0%	Alcohol	The QF was used to assess peak and typical drinks and drinking frequency in the past month. (greater number of drinks on the heaviest occasion, number of drinks on a typical occasion, drinking frequency and frequency of heavy drinking episodes)	Participants Consumed, on average, almost six drinks on heaviest drinking occasion in past month (SD = 5.84) Participants reported drinking almost four drinks on a typical occasion (SD = 1.89), on average, and drinking on a mean of approximately 10 days in the last month (SD = 8.94) Participants reported approximately 1.4 heavy drinking episodes in the past month, on average (SD = 1.93)	Gender COVID-19 threat	Alcohol use was correlated with gender ($p < 0.001$) and COVID related psychological distress ($p < 0.001$) Both COVID-19-related perceived threat and psychological distress showed significant bivariate associations with all four drinking indices Psychological distress related to the COVID-19 pandemic was consistently related to alcohol use indices, and moderation results indicated this pattern was significant only among women for number of drinks consumed during the recent heaviest drinking occasion and number of drinks consumed on a typical evening. COVID-related distress' link to frequency of drinking and heavy drinking episodes was not different for men and women Men and women did not differ in their COVID-19-

Table 1 (*continued*)

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											related perceived threat or psychological distress (p > 0.30); however, men reported greater drinking on all four indices (p < 0.01)
27	Rogers et al., (2020)	160 USA	Quantitative Cross Sectional	Web via Amazon Mechanical Turk April-May 2020	Mean= 37.9	Female= 43.5%	Alcohol and substance use (cannabisstimulants opioids, other drug use)	Self-report of use prior and since Covid-19 outbreak (No change, more or less) Substance use motives- modified version of the DMQ-R anchored to the most used substance	Prior to the COVID-19 outbreak: 43.1% used alcohol, 12.5% used cannabis, 5.0% used stimulants, and 3.1% used opioids Since the COVID-19 outbreak an additional: 8.8% used alcohol, 5.0% started using cannabis, 5.6% started using stimulants, and 5.6% started using opioids	COVID worry COVID fear	Across substances, levels of COVID-19-related worry and fear were highest among those people who initiated substances during the COVID-19 pandemic compared to those who used substances prior and those who never used Effect sizes for the mean differences indicated small to medium mean differences between the groups, with the largest differences between the COVID-19 initiators and the abstainers
28	Rolland et al., (2020)	11391 France	Quantitative Cross Sectional	Open web-based survey disseminated on social media and national media March 2020	Mean= 47.5	Female= 52.1%	Alcohol Cannabis Other drugs	Self-report of any changes in alcohol and cannabis use, other drugs: No use, no change in use Decrease with craving/ withdrawal, decrease without craving/ withdrawal, increase (moderate) increase (difficult to control) History of addiction treatment	Overall, the respondents reported more increases in addiction-related habits than decreases, specifically 24.8% (alcohol use), and 31.2% (cannabis use) 62.4% used alcohol more or less regularly. Among them, 57.8% had not changed average daily use of alcohol, 23.37% moderately increased alcohol use, 1.5% increased alcohol use in a difficult-to-control manner, 16.4% reduced or stopped without craving/ withdrawal, 1.0% reduced with craving/ withdrawal 5.44% reported using cannabis. Among them 39.5% reported that they had not changed their average daily use, 24.3%	Age Education Current psychiatric treatment	Factors of increase in alcohol use were age 30–49 years (aOR 1.18, 95% CI 1.01–1.39), a high level of education (aOR 1.52, 95% CI 1.24–1.8)., and current psychiatric treatment (aOR 1.44, 95% CI 1.10–1.88) The only significant factor of increase in cannabis use was intermediate (aOR 0.41) or low level (aOR 0.38 of education (P < 0.001)

Table 1 (*continued*)

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									moderately increased their cannabis use, 6.9% increased their cannabis use in a difficult-to-control manner, 22.5% reduced or stopped their cannabis use without craving/ withdrawal, 6.8% reduced their cannabis use with craving/withdrawal		
29	Romero-Blanco et al., (2020)	213 Spain	Quantitative Cross Sectional	Pre-post study on Spanish University students with two cut off points- Jan and April 2020 Carried out in the context of another study on healthy habits and lifestyles	Mean= 20.5	Female= 80.8% Male= 19.2%	Alcohol	A question about alcohol consumption (yes/no) and number of drinks a week	Alcohol consumption= 81.4%	Physical activity Sitting time	Both weekly physical activity (MD: 161.4; CI: 94.2–228.6; P < 0.001) and daily sitting time increased (MD: 109.0; CI: 69.8–148.1; P < 0.001) in those that consumed alcohol
30	Sallie et al., (2020)	1346 85 different majority in the UK	Quantitative Cross-sectional	HabiT survey that sought to assess the effects of isolation on alcohol, smoking and internet use May 2020	Mean= 28.9	Male= 74.7% Female= 24.1% Other= 1.1%	Alcohol	AUDIT AUDIT C Self-reported behavioural changes in alcohol drinking	Abstention = 20% Decrease in use= 45% Increase in use = 36% No change= 19% Of the total sample, the change in problem drinking severity was 0.89 ± 1.43 (95% CI 0.81–0.96) (range: 0–8) and the mean change in the amount consumed was 5.62 ± 9.55 units per week (95% CI 3.16–4.02) (range: 0–120) The units of alcohol consumed per week was significantly decreased during the quarantine period (8.03 ± 14.22 units (7.11–8.94) range= 1–120) compared with November (8.32 ± 11.92 units (95% CI 7.47–9.02) range= 0–150), U= −2.29 (95% CI 0.0–0.0) p = 0.02 However, in the UK, the units of alcohol consumed per week was	Age Essential workers Children personal relationship with someone severely ill from COVID-19 Depression Anxiety Impulsivity UK	Those who increased alcohol use during quarantine were older individuals (95% CI 0.04–0.1, p < 0.0001), essential workers (95% CI −0.58 to −0.1, p = 0.01), individuals with children (95% CI −12.46 to 0.0, p = 0.003), those with a personal relationship with someone severely ill from COVID-19 (95% CI −2 to −0.38, p = 0.01) and those with higher depression (95% CI 0.67–1.45, p < 0.0001), anxiety (95% CI 0.61–1.5, p = 0.0002), and positive urgency impulsivity (95% CI 0.16–0.72, p = 0.009) Furthermore, country-level subsample analyses indicated that drinking amount (95% CI 9.36–13.13, p = 0.003) increased in the UK during quarantine

Table 1 (*continued*)

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									significantly increased during the quarantine period (11.25 ± 17.73 units (95% CI 9.36–13.13) range= 1–120) compared to November (10.94 ± 14.17 units (95% CI 9.44–12.45) range= 0–150), U= 3.0 (95% CI 0–0.7) p = 0.003		
31	Sanchez, Zlotorzynska, Rai and Baral (2020)	1051 US	Quantitative Cross-Sectional	Men who have sex with men recruited through a series of websites and social media April 2020	Median age: 35.0	Male= 100%	Alcohol and drug use	Two questions asking if the use of recreational drugs and alcohol consumption has decreased, stayed the same or increased because of Covid	Compared to pre-pandemic alcohol intake: 26.0% reported an increase in alcohol intake. 10.1% reported a decrease in alcohol intake. 62.6% reported no change in alcohol intake Use of recreational drugs: 9.9% reported an increase in drug use 6.8% reported a decrease in drug use. 82.1% reported no change in drug use	Age	Younger participants (15–24 years old) were more likely to report increased alcohol consumption (OR 1.91; CI 1.45–2.52) and drug use (OR 1.30; CI 1.09–1.56) compared to older participants (aged 25 years and older)
32	Scarmozzino and Visioli, (2020)	1392 Italy	Quantitative Cross Sectional	Questionnaire distributed online via social media and a poplar Italian agriculture magazine (Olio Officina), also students from University of Padova distributed the survey to personal contacts. April 2020	NR	NR	Alcohol	A question about increase or decrease in consumption of wine, beer and liquors during lockdown.	36.8% decrease in alcohol use 53.1% alcohol use the same 10.1% increase in alcohol use	NR	NR
33	Sidor and Rzymski, (2020)	1097 Poland	Quantitative Cross Sectional	Online via social media April-May 2020	Mean= 27.7	Female= 95.1% Male= 4.9%	Alcohol	Self-reported frequency of alcohol consumption in general population and also in those addicted to alcohol during quarantine	The majority did not report an increase (77%), 8.3% were uncertain 14.6% reported an increase Higher tendency to drink more found among alcohol addicts compared to non-addicts (64.0% vs 14.0%; p < 0.001)	Nothing Significant	No significant associations

