CRITICAL REVIEW

ALCOHOLISM
CLINICAL & EXPERIMENTAL RESEARCH

Changes in alcohol use during the COVID-19 pandemic and previous pandemics: A systematic review

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Abstract

The objective of this study is to summarize the research on the relationships between exposure to the COVID-19 pandemic or previous pandemics and changes in alcohol use. A systematic search of Medline and Embase was performed to identify cohort and cross-sectional population studies that examined changes in alcohol use during or following a pandemic compared to before a pandemic occurred. Outcomes examined included differences in the volume and frequency of alcohol consumption and the frequencies of heavy episodic drinking (HED) and alcohol-related problems during a pandemic compared to before a pandemic. Quality assessment was performed using the Cochrane Risk of Bias Tool for Nonrandomized Studies. This study was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. The search yielded 672 articles; 27 were included in the narrative review, of which 6 were cohort studies (all from high-income countries). A total of 259,188 participants were included. All cohort studies examined the impact of COVID-19 and associated pandemic-related policies, including social distancing and alcohol-specific policies, on alcohol use. Cohort studies demonstrated a consistent significant decrease in total alcohol consumption (Australia) and a significant increase in the frequency of alcohol use (United States). A significant decrease in the frequency of HED was observed in Australia and Spain but not in the United States. A significant increase in the proportion of people with problematic alcohol use was observed in the United Kingdom. Initial insights into changes in alcohol use indicate substantial heterogeneity. Alcohol use may have decreased in some countries, while HED and the proportion of people with problematic alcohol use may have increased. The lack of high-quality studies from low- and middle-income countries reflects a dearth of information from countries inhabited by most of the world's population.

KEYWORDS
alcohol, COVID-19, heavy episodic drinking, pandemic, systematic review

INTRODUCTION

Health researchers are warning that alcohol use in many jurisdictions may be increasing due to the COVID-19 pandemic; however, scientific evidence is sparse on the impact of the COVID-19 pandemic as well as previous pandemics on alcohol consumption (Rehm et al., 2020). Several countries, including Canada, the United States, and Australia have reported increases in alcohol sales during the pandemic (Benzie, 2020; Chaudhuri, 2020; Foundation for Alcohol Research and Education [FARE], 2020; Zussman, 2020). In the United Kingdom, alcohol sales increased by 67% just prior to the implementation of lockdown measures at the beginning of the pandemic (Finlay & Gilmore, 2020). Prior to the COVID-19 pandemic, alcohol use was already a leading risk factor for both mortality and morbidity globally, and was the leading risk factor among those 15 to 49 years of age in 2016 (GBD 2016 Alcohol Collaborators, 2018). Consequently, increased consumption resulting from the current pandemic and pandemic-related policies can have significant public health consequences and further exacerbate the burden attributable to alcohol use (Rehm et al., 2017).

The COVID-19 pandemic potentially has multiple, countervailing effects on the levels and patterns of alcohol consumption. For example, to slow the spread of COVID-19 transmission and prevent healthcare systems from becoming overwhelmed, many countries have, to varying degrees, instituted social distancing restrictions and stay-at-home orders or "lockdown" measures. The social isolation experienced as a result of the pandemic may lead to an increase in alcohol consumption and dependence by increasing anxiety and depression (Wardell et al., 2020). Further, unemployment and the ensuing financial distress associated with the pandemic may increase alcohol consumption, while decreased incomes which lower the affordability of alcohol may decrease alcohol consumption (Rabinovich et al., 2009). A blurring of work and leisure hours and popularization of the cocktail hour during the current lockdown may also be contributing to increased drinking (Campbell, 2020). Further, a shift from on-premise (e.g., bars, pubs, and restaurants) to off-premise drinking may result in a decrease in alcohol consumption among people who typically consume on-premise but also may lead to an increase in alcohol consumption among people who typically drink off-premise (Chisholm et al., 2018). Moreover, the pricing of alcohol can impact consumption, as off-premise drinking is more affordable than on-premise (Jiang et al., 2016). Accordingly, a shift from on-premise to off-premise drinking increases the affordability of alcohol, with this increase in affordability potentially leading to increased alcohol consumption.