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34	Silczuk, (2020)	113 Poland	Quantitative Cross Sectional	Online ALCOVID survey with a cover letter recruited online via accessible networks to physicians who were isolating or in quarantine in April 2020	Most under 50 years old.	Female= 54.9% Male= 45.1%	Alcohol	Self-report on whether drinking changed during quarantine or isolation, and if so, then how. Items 2 & 3of the AUDIT-3	31.8% used alcohol four or more times a week 27.4% two to three times a week 13.3% two to four times a month 6.2% one or fewer times a month. 21.2% abstinence from alcohol Alcohol use increased = 53.1% Alcohol use decreased= 8.8% Alcohol use had not changed= 38.1% Almost 20% of subjects binged over seven standard drinks for one occasion. Close to every second used six or more drinks on one occasion. Of those in isolation or quarantine, 41.2% % used alcohol more than four times per week	Reasons for drinking Gender	Anxiety (the most common answer on the question concerning motives for using alcohol), tension and fear about their health: feeling helpless, hopeless and lacking reliable information and worries about the future were the motivations and triggered them to drink more alcohol while in quarantine or isolation Females used alcohol more often and more standard drinks per occasion. Males binged more. Anxiety and hopelessness were the most common motives to drink
35	Slavova et al., (2020)	124,425 USA	Quantitative Time series analysis	Standard reporting data from Kentucky State Emergency Medical Services (EMS) runs between January 2020 and April 2020 (52 days)	NR	NR	Opioids	Overdoses requiring emergency admissions (OOR): Opioid Overdose runs)	Overall, there was an increase in the total number of EMS OOR during the COVID-19 study period compared to the pre−COVID-19 period EMS OOR-Transport (1133 during the pre−COVID-19 period vs. 1323 during the COVID-19 period; 17% increase) EMS OOR-Refusal (223 vs. 382; 71% increase) EMS runs for suspected opioid overdose with death at the scene (12 vs. 18; 50% increase) Decline in the total number of all EMS Transport Runs Excluding OOR-Transport (55,855 vs. 43,478; 22% decline) and almost no change in all EMS Refusal Runs Excluding ORR-Refusal	NR	NR

Table 1 (*continued*)

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36	Stanton et al	1491 Australia	Quantitative Cross Sectional	Survey distributed on social media and via institutional sources using email and public marketing in April 2020	Mean= 50.5	Female= 67.4% Male= 32.6%	Alcohol	AUDIT-C	(11,04 vs. 10,957; 0.8% decline) Alcohol consumption: Never: 20.2% Monthly or less: 21.6% 2–4 times per week: 16.8% 2–3 times per week- 19.2% 4 or more times a week: 22.3% Since the onset of the COVID-19 pandemic: No change in alcohol consumption= 55.3% Negative change= 26.6% Positive change= 18.1%	Depression Anxiety Stress	For those who reported a negative change in alcohol intake were more likely to have higher depression (adjusted OR = 1.07, 95% CI = 1.04, 1.10), anxiety (adjusted OR = 1.08, 95% CI = 1.04, 1.12), and stress (adjusted OR = 1.10, 95% CI = 1.07, 1.13)
37	Sun et al., (2020)	6416 China	Quantitative Cross Sectional	Chinese social media: Joybuy.com, Webchat and Weibo March 2020	Mean = 28.2	Female= 53.0% Male= 47.0%	Alcohol	Self-reported behavioural changes in alcohol drinking	The overall rate of alcohol drinking increased marginally during the COVID-19 pandemic from 31.3% to 32.7%. However, addictive behaviours increased substantially in two areas: 18.7% ex-drinkers had relapsed 32.1% regular drinkers reported an increased amount of drinking 1.7% non-drinkers initiated the use of alcohol 1.6% once occasional drinkers transited from occasional use to regular use 3.4% regular drinkers quit	NR	NR
38	Tran et al., (2020)	13,829 Australia	Quantitative Cross Sectional	Online survey available four days after Covid-19 restrictions were implemented for a month April-May 2020	Most: 33.4% in 50–64 group (Only those that drank alcohol reported)	Female= 74.9% Male = 25.1% (Only those that drank alcohol reported) Non binary= 0.6% (not included in the analysis)	Alcohol	Self-reported behavioural changes in alcohol drinking	About one in five adults reported that they had been drinking more alcohol than usual since the COVID-19 pandemic began. More than I used to: 20.9% Less than I used to: 10.5% About the same: 43.9%	Depression Anxiety Age	Increased alcohol consumption was associated with more severe symptoms of depression: Mild depression= (adjusted OR = 1.7, 95% CI = 1.6, 2.0) Moderate to severe depression= (adjusted OR = 2.5, 95% CI = 2.1, 2.9)

Table 1 (*continued*)

Authors & date of publication	Sample size (n) Country & Region	Study type & research design (e.g. quantitative, clinical trial)	Recruitment strategy (E.g. waiting room, A & E)	Age	Gender	Alcohol/ substance (i.e. non- prescribed drug etc)	Alcohol & substance use measure (s) (e.g. Validated scale/ interview)	Proportion reporting use (%)	Additional significant analyses (health/ mental health/ demographics)	Covariates with alcohol and substance use
								Don't drink alcohol: 24.7%		Increased alcohol consumption was associated with more severe symptoms of anxiety: Mild anxiety= (adjusted OR = 1.2, 95% CI = 1.1, 1.3) Moderate to severe anxiety= (adjusted OR = 1.5, 95% CI = 1.3, 1.7) The positive associations between the severity of anxiety symptoms and increased alcohol use since COVID-19 restrictions were stronger in the mid-aged groups than in younger or older groups
39 Vanderbruggen et al., (2020)	3632 France	Quantitative Cross Sectional	Online survey distributed by the communication services of the University Hospital and University of Brussels April 2020	Mean= 42.1 years	Female= 70.0% Male= 29.8% Gender-neutral= 0.2%	Alcohol Cannabis	Self-reported behavioural changes in alcohol drinking and cannabis use and reasons for any change	Overall, respondents reported consuming more alcohol (d = 0.21) than before the COVID-19 pandemic (both p < 0.001), while no significant changes in the consumption of cannabis were noted Quit drinking= 9.4% Started drinking= 5.8% Drank more= 30.3% Drank less= 13.7% A statistically significant, but small (d = 0.21), difference was found between the number of drinks per day before and during the lockdown (1.0 ± 1.4, range 0–15, and 1.4 ± 2.1, range 0–21, respectively; p < 0.001) Quit using cannabis= 0.7% Started using cannabis= 0.9% Used cannabis more= 2.1% Used cannabis less= 1.1%	Age Children at home Non-healthcare workers Being technically unemployed related to COVID-19 Boredom Lack of social contacts Loss of daily structure Reward after a hard-working day Loneliness Conviviality	The odds of consuming more alcohol during the lockdown were associated with younger age (OR = 0.981, p < 0.001), more children at home (OR = 1.220, p < 0.001), non-healthcare workers (OR = 1.404, p < 0.001), and being technically unemployed related to COVID-19 (OR=1.357, p = 0.037) Students were less likely to drink more (OR = 0.54, p < 0.001) Boredom, lack of social contacts, loss of daily structure, reward after a hard-working day, loneliness, and conviviality were the main reasons for consuming more of the various substances

Table 1 (*continued*)

Authors & date of publication	Sample size (n) Country & Region	Study type & research design (e.g. quantitative, clinical trial)	Recruitment strategy (E.g. waiting room, A & E)	Age	Gender	Alcohol/ substance (i. e. non- prescribed drug etc)	Alcohol & substance use measure (s) (e.g. Validated scale/ interview)	Proportion reporting use (%)	Additional significant analyses (health/ mental health/ demographics)	Covariates with alcohol and substance use
40 Van Laar et al., (2020)	1563 Netherlands	Quantitative Cross Sectional	Participants were recruited through social media and by recontacting cannabis users from a former study March 2020	Mean= 32.7	Male= 66.3% Female= 33.0% Other= 0.6%	Cannabis	Self-reported change in use (more often, same, less often) and motives for increasing or decreasing use. Use patterns were further specified by assessing frequency of use before and after implementation of the lockdown Number of joints per typical use day and mode of use.	There was no statistically significant difference between the number of joints per day before and during the lockdown (0.1 ± 0.5 joints per day, range 0–8, and 0.1 ± 0.4 joints per day, range 0–5; $p = 0.508$) 67.9% used cannabis (almost) daily more users increased rather than decreased cannabis consumption according to both frequency and quantity 41.3% of all respondents indicated that they had increased their cannabis use since the lockdown measures, 49.4% used as often as before, 6.6% used less often, and 2.8% stopped (temporarily). One-third of those who were not daily users before the lockdown became (almost) daily users Before the lockdown, most respondents (91.4%) used cannabis in a joint mixed with tobacco and 87.6% still did so. Among users of joints, 39.4% reported an increase in the average number consumed per use day; 54.2% stayed the same and 6.4% used fewer joints	Age Gender Boredom Mental Health Stress Isolation Physical health Loneliness	Chi-square test showed a relation between self-reported change and gender ($\chi2 = 34.3$, $p < 0.001$) and age ($\chi2 = 157.9$, $p < 0.001$) The proportion of women (50.4%) who used cannabis more often since the lockdown was higher than the proportion of men (36.5%). In addition, the proportion of young adults (51.6%) who used cannabis more often since the lockdown was higher than the proportion of older adults (23.1%) Boredom was by far the most commonly stated reason for using cannabis more often (78.4%) Stress (36.3%), Mental health (30.1%), loneliness (29.6%), physical health (7.9%), less parties/ nightlife (26.5%), seeing friends less (22.5%) were all reasons for an increase in use (Mental) health problems and stress were more important reasons for women than men, while social motives were more important for men Those who reported stopping or decreasing their cannabis use attributed this to seeing friends less (often)

Table 1 (*continued*)

	Authors & date of publication	Sample size (n) Country & Region	Study type & research design (e.g. quantitative, clinical trial)	Recruitment strategy (E.g. waiting room, A & E)	Age	Gender	Alcohol/ substance (i.e. non- prescribed drug etc)	Alcohol & substance use measure (s) (e.g. Validated scale/ interview)	Proportion reporting use (%)	Additional significant analyses (health/ mental health/ demographics)	Covariates with alcohol and substance use
											(32.2%) and mental health concerns (29.5%). One fifth (19.9%) of this small group of users decreased their use because of physical health concerns
41	Vidot et al., (2020)	1202 USA	Quantitative Cross Sectional	An internet-based questionnaire was administered to adults ≥ 18 who self-reported medicinal cannabis use within the past year March to April 2020	Mean= 47.2 years	Male= 52.0% Female= 46.9% Transgender= 1.1%	Cannabis	The COVID-19 Cannabis Health Questionnaire (CCHQ)	Since COVID-19 was declared a pandemic, 38.4% reported an increase in dose, 8.8% reported a decrease in dose, and 47.9% reported no change in dose	Mental Health	Those with mental health conditions reported increased medicinal cannabis use by 91% since COVID-19 was declared a pandemic compared to those with no mental health conditions (adjusted odds ratio: 1.91, 95% CI: 1.38–2.65)
42	Wainwright et al., (2020)	150,000 (75,000 in both time periods) USA	Quantitative Cross Sectional Time Series Analysis	Urine drug test results from patients diagnosed with or at risk of substance use disorders ordered by health care professionals as part of a comprehensive treatment plan November 14, 2019-March 12 2020 (before), and March 13 2020 to July 10, 2020 (during)	Median Age Before= 49 (23–75) During= 46 (20–72)	Before: Female= 53.9 Male= 46.1 During: Female= 51.5 Male= 48.5	Drugs cocaine, fentanyl, heroin, metham- phetamine	Test results performed by liquid chromatography tandem mass spectrometry for cocaine, fentanyl, heroin, and methamphetamine	Compared with the period before COVID-19, the proportion of specimens testing positive during the COVID-19 period increased: From 3.59% to 4.76% for cocaine (adjusted OR, 1.19 [95% CI, 1.11–1.29]; P < 0.001 From 3.80% to 7.32% for fentanyl (adjusted OR, 1.67 [95% CI, 1.55–1.81]; P < 0.001 From 1.29% to 2.09% for heroin (adjusted OR, 1.33 [95% CI, 1.11–1.61]; P = 0.002 From 5.89% to 8.16% for methamphetamine (adjusted OR, 1.23 [95% CI, 1.14–1.32]; P < 0.001	Age Gender Treatment setting	The patients tested for the selected drugs during the COVID-19 period were significantly younger vs the period before COVID-19 (median age, 46 years vs 49 years, respectively; P < 0.001), were more often male (48.48% vs 46.06%; P < 0.001), and were more likely from a substance use disorder treatment setting (30.84% vs 25.47%)
43	Wang et al., (2020)	2229 China	Quantitative Cross Sectional	An internet-based questionnaire was administered to adults ≥ 18 who were alcohol drinkers May to August 2020	Mean= 36.6 years	Male= 78.7% Female= 21.3%	Alcohol	AUDIT AUDIT-C Timeline Followback (TLFB) questionnaire	Alcohol consumption slightly decreased during COVID-19 (from 3.5 drinks to 3.4 drinks, p = 0.035) in the overall sample The average of drinking days per week reduced (from 1.9 to 1.8 days, p = 0.03)	Gender Anxiety	Most (78.7%) alcohol drinkers were males Before and during COVID-19, males consumed more drinks per week (4.2 and 4.0 vs. 1.3 and 1.2 drinks), had a higher percentage of heavy drinking (8.1% and 7.7% vs. 4.4% and 2.7%), and more drinking days per week (2.1 and 2.1 vs. 1.0 and 0.9 days). Males

Table 1 (*continued*)

	Authors & date of publication	Sample size (n) Country & Region	Study type & research design (e.g. quantitative, clinical trial)	Recruitment strategy (E.g. waiting room, A & E)	Age	Gender	Alcohol/ substance (i.e. non- prescribed drug etc)	Alcohol & substance use measure (s) (e.g. Validated scale/ interview)	Proportion reporting use (%)	Additional significant analyses (health/ mental health/ demographics)	Covariates with alcohol and substance use
											also had more risky drinking (43.2 vs. 9.3%) and hazardous drinking (70.2 vs. 46.6%) than female counterparts This study also found that high-risk drinking predicted anxiety in females (OR 2.62; p = 0.02)
44	Wardell et al., (2020)	320 Canada	Quantitative Cross Sectional	Participants who drink alcohol were recruited via Prolific, an online crowdsourcing platform in from April to May 2020	Mean = 32	Male= 54.7%	Alcohol	Frequency and quantity of alcohol use for past 30 days and 30 days prior to lockdown adapted from using modified items from the NIAAA recommended alcohol questions Frequency of solitary drinking The Short Inventory of Problems, a subset of items from the DrInC assessed alcohol-related problems over the past 30 days How often participants drank to cope with negative affect (Coping Motives Scale of the DMQ-R-SF)	Average drinking frequency was slightly higher (Mean: 3.48 vs 3.21), and average drinking quantity was slightly lower (Mean 2.25 vs 2.39), for the past 30 days versus the 30 days prior to the COVID-19 emergency There was a statistically significant increase in solitary drinking reported for the past 30 days relative to the 30 days prior to the COVID-19 emergency Mean: (4.62 vs 3.38)- the percentage of solitary versus social drinking time increased from an average of 30–40% to an average of 40–50% The total score on the Short Inventory of Problems suggests low levels of past 30–day alcohol problems in the sample, although total scores ranged from 0 to 21, indicating variability across participants	Child under 18 Depression Social connectedness Coping Income loss Living arrangements	The results of a theory-informed path model showed that having at least 1 child under the age of 18, greater depression, and lower social connectedness each predicted unique variance in past 30- day coping motives, which in turn predicted increased past 30-day alcohol use (controlling for pre-COVID-19 alcohol use reported retrospectively) Income loss was associated with increased alcohol use, and living alone was associated with increased solitary drinking (controlling for pre-COVID-19 levels), but these associations were not mediated by coping motives. Increased alcohol use, increased solitary drinking, and greater coping motives for drinking were all independently associated with past 30-day alcohol problems, and indirect paths to alcohol problems from having children at home, depression, social connectedness, income loss, and living alone were all supported

Table 1 (*continued*)

	Authors & date of publication	Sample size (n) Country & Region	Study type & research design (e.g. quantitative, clinical trial)	Recruitment strategy (E.g. waiting room, A & E)	Age	Gender	Alcohol/ substance (i.e. non- prescribed drug etc)	Alcohol & substance use measure (s) (e.g. Validated scale/ interview)	Proportion reporting use (%)	Additional significant analyses (health/ mental health/ demographics)	Covariates with alcohol and substance use
45	Yazdi et al., (2020)	127 Austria	Quantitative	Data was collected from a clinical sample of patients with alcohol use disorder	Mean= 49.3 years	Male= 66.9%	Alcohol	AUDIT-C	Abstinent= 29.1% Consuming= 38.6% Relapsed= 32.2%	Craving PTSD Psychosocial COVID-19 factors (isolation, anxiety, depression) Living alone	There were positive associations between alcohol consumption, craving, and PTSD symptoms Patients with psychosocial COVID-19 factors have an increased risk (odds ratio=3.65, p = 0.010) of relapsing compared to patients not reporting psychosocial impact of COVID-19 Living alone also leads to a higher risk of relapsing (odds ratio of 3.00, p = 0.037) compared to those living with others, and age showed a small negative non-significant effect (odds ratio = 0.97, p = 0.171)

AUDIT (Alcohol Use Disorders Identification Test; Babor et al., 1992); AUDIT-C/ AUDIT-3 (Alcohol Use Disorders Identification Test Consumption; Bush et al., 1998); BRFSS (Behavioral Risk Factor Surveillance System; Centers for Disease Control and Prevention, 2019); BRIEF COPE (Brief Coping Orientation to Problems Experienced Scale; Carver, 1997); CAGE (Dhalla and Kopec, 2007); CCHQ; (COVID-19 Cannabis Health Questionnaire; Vidot et al., 2020a); CRISIS tool (National Institute of Mental Health-developed CoRonavIruS Health Impact Survey; Merikangas et al., 2020); DrInC (Drinkers Inventory of Consequences; Miller et al., 1995); DMQ-R; (Drinking Motives Questionnaire Revised; Cooper, 1994), DMQ-R-SF; (Drinking Motives Questionnaire Revised Short Form; Kuntsche and Kuntsche, 2009), BRFSS (Behavioral risk factor surveillance system; Centers for Disease Control and Prevention, 2019); QF (Quantity/ Frequency/ Peak Alcohol Use Index; Dimeff, 2000); NIAAA (The National Institute on Alcohol Abuse and Alcoholism's recommended alcohol questions; National Institute on Alcohol Abuse and Alcoholism, 2003); TLFB (Timeline follow back interview; Sobell et al., 1996).

Table 2
Studies identifying alcohol use using longer questionnaires/instruments.

Measure	Study reference
Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1992)	Ahmed et al., 2020 Chodkiewicz et al., 2020 Kim et al, 2020 McPhee et al., 2020 Sallie et al., 2020 Wang et al., 2020
Alcohol Use Disorders Identification Test Consumption (AUDIT-C/ AUDIT-3; Bush et al., 1998)	Newby et al., 2020 Sallie et al., 2020 Stanton et al., 2020 Silczuk, 2020 Wang et al., 2020 Yazdi et al. (2020)
Behavioral Risk Factor Surveillance System (BRFSS; Centers for Disease Control and Prevention, 2019)	Knell et al., 2020
CAGE[a] (Dhalla and Kopec, 2007)	Panno et al., 2020
Drinking Motives Questionnaire Revised (DMQ-R; Cooper, 1994)	Rogers et al., 2020
Drinking Motives Questionnaire Revised Short Form (DMQ-R-SF;Kuntsche and Kuntsche, 2009)	Wardell et al., 2020 McPhee et al., 2020
Quantity/ Frequency/ Peak Alcohol Use Index (QF;Dimeff, 2000)	Rodriguez et al., 2020
National Institute on Alcohol Abuse and Alcoholism's recommended alcohol questions (The National Institute on Alcohol Abuse and Alcoholism, 2003)	Wardell et al., 2020 McPhee et al., 2020
The Short Inventory of Problems; a subset of items from the Drinker Inventory of Consequences (DrInC; Miller et al, 1995)	Wardell et al., 2020
Timeline follow back interview (TLFB; Sobell et al., 1996)	Lechner et al., 2020 Wang et al., 2020

[a] The acronym stands for 4 yes/no items constituting the screening test: 1) Have you ever felt that you ought to Cut down on your drinking? 2) Have people Annoyed you by criticizing your drinking? 3) Have you ever felt bad or Guilty about your drinking? 4) Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover (Eye-opener)?

28.2% (Chodkiewicz at al., 2020) to 52.7% (Newby et al., 2020) with binge drinking from 7.1% (Gritsenko et al., 2020), to 20% (Silczuk, 2020). Problematic alcohol was 7.1% (Panno et al., 2020), harmful drinking 0.7% (Chodkiewicz at al., 2020) and possible addiction 0.9% (Chodkiewicz at al., 2020). Across all studies, the percentage of individuals who did not drink during the study period ranged from 17% (Håkansson, 2020) to 32.1% (Đogaš et al., 2020).

Three studies exclusively reported a decrease in alcohol use because of the pandemic (López-Bueno et al., 2020; Đogaš et al., 2020; Wang et al., 2020). A further three studies from Canada and USA reported that the overall percentage who used alcohol did not change dramatically from pre-COVID to post-COVID (Dumas et al., 2020; McPhee et al., 2020; Wardell et al., 2020). However, in the study of drinkers from the USA, although participants reported typical quantities, frequency, and time spent drinking post-social-distancing that were commensurate with pre-social-distancing values, participants reported significantly more binge episodes and solitary drinking post-social-distancing (McPhee et al., 2020).

In contrast, seven studies reported an increase in the use of alcohol during the pandemic (Ahmed et al., 2020; Boehnke et al., 2020; Gritsenko et al., 2020; Lechner et al., 2020; Rogers et al., 2020; Sidor and Rzymski, 2020; Sun et al., 2020).

Fourteen studies also reported a mixed effect of the epidemic on the use of alcohol (Avery et al., 2020; Chodkiewicz et al., 2020; Håkansson, 2020; Kim et al., 2020; Knell et al., 2020; Rolland et al., 2020; Sallie et al., 2020; Sanchez et al., 2020; Scarmozzino and Visioli, 2020; Silczuk, 2020; Stanton et al., 2020; Tran et al., 2020; Vanderbruggen et al., 2020; Yazdi et al., 2020). In four studies, there was a higher proportion of individuals reporting using less alcohol during the pandemic compared to those reporting more alcohol use in relation to pre-pandemic levels (Chodkiewicz et al., 2020; Håkansson, 2020;

Scarmozzino and Visioli, 2020; Sallie et al., 2020). In contrast, in ten studies there was a higher proportion of individuals reporting more alcohol use compared to those reporting less alcohol use (Avery et al., 2020; Kim et al., 2020; Knell et al., 2020; Rolland et al., 2020; Sanchez et al., 2020; Silczuk, 2020; Stanton et al., 2020; Tran et al., 2020; Vanderbruggen et al., 2020; Yazdi et al., 2020).

Time-series analyses comparing periods of lockdown, where individuals were restricted in their movement, to the previous year, showed that alcohol problems increased during lockdown (Grigoletto et al., 2020; Leichtle et al., 2020). For example, in one study of data taken from hospitals in Italy, when compared to the same time period in 2019, despite a lower number of attendances to the Emergency Department, the absolute number of patients presenting with severe alcohol intoxication increased (25 vs. 15). This number increased further immediately after the easing of lockdown measures (11.3%) (Grigoletto et al., 2020). Likewise, a timepoint analysis from two psychiatric hospitals in Italy showed that admissions related to alcohol increased from 3.7% and 23.5–6.1% and 36.9% of the total when comparing the first two months of 2020 with March-May 2020 (Luca et al., 2020).

3.4. Factors associated with alcohol use

One of our aims was to assess what risk factors might be associated with alcohol use during the pandemic. Various covariates were significantly associated with increased alcohol use during the pandemic in the different studies. Mental Health (n = 19) and gender (n = 8) were the most common of these followed by age (n = 7), solitude (n = 6), offspring (n = 5), perceived threat and distress (n = 3), impulsivity (n = 2), physical health (n = 2), education (n = 2), income loss or unemployment (n = 2), religion (n = 1), being in a relationship (n = 1) and/ or in relationship with someone severely ill from COVID-19 (n = 1), being a student (n = 1), an essential worker (n = 1) or a non-healthcare worker (n = 1), gambling (n = 1), smoking (n = 1), drinking more intensively before the pandemic started (n = 1), fear overall (n = 1), or tension and fear about health: feeling helpless, hopeless, lacking reliable information and worries about the future (n = 1), boredom, loss of daily structure, reward after a hard-working day, and conviviality (n = 1), living in the UK (n = 1), and having contact with an alcohol nurse specialist (n = 1). The included studies reported heterogeneous methodology regarding the covariates of alcohol use, which were generally unsuitable for quantitative syntheses via meta-analyses. As such, the relevant findings regarding associations with physical and mental health measures, as well as co-occurring addictive behaviours, are synthesised via a narrative discussion (see below).

3.4.1. Mental health

For participants in several studies (n = 17), mental health difficulties were associated with higher alcohol usage overall. Silczuk et al. (2020) found that anxiety (and hopelessness) were the most common motives to drink. Higher psychological distress was associated with higher alcohol consumption in a Timeline Follow-back Interview with students in the USA (Lechner et al., 2020). In another study in the USA, those with a moderate to severe depression symptom severity score had significantly higher odds of an increase in alcohol consumption compared to those with none to mild depression symptom severity scores (Knell et al., 2020) and equally twins in the USA with higher levels of stress and anxiety were more likely to report an increase in alcohol intake (Avery et al., 2020). Similarly, mediation analyses suggested a significant indirect effect of reduced environmental reward with drinking quantity and frequency via increased depressive symptoms and coping motives (McPhee et al., 2020). Likewise, in Australia those who reported a negative change in alcohol intake were more likely to be depressed (Stanton et al., 2020; Tran et al., 2020) and anxious (Tran et al., 2020). Again, in a Russian sample, respondents who reported increased alcohol use, compared to those who did not, had higher levels of depression

Table 3
List of substances/ drugs investigated in the review.

Drug/ substance	Study Reference
Amphetamine	Marais et al., (2020)
Benzodiazepine	Martinotti et al., (2020)
Cannabis	Boehnke et al., (2020)
	Dumas et al. (2020)
	Gritsenko et al., (2020)
	Knell et al. (2020)
	Marais et al. (2020)
	Rogers et al. (2020)
	Rolland et al. (2020)
	Tucker et al. (2020)
	Vanderbruggen et al. (2020)
	Van Laar et al. (2020)
	Vidot et al. (2020)
Cocaine	Marais et al. (2020)
	Martinotti et al. (2020)
	Wainwright et al. (2020)
Fentanyl	Wainwright et al. (2020)
General or Recreational Drugs	Ballivian et al. (2020)
	Chodkiewicz et al. (2020)
	Glober et al. (2020)
	Sanchez et al. (2020)
GHB	Marais et al. (2020)
Heroin	Marais et al. (2020)
	Martinotti et al. (2020)
	Wainwright et al., (2020)
Ketamine	Martinotti et al. (2020)
Methamphetamine	Marais et al. (2020)
	Martinotti et al. (2020)
	Wainwright et al. (2020)
MDMA	Marais et al. (2020)
	Martinotti et al. (2020)
Opioids	Glober et al. (2020)
	Martinotti et al. (2020)
	Ochalek et al. (2020)
	Rogers et al. (2020)
	Slavova et al. (2020)
Pain relief	Gritsenko et al. (2020)
Prescription or Opioid substitution medication (prescribed and unprescribed)	Gritsenko et al. (2020)
Sedatives or sleeping pills	Boehnke et al. (2020)
	Chodkiewicz et al. (2020)
	Gritsenko et al. (2020)
Stimulants	Rogers et al. (2020)
Synthetic cannabanoids	Marais et al. (2020)
Substance use:	
Alcohol, Legal or illegal drugs, or prescription drugs taken in a way not recommended by a doctor	Boehnke et al. (2020)
	Czeisler et al. (2020)
Alcohol and drugs	Hawke et al. (2020)
	Martinotti et al. (2020)
Other substance	Leichtle et al. (2020)
THC	Martinotti et al. (2020)

(Gritsenko et al., 2020) and the UK, those who increased alcohol use during the initial lockdown period were those with higher depression (Sallie et al., 2020). In China, high-risk drinking predicted anxiety in females (Wang et al., 2020). Results of a theory-informed path model based in Canada showed that greater levels of depression predicted unique variance in past 30- day coping to drink motives, which in turn predicted increased past 30-day alcohol use (controlling for pre-COVID-19 alcohol use reported retrospectively; Wardell et al., 2020). In a general population cross-sectional study in Poland, a higher tendency to drink more was found among alcohol addicts compared to non-addicts (Sidor and Rzymski, 2020); and individuals who had

current suicidal thoughts were more likely to drink more alcohol than before the pandemic than those without such thoughts (Chodkiewicz et al., 2020). Previous diagnosis/ treatment was also associated with higher alcohol consumption. In one large open web-based survey from over 11,000 participants in France, a factor in the increase in alcohol use was current psychiatric treatment (Rolland et al., 2020). In another study, more than half the patients admitted for severe alcohol intoxication after the end of a lockdown period had a history of substance abuse or psychiatric disorder (Grigoletto et al., 2020). In Austria, patients with alcohol use disorder who had psychosocial COVID-19 factors (anxiety, depression) had an increased risk of relapsing compared to patients not reporting psychosocial impact of COVID-19. In addition, in this sample, there were positive associations between alcohol consumption, craving, and PTSD symptoms (Yazdi et al., 2020). Additionally, in Italy, higher food addiction scores were independently associated with CAGE total scores (Panno et al., 2020).

Conversely, in two studies mental health difficulties were associated with lower alcohol usage. In a large Australian study, participants with a prior mental health diagnosis had lower rates of hazardous drinking compared to those who had no such diagnosis (Newby et al., 2020). In another study, individuals with alcohol addiction in their families consumed significantly less alcohol than those respondents from families without alcohol problems, and individuals with somatic illness drank less than those who were healthy (Chodkiewicz et al., 2020).

3.4.2. Physical health

For two studies, poorer physical health was associated with higher alcohol usage. Changes in alcohol consumption were related to BMI: those who were overweight/ obese had significantly lower odds of decreased alcohol consumption compared to those that were not (Knell et al., 2020). Likewise, both weekly physical activity and daily sitting time increased in those that consumed alcohol (Romero-Blanco et al., 2020).

3.4.3. Solitude

Five studies found a statistically significant role of solitude in increasing alcohol use during the pandemic. Those under quarantine/ strict self-isolation conditions had a significantly higher rate of alcohol use than those not restricted (Gritsenko et al., 2020). Likewise, living alone was associated with increased solitary drinking (controlling for pre-COVID-19 levels) and there was a statistically significant increase in solitary drinking reported for the past 30 days relative to the 30 days prior to the COVID-19 emergency (Wardell et al., 2020). Lechner et al., (2020) found that those with more social support, consumed less alcohol overall. Yazdi et al., (2020) found that living alone led to a higher risk of relapsing compared to those living with others in a clinical sample of patients with alcohol use disorder in Austria and Vanderbruggen et al. (2020) found that lack of social contacts and loneliness were some of the main reasons for consuming more of the various substances during lockdown. In contrast, one study found that solitude was associated with lower alcohol usage. In this study, people in self-isolation reported lower alcohol consumption than those who were not self-isolating (Newby et al., 2020).

3.4.4. Demographic factors

Eight studies found a statistically significant role of gender in increasing alcohol use during the pandemic. Six studies found that men were significantly more likely to use alcohol than women during the pandemic. In the USA, men reported a greater number of drinks on a typical, as well as the heaviest, occasion, a higher overall drinking frequency alongside greater frequency of heavy drinking episodes (Rodriguez et al., 2020). In another study in Croatia, while similar drinking patterns were seen in both males and females, the greatest increase in those that drank more than 15 drinks weekly was seen in males (Đogaš et al., 2020). In Russia, while last month binge drinking because of COVID-19 was reported by 7.1% of all the survey respondents, this

Table 4

Studies identifying substance or drug use using longer questionnaires/instruments.

Measure	Study Reference
Brief Coping Orientation to Problems Experienced Scale (Brief COPE; Carver, 1997)	Chodkiewicz et al., 2020
COVID-19 Cannabis Health Questionnaire (CCHQ; Vidot, Messiah, Gattamorta, 2020a)	Vidot et al., 2020
CRISIS Tool (National Institute of Mental Health-developed CoRonavIruS Health Impact Survey; Merikangas et al., 2020)	Hawke et al., 2020
Self-report using items (lifetime and past month use of each of marijuana) adapted from the Behavioral Risk Factor Surveillance System; (BRFSS; Centers for Disease Control and Prevention, 2019)	Knell et al., 2020
Substance use motives- a modified version of the Drinking Motives Questionnaire Revised (DMQ-R Cooper, 1994) anchored to the most used substance (e.g. cannabis, stimulants, opioids or other substance)	Rogers et al., 2020

percentage was much higher in males compared to females (Gritsenko et al., 2020). In Italy, male gender was independently associated with the CAGE total score (Panno et al., 2020). In two other studies in China, the ratio of harmful users and dependent users for males were six times higher than females (Ahmed et al., 2020) and during COVID-19, males consumed more drinks per week, had a higher percentage of heavy drinking, more drinking days per week, more risky drinking, and hazardous drinking than female counterparts (Wang et al., 2020).

In contrast, two studies found that women were significantly more likely to use alcohol than men during the pandemic. In a polish study of physicians, females used alcohol more often and drank more standard drinks per occasion. However, this study did report that males binged more during the pandemic (Silczuk, 2020). In a large study with teenagers in Canada, there was an overall increase in the frequency of alcohol use. However, in this study, the increase was significant only for females and not males when the analysis was separated by gender (Dumas et al., 2020).

Seven studies reported a statistically significant role of age in increasing alcohol use during lockdown. In four studies, older age was associated with increased alcohol use (Chodkiewicz et al., 2020; Knell et al., 2020; Rolland et al., 2020; Sallie et al., 2020), one suggested middle age was associated with increased use (Tran et al., 2020), and two studies showed younger age associated with increased use (Sanchez et al., 2020; Vanderbruggen et al., 2020).

Five studies reported a statistically significant role of offspring in increasing alcohol use during lockdown. In a cross-sectional USA survey, those with children had significantly higher odds of an increase in alcohol consumption compared to those without (Knell et al., 2020). Likewise, in Canada, having at least one child under 18 living at home was associated with greater motives for drinking to cope (Wardell et al., 2020). In France, the odds of consuming more alcohol during the lockdown were associated with more children at home (Vanderbruggen et al., 2020) and in the UK, those who increased alcohol use during the initial lockdown were individuals with children (Sallie et al., 2020). One smaller European study reported that 8.9% participants with offspring declared drinking more than before the pandemic compared to only 5% without children. However, in this study 15.7% of participants with children drank less than before the pandemic, but the paper does not give the actual data to compare to those without children (Chodkiewicz et al., 2020).

Two studies reported a statistically significant role of the level of education in increasing alcohol use during lockdown. Specific factors of the increase in alcohol use were reported in one study as a high level of education (Rolland et al., 2020) and in another that college graduates had significantly lower odds of decreased alcohol consumption compared to people who were not graduates (Knell et al., 2020).

One study reported a statistically significant role of the level of

ethnicity in increasing alcohol use during lockdown. In a US sample who had consumed alcohol on more than one occasion per month in the past year, non-white participants seemed to be at higher risk for higher drinking levels, riskier drinking patterns, and greater affective distress, when compared to white participants (McPhee et al., 2020).

Other variables reported to play a role in increased alcohol use during the pandemic were being in a relationship (Chodkiewicz et al., 2020) and/ or in personal relationship with someone severely ill from COVID-19 (Sallie et al., 2020); gambling (Håkansson, 2020), smoking (Panno et al., 2020), income loss or unemployment (Vanderbruggen et al., 2020; Wardell et al., 2020), being a healthcare worker (Vanderbruggen et al., 2020), or an essential worker (Sallie et al., 2020), drinking more intensively before the pandemic started (Chodkiewicz et al., 2020), increased fear (Gritsenko et al., 2020) or perceived threat and distress (McPhee et al., 2020; Panno et al., 2020; Rodriguez et al., 2020), impulsivity (Panno et al., 2020; Sallie et al., 2020); tension and fear about health: feeling helpless, hopeless, lacking reliable information and worries about the future (Silczuk, 2020), living in the UK (Sallie et al., 2020) and boredom, loss of daily structure, reward after a hard-working day, and conviviality (Vanderbruggen et al., 2020). Religion was reported to play a role in decreasing alcohol use; last month binge drinking because of COVID-19 was reported by 10.3% of secular respondents compared to only 5.0% who were religious (Gritsenko et al., 2020), as was being a student (Vanderbruggen et al., 2020). Likewise, in patients with pre-existing alcohol disorders, contact with an alcohol nurse specialist was a positive predictor of relapse and improving new abstinence (Kim at al., 2020).

3.5. Patterns of substance use

The prevalence of drug use was provided in $n = 17$ (37.7%) of the 45 selected studies. A further four studies (8.8%) provided the prevalence of defined substance use (e.g., alcohol, legal or illegal drugs, or prescription drugs taken in a way not recommended by a doctor; Hawke et al., 2020), or undefined substance use or abuse (e.g., Leichtle et al., 2020). The main substances investigated in the studies were Cannabis (n = 11),

Opioids (n = 5), general or recreational drugs (n = 4), Heroin (n = 3), Methamphetamine (n = 3), Sedatives or sleeping pills (n = 3), Cocaine (n = 3), MDMA (n = 2), Ketamine (n = 1), Benzodiazepine (n = 1), Stimulants (n = 1), Amphetamine (n = 1), Prescription drugs (n = 1), Synthetic Cannabinoids (n = 1), GHB (n = 1), Fentanyl (n = 1) and Pain relief (n = 1): See Table 3.

Five studies (11.1%) identified drug/ substance using longer questionnaires/instruments (see Table 4). Twelve quantitative studies (26.7%) asked shorter or individual questions about self-reported frequency or behavioural changes of substance (e.g., Ballivian et al., 2020) and if any change was functionally related to the pandemic or any other reason (i.e., through stress; Czeisler et al., 2020). The remaining six studies (11.3%) used existing data and performed a time-series analysis linked to substance use (Glober et al., 2020; Leichtle et al., 2020; Marais et al., 2020; Ochalek et al., 2020; Slavova et al., 2020; Wainwright et al., 2020).

During the pandemic, the proportion of individuals using substances varied across samples from 3.6% (recreational drugs; Chodkiewicz et al., 2020) and 17.5% (Marijuana; Rogers et al., 2020) in general population samples, 13.8% in youth (ages 14–18; Dumas et al., 2020) and as high as 75% in people living with HIV (general drug use; Ballivian et al., 2020), or who used cannabis medicinally (Boehnke et al., 2020). In a cross-sectional sample of youth participants, 23.2% in the clinical sample and 3.0% of the community sample met the criteria for a substance use disorder during the pandemic (Hawke et al., 2020). This Canadian study was the only study to exclusively report a decrease in substance use because of the pandemic. One study reported that patients and residential patients with ongoing or previous substance use disorders reported low cravings (Martinotti et al., 2020).

Three studies specifically reported a negative effect of the epidemic on the use of substances (Czeisler et al., 2020; Gritsenko et al., 2020; Rogers et al., 2020). In general population US samples, an additional 5.0% started using cannabis, 5.6% started using stimulants and 5.6% opioids since the COVID-19 outbreak (Rogers et al., 2020). Likewise, 13.3% started or increased substance use (Czeisler et al., 2020). Equally, in Russia, those who reported substance use in the last month before COVID 19 reported their use increased as a COVID-19 consequence. Among substance users, there were increases in specific drugs including 27.3% cannabis, 16.7% Ritalin or similar substance, 18.2% pain relievers, and 23.5% sedatives (Gritsenko et al., 2020).

Nine studies also reported a mixed effect of the pandemic, but for all the studies there was a higher proportion of individuals reporting using more drug use compared to those reporting less drug use (Boehnke et al., 2020; Chodkiewicz et al., 2020; Dumas et al., 2020; Knell et al., 2020; Rolland et al., 2020; Sanchez et al., 2020; Vanderbruggen et al., 2020; Van Laar et al., 2020; Vidot et al., 2020).

Studies that investigated emergency department patient admissions related to drug use demonstrated that they increased during lockdown (Glober et al., 2020; Leichtle et al., 2020; Marais et al., 2020; Ochalek et al., 2020; Slavova et al., 2020; Wainwright et al., 2020).

Two studies found increased rates of death associated with substance use during the COVID-19 pandemic; Glober et al. (2020) found a 47% increase in deaths caused by drug overdose, and Slavova et al. (2020) found a 50% increase in emergency medical service attendance to suspected opioid overdose with death at the scene.

3.6. Factors associated with substances other than alcohol

One of our aims was to assess what risk factors might be associated with substance use during the pandemic. As with the same exploration regarding alcohol use above, the relevant findings regarding associations with physical and mental health measures, as well as co-occurring addictive behaviours, were synthesised using a narrative approach. Various covariates were significantly associated with increased substance use during the pandemic in the different studies. Mental health ($n = 5$) and age ($n = 6$) were the most common of these followed by gender ($n = 4$), physical health ($n = 2$), fear about Covid-19 ($n = 3$) boredom ($n = 2$), ethnicity ($n = 2$), education ($n = 2$), peer reputation ($n = 1$), lower social support ($n = 1$), solitude ($n = 1$), access to legal cannabis ($n = 1$), and fewer responsibilities ($n = 1$).

3.6.1. Mental Health

For participants in 5 studies, mental health difficulties were associated with higher substance usage overall. One study noted that changes in marijuana use were associated with symptoms of depression: those with moderate- to severe- symptoms of depression had significantly higher odds of increasing marijuana use compared to those with no symptoms of depression (Knell et al., 2020). Likewise, those starting medications/substances reported worse mental/emotional health in an US sample of individuals who reported current medical cannabis use (Boehnke et al., 2020). Almost half of patients with ongoing or previous Substance Use Disorder and/ or gambling problems across 7 different Italian regions, reported a comorbid psychiatric condition, especially mood disorders (depression and bipolar disorder) or anxiety during lockdown (Martinotti et al., 2020). Likewise, those with mental health conditions reported increased medicinal cannabis use by 91% in the US since COVID-19 was declared a pandemic compared to those with no mental health conditions (Vidot et al., 2020) and mental health and stress were among the highest cited reasons for an increase in cannabis use in the Netherlands (Van Laar et al., 2020).

3.6.2. Physical health

For two studies, poorer physical health was associated with higher drug usage. Poor physical health was a reason for an increase in cannabis use in former cannabis users (Van Laar et al., 2020). In individuals who reported current medical cannabis use, increased symptom burden was associated with an increase in use (Boehnke et al., 2020).

3.6.3. Boredom and solitude

Two studies found a statistically significant role of boredom in increasing drug use during the pandemic. It was reported that individuals who reported current medical cannabis use increased use because of boredom (Boehnke et al., 2020) and boredom was by far the most commonly stated reason for using cannabis more often in users in the Netherlands (Van Laar et al., 2020).**:** One study found a statistically significant role of solitude/ isolation in increasing substance use during the pandemic. Fewer parties/ nightlife and seeing friends less and loneliness were all reasons for an increase in cannabis use (Van Laar et al., 2020).

3.6.4. Demographic factors

Four studies found a statistically significant role of gender in increasing drug use during the pandemic. Ballivian et al., (2020) reported that being male predicted drug use during quarantine in Argentina. Similarly, in a study reporting nonfatal opioid overdoses in the US, male patients made up a relatively larger proportion of opioid overdose visits to an urban emergency department during lockdown compared with the previous year (Ochalek et al., 2020). Conversely, in Canada, Dumas et al. (2020) reported contradictory findings, that in girls only, the percentage of cannabis use decreased and yet, the frequency of cannabis use (average number of cannabis using days) increased significantly. Van Laar et al., (2020) reported that the proportion of women in the Netherlands who used cannabis more often since the lockdown was higher than the proportion of men.

Two studies reported a statistically significant role of ethnicity in increasing drug use during lockdown. In the US, black patients made up a relatively larger proportion of opioid overdose visits during lockdown compared with the previous year (Ochalek et al., 2020). Likewise, those of Hispanic (21.9%) or Black (18.4%) ethnicity had 3.33 times the odds of increased substance use, according to Czeisler et al. (2020).

Six studies reported a statistically significant role of younger age in increasing drug use during lockdown. Ballivian et al., (2020) report that being younger predicted drug use during quarantine. Czeisler et al. (2020) reported that substance use increase was most reported in persons aged 18–24 years and that prevalence decreased progressively with age. Wainwright et al. (2020) found that patients tested positive for selected drugs during the COVID-19 period were significantly younger compared with the period before COVID-19. Likewise, younger participants (15–24 years old) were more likely to report increased drug use compared to older participants (aged 25 years and older) according to Sanchez et al. (2020). Similarly, the proportion of young adults who used cannabis more often since lockdown was higher than the proportion of older adults (Van Laar et al., 2020) and those starting medications/substances were also younger (Boehnke et al., 2020).

Two studies reported a statistically significant association between educational status and increasing drug use. The factor related to an increase in cannabis use was intermediate or low level of education, in a study by Rolland et al. (2020) whereas those starting medications/substances had a higher level of education in study by Boehnke et al., (2020).

3.6.5. Other

Concerns for how social distancing would affect peer reputation was a significant predictor of face-to-face substance use with friends amongst adolescents with low self-reported popularity and a significant predictor of solitary substance use among average and high popularity teens. Adjustment predictors, including depression and fear of the infectivity of COVID-19, predicted using solitary substance use during the pandemic (Dumas et al., 2020). In another study, having lower social support predicted drug use during quarantine (Ballivian et al., 2020). Across substances, levels of COVID-19-related worry and fear were highest

among those people who initiated substances during the COVID-19 pandemic compared to those who used substances prior and those who never used (Rogers et al., 2020). Likewise, anxiety about Covid was a reason for an increase in use in medical cannabis users (Boehnke et al., 2020). In the former study, participants without access to legal cannabis and those with fewer responsibilities were more likely to report decreased frequency of cannabis (Boehnke et al., 2020).

4. Discussion

In the early days of the COVID 19 pandemic there was concern that the use of alcohol and other substances, together with related mental health issues would increase significantly. However, as noted in the introduction, evidence from earlier pandemics suggested that use could go in two directions: an increase in use in some populations due to the psychological distress experienced (Baker et al., 2004; Cepeda et al., 2010; Goldmann and Galea, 2014), or a decrease in use due to limited availability and financial constraints (Lapeyre-Mestre et al., 2020).

Vis-à-vis alcohol use, the evidence found for this review suggests a mixed picture, with some studies reporting a decrease in alcohol consumption, some reporting an increase and some reporting a varied effect. However, despite the mixed findings, overall, there was a trend towards increased alcohol consumption during the COVID-19 pandemic. The proportion of people consuming alcohol during the pandemic ranged from 21.7% to 72.9% in general population samples. Time-series analyses comparing lockdown to either the previous few months (Luca et al., 2020) or the previous year (Grigoletto et al., 2020; Leichtle et al., 2020) showed that alcohol problems increased during lockdown (Grigoletto et al., 2020; Leichtle et al., 2020). Likewise, seven studies ultimately found that the pandemic and lockdown were associated with increased alcohol use (Ahmed et al., 2020; Boehnke at al., 2020; Gritsenko et al., 2020; Lechner et al., 2020; Rogers et al., 2020; Sidor and Rzymski, 2020; Sun et al., 2020), and in the ten studies that showed mixed findings, there was a higher proportion of individuals reporting greater alcohol use compared to those reporting less use (Avery et al., 2020; Kim et al., 2020; Knell et al., 2020; Rolland et al., 2020; Sanchez et al., 2020; Silczuk, 2020; Stanton et al., 2020; Tran et al., 2020; Vanderbruggen et al., 2020; Yazdi et al., 2020). More people reported a change in alcohol use compared to consumption remaining unchanged which is consistent with the supposition that there is a larger predilection towards poles in alcohol use patterns (abstention or heavy drinking) when faced with heightened stressors (Jose et al., 2000).

Risk factors for increased alcohol consumption during the COVID-19 pandemic included: solitude, male gender, older age, parental status (those with children), higher levels of education, income loss or unemployment, poor physical health (overweight), fear and distress, impulsivity, and mental health conditions (depression, anxiety, hopelessness, isolation). Mental health factors were the most common correlates or triggers for increased use (reported in seventeen different studies). The most common specific disorder linked to alcohol use was depression, and studies from USA, Canada, Australia, UK and Russia all confirmed greater odds of increased alcohol use with higher scores for depression. Associations between alcohol and depression have been reported in many other studies and reviews (Li et al., 2020; Crum et al., 2013). Such an association is perhaps not unexpected. Alcohol is a central nervous system depressant and many studies and reviews have shown that heavier drinking tends to lead to an increase in depressive symptoms (Li et al., 2020; Crum et al., 2013). However, the pathways linking mental health and alcohol use are not always discernable and unidirectional. For example, one large study in France found that existing psychiatric treatment was a significant factor for increased drinking during the pandemic, suggesting that the mental health factors came first for this cohort (Rolland et al., 2020). The self-medication theory of substance use disorders suggests that those with an existing mental health concern might use alcohol as a coping technique (Khantzian, 2017). Likewise, there may be common determinants (e.g. genetic or environmental) for

alcohol dependence and other mental health disorders (Kendler et al., 1995). Moreover, it may have been the experience of isolation resulting from lockdown that increased depression; the behavioural theory of depression suggests that restrictions in access to environmental and social rewards alone can increase the risk (Carvalho and Hopko, 2011). Further studies would be required to elucidate the different pathways linking alcohol use, mental disorder, enforced isolation, and the experience of a pandemic more fully.

Anxiety, hopelessness, and social isolation were other psychological factors observably related to increases in alcohol use in a number of studies. Similar to depression, many studies have demonstrated co-morbidity of alcohol use with mood and anxiety disorders (Kushner et al., 2000; Rodgers et al., 2000). The isolation which was forced by quarantine/ self-isolation measures, particularly for those who live alone, was linked to increases in consumption. Previous studies have shown that social isolation and loneliness are strongly associated with anxiety, and depression (Elovainio et al., 2017; Matthews et al., 2019) and a recent study demonstrated similar findings during lockdown; a significant negative association between loneliness and isolation and both depression and anxiety at the start of the pandemic (Robb et al., 2020). The stress and anxiety of social isolation in lockdown may have triggered individuals to drink more alcohol as a method of coping. The Stress Dampening Model suggests that certain individuals may use alcohol to escape from their negative life experiences and turn to alcohol as a way to cope with pain and trauma (Backer-Fulghum et al., 2012). Some people in isolation may turn to alcohol to alleviate feelings of fear or boredom (Krotava and Todman, 2014) while others may do so because they do not have social pressures or answerability that is more likely when drinking in public and/or with friends.

Other identified risk factors for increased alcohol consumption have also been found in previous studies; male gender (Nolen-Hoeksema, 2004); income loss or unemployment (Khan et al., 2002); education (Crum et al., 1993), poor physical health (Okosun et al., 2005), impulsivity (Simons et al., 2004), and fear and distress (Holzhauer et al., 2017). One perhaps surprising risk factor in the included studies was parental status (those with children were more likely to increase their alcohol use during the pandemic). During lockdown, many parents had to 'home-school' their children alongside continuing to work at home. Study authors suggest that this may have led to role overload and distress and consequently heavier drinking (Sallie et al., 2020).

Factors linked to lower alcohol consumption included religion (Gritsenko et al., 2020), high levels of social support (Kim at al., 2020) and being a student (Vanderbruggen et al., 2020). The first two factors may well be linked, since religious faith or other forms of spirituality tend to offer a reliable social support network (Hastings, 2016) and religious based social support has been shown in a number of studies to be linked with lower consumption (Demir-Dagdas and Child, 2019). The low alcohol use in students is surprising as previous studies have found alcohol use among college students to be highly prevalent and often extreme (Hingson et al., 2017). The closure of university campuses may have limited the availability of alcohol purchase, and many students may have gone home to live with their parents, which is associated with lower alcohol use compared to those living on campus (Patrick et al., 2020).

Unlike alcohol use, there was a clear trend towards increased use of other substances use during the COVID-19 pandemic. The proportion of people consuming other substances during the pandemic ranged from 3.6% to 17.5% in the general population. Three studies reported a negative effect of the epidemic on other substance use (Czeisler et al., 2020; Gritsenko et al., 2020; Rogers et al., 2020). Increases in use ranged from 5.0% (Rogers et al., 2020) to 13.3% in the general population (Czeisler et al., 2020). Studies that investigated emergency department patient admissions related to drug use demonstrated that they increased during lockdown (Glober et al., 2020; Leichtle et al., 2020; Marais et al., 2020; Ochalek et al., 2020; Slavova et al., 2020; Wainwright et al., 2020). Nine studies reported a mixed effect of the pandemic, but for all

these studies there was a higher proportion of individuals reporting using more compared to those reporting less drug use (Boehnke et al., 2020; Chodkiewicz et al., 2020; Dumas et al., 2020; Knell et al., 2020; Rolland et al., 2020; Sanchez et al., 2020; Vanderbruggen et al., 2020; Van Laar et al., 2020; Vidot et al., 2020). The increased trend in drug use may be associated with an increased number of deaths (Glober et al., 2020; Slavova et al., 2020).

Many of the risk factors related to drug use were broadly similar to those which were related to alcohol use. Risk factors for increased substance use during the COVID-19 pandemic that have also been found in previous studies included: male gender (Cotto et al., 2010), low level education, younger age, ethnicity (Hispanic or Black), mental health conditions (depression), poor physical health, solitude, boredom, worry and fear and lack of social support.

A large number of studies found an association between mental health difficulties and substance use. Marijuana use, in particular, was associated with higher levels of depression. A previous systematic review concluded that the links between cannabis use and depression were clear, especially between heavy or problematic cannabis use and depression in cohort studies and well-designed cross-sectional studies in the general population (Degenhardt et al., 2003). However, it is not clear whether the increases in substance use during the pandemic are a cause or a consequence of increases in mental health and other problems. Previous work has suggested that cannabis use is a contributory cause of depression (Johns, 2001). Again, there could be common social or demographic factors that increase the likelihood of both cannabis use and depression (Kelder et al., 2001).

One recent published review and meta-analysis suggests a very significant increase in depression during the pandemic; Bueno-Notival et al., (2021) suggest that the pooled prevalence of depression, across twelve studies was 25%, compared to a global estimate of 3.44% in 2017, which would indicate a 7-fold increase. The review included large studies from a number of countries and the finding seems valid. This increase shows the impact that the pandemic has had on mental health. Increased alcohol or other substance use may be responsible for some of this increase in depression. Whilst the increases in alcohol or other substance use are not of the same magnitude, most of the included studies showed increase in use and there were some notable consequences, such as marked increases in deaths from drug overdoses.

4.1. Strengths and limitations of the study

This report was prepared using the PRISMA guidelines. Additionally, we published a protocol for the review via PROSPERO before the literature search was conducted. The results obtained from searches were reviewed in parallel by two reviewers independently to increase the chance that all relevant papers were included. However, the interpretations presented here should be understood in the context of a number of limitations. First of all, studies meeting the inclusion criteria came from 17 different countries but do not cover the whole of the globe and may not capture all the different responses to the pandemic in different countries and regions, either in terms of individual behaviours, or regulations and the interventions of governments and other public bodies. For example, South Africa introduced significant restrictions on the sale of alcohol for two different periods in 2020 (Banerjee et al., 2020), but there were no studies available for this review which assessed the impact of this policy. We were unable to assess data between countries due to variation in national policy, quantity of studies and methods used. We were only able to consider papers published in

English at the time of the search and it may be that we missed some significant studies as a result. The majority of included studies relied on self-report in response to questionnaires to estimate both substance use and other related issues. It is well established that people often under report substance use when questioned about it (Johnson, 2014). Moreover, the substantial range of methodological differences between studies such as sample, sample size (n = 153–150,000), and age (13–82 years) may have been the reason for the mixed findings.

5. Conclusion

This review suggests that there may be an increased need for vigilance for alcohol and other substance use related problems and there is likely to be an increase in the need for treatment for both (with a firm focus on the former). Problematic substance or alcohol use which is not addressed can lead to adverse consequences for individuals and families, and has significant costs for health systems and societies (Public Health England, 2018). The data on increases in emergency admissions relating to overdose provides information which may be useful to emergency services and emergency response planners, in relation to future crises and pandemics.

As countries struggle to contain COVID 19, and to rebuild economies and societies in the aftermath, careful thought needs to be given to how best to use limited resources to meet the needs for intervention and treatment relating to substance use. Investing in evidence-based treatment pays dividends (Glasner-Edwards et al., 2010) and estimates from Public Health England (2017) suggest that, at least in the UK, the net cost benefit ratio is 2.5–1. The increase in problematic use during the pandemic suggests that increasing targeted and evidence-based interventions will be important in the period which follows, both to improve the lives of individuals and families, and prevent additional costs to societies and health systems.

CRediT authorship contribution statement

AR and JR contributed to the study selection, data extraction, data analyses, and manuscript drafting. RM, ANS, TH, GAW & GRL contributed to the data analyses and manuscript drafting.

All authors have approved the final article.

Contributors

All authors have materially participated in the research and/or article preparation.

Amanda Roberts and Jim Rogers contributed to the study selection, data extraction, data analyses, and manuscript drafting. Rachael Mason, Aloysius Niroshan Siriwardena, Todd Hogue, Gregory Adam Whitley & Graham R. Law contributed to the data analyses and manuscript drafting.

All authors have approved the final article.

Conflicts of interest

The authors have no conflicts of interest to declare.

Appendix 1. : Methodological quality, risk of bias, and quality assessment for the 53 initial studies

	Sample	Sampling	Sample Size	Description	Data analysis	Methods	Measures	Statistical analysis	Response rate	Total Score for overall risk of bias
Ahmed, 2020	+	+	+	+	+	+	+	+	+	0
Avery, 2020	+	+	+	+	+	+	+	+	+	0
Balhara et al., 2020	+	+	?	+	+	?	?	N/a	?	4
Ballivian, 2020	+	+	+	+	+	+	+	+	+	0
Bartel et al., 2020	+	+	?	+	+	+	+	+	?	2
Boehnke, 2020	+	+	+	+	+	+	+	+	+	0
Chodkiewicz, 2020	+	+	+	+	+	+	+	+	+	0
Czeisler, 2020	+	+	+	+	+	+	+	+	?	1
Đogaš, 2020	+	+	+	+	+	+	?	+	?	2
DeJong et al., 2020	+	–	–	+	+	+	N/a	N/a	N/a	2
Dumas, 2020	+	+	+	+	+	+	+	+	+	0
Fuchs-Leitner et al., 2020	+	+	–	+	+	+	+	N/a	+	1
Glober, 2020	+	+	+	+	+	+	+	+	+	0
Grigoletto, 2020	+	+	+	+	+	+	+	+	+	0
Gritsenko, 2020	+	+	+	+	+	+	?	+	+	1
Håkansson, 2020	+	+	+	+	+	+	?	+	+	1
Hawke, 2020	+	+	+	+	+	+	?	+	+	1
Kim, 2020	+	+	+	+	+	+	+	+	+	0
Knell, 2020	+	+	+	+	+	+	?	+	–	2
Lechner, 2020	+	+	+	+	+	+	+	+	?	1
Leichtle, 2020	+	+	+	+	+	+	?	+	+	1
López-Bueno, 2020	+	+	+	+	+	+	?	+	+	1
Luca, 2020	+	+	+	+	?	+	?	+	+	2
Marais, 2020	+	+	+	+	–	?	?	+	?	4
Martinotti, 2020	+	+	+	+	+	+	?	+	+	1
McPhee, 2020	+	+	+	+	+	+	+	+	+	0
Narasimha et al., 2020	+	+	–	+	+	+	+	+	+	1
Newby, 2020	+	+	+	+	+	+	+	+	+	0
Ochalek, 2020	+	+	+	+	–	+	+	–	+	2
Panno, 2020	+	+	+	+	+	+	+	+	+	0
Rodriguez, 2020	+	+	+	+	+	+	+	+	+	0
Rogers, 2020	+	+	+	+	+	+	+	+	+	0
Rolland, 2020	+	+	+	+	+	+	?	+	+	1
Romero-Blanco, 2020	+	+	+	+	+	+	?	+	+	1
Sallie, 2020	+	+	+	+	+	+	+	+	+	0
Sanchez, 2020	+	+	+	+	+	+	?	+	+	1
Scarmozzino, 2020	+	+	+	+	+	+	?	–	+	2
Shokoohi et al., 2020	+	+	+	?	–	?	?	–	+	5
Sidor, 2020	+	+	+	+	+	+	?	+	+	1
Silczuk, 2020	+	+	+	+	+	+	?	?	+	2
Slavova, 2020	+	+	+	+	+	+	+	+	+	0
Stanton, 2020	+	+	+	+	+	+	+	+	+	0
Sun, 2020	+	+	+	+	?	+	?	?	+	3
Tran, 2020	+	+	+	+	+	+	?	+	+	1
Tucker, 2020	+	+	–	+	+	+	?	–	+	3
Vanderbruggen, 2020	+	+	+	+	+	+	?	+	+	1
Van Laar, 2020	+	+	+	+	+	+	?	+	+	1
Vidot, 2020	+	+	+	+	+	+	+	+	+	0
Wainwright, 2020	+	+	+	+	+	+	+	?	+	1
Wang, 2020	+	+	+	+	+	+	+	+	+	0
Wardell, 2020	+	+	+	+	+	+	+	+	+	0
Yazdi, 2020	+	+	+	+	+	+	+	+	+	0
Yip et al., 2020	+	+	–	+	?	+	?	–	N/a	4

Key: + yes; - no; ? unclear; N/a not applicable

Contents for this table are guided by the assessment of methodological quality using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data (Munn et al., 2015).

Scoring for each item: + = low risk of bias (0 points); **-** *or* **?** = high risk of bias (1 point).

Total score for each study: 0–1 =Low risk of bias overall, 2–4 = Moderate risk of bias overall, 5–10 = High risk of bias overall.

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