Additionally, the extent of pandemic-related policies, including social distancing and alcohol-specific policies, in response to COVID-19 varies by region. For example, in England, national lockdown measures included closing nonessential businesses (such as pubs, restaurants, and gyms), regional travel bans, and advising people to stay at home except in the case of work or educational necessities (BBC News, 2020a). In other countries, such as Spain and Australia, more severe lockdown restrictions were imposed, which included nighttime curfews (Dangerfield, 2020; Spain in English, 2020). Several provinces in Canada and states in the United States implemented policy reforms, or suspended enforcement of previous laws, as part of their COVID-19 response to allow on-premise establishments to offer takeout or curbside pick-ups, delivery to consumer's homes, and, in some cases, to deliver alcohol to consumer's homes without obtaining a delivery permit—thereby expanding the availability of and access to alcohol (Attorney General, 2020; National Institute on Alcohol Abuse & Alcoholism, 2020). For example, Ontario introduced permanent reforms to allow licensed businesses to include alcohol with food as part of takeout or delivery orders, and reduced minimum pricing of spirits for on-site consumption—matching the reduced pricing of alcohol included in takeout and delivery orders (Attorney General, 2020).

Finally, in some countries of the world, direct prohibition or bans of alcohol sales and production have been implemented. Examples are temporary prohibitions of alcohol in South Africa (Matzopoulos et al., 2020) and some Indian provinces (Mahadevan et al., 2021), a ban on alcohol in places where it was allowed previously, such as in Japanese restaurants (National Institutes of Infectious Diseases, 2021), and a temporary halt of the production of alcohol in Mexico because it was classified as a nonessential good (Medina-Mora et al., 2021). All of these measures were associated with decreases in consumption.

Based on the lack of synthesized information on changes in alcohol consumption during the COVID-19 pandemic and previous pandemics, the primary objective of this review is to summarize the reported changes in alcohol use during or following the current COVID-19 or previous public health pandemics compared to before the pandemics occurred. An understanding of the impact on alcohol use of public health pandemics and associated pandemic-related policies, including social distancing and alcohol-specific policies, interactions between policy measures and time-dependent changes in these policies, is germane to establishing public health-related policies aimed at minimizing increased consumption and/or improving harmful drinking patterns, both at the present time and in future public health crises. Additionally, as secondary objectives, this review examines the length of time between the date of submission for peer-review and the date of publication of the cohort and cross-sectional studies included in this review as it is essential to acquire evidence-based information in a timely manner to guide policy-making decisions in the interest of public health and safety during unprecedented times.

METHODS

The systematic review was registered with PROSPERO (National Institute for Health Research, 2021; CRD4201228813) and performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (Moher et al., 2009).

Search strategy and selection criteria

A systematic electronic search was performed using Medline and Embase from inception to June 30, 2021 for keyword and MeSH terms relating to alcohol consumption, pandemics, and surveys or questionnaires. Articles were included if the following criteria were met: (1) articles were epidemiological studies, irrespective of claims of representativity (see Rehm et al., 2021 for further discussion) and (2) articles assessed a change in one or more dimensions of alcohol use, including changes in average alcohol volume, irregular heavy drinking (binge drinking), frequency of alcohol consumption (e.g., number of days drinking alcohol per week), the prevalence of problem drinking or alcohol use disorders (AUD) during or following a pandemic compared to before the corresponding pandemic occurred, or reported the prevalence of one or more dimensions of alcohol use before the pandemic and during or following the pandemic. Primary outcomes were based on population-representative cohort studies, defined as minimally two independent measurement points which examined differences in alcohol use. Secondary outcomes were based on cross-sectional studies and nonpopulation representative cohort studies.

No language restrictions were applied. One reviewer independently excluded identified articles based on title and abstract or full-text. A second reviewer independently assessed a subset of 44.5% of the articles for the title and abstract inclusion, and subsequently assessed a subset of 38.8% of the articles for full-text eligibility. A third reviewer was consulted in the case of any discrepancies. All data were extracted by one investigator and then independently cross-checked by a second investigator.

Data extraction

From all relevant articles, we extracted authors' names, country, dates the article was received/accepted/published, study setting, study design, date(s) the survey was conducted, age of the sample, sex, sample size, assessment of pandemic exposure, number of participants in each category of alcohol intake, ascertainment of changes in alcohol consumption measures or the prevalence of alcohol consumption before and during or following the pandemic, measures of association for changes in alcohol consumption before the pandemic compared to during or after the pandemic, mediators, and associated 95% confidence intervals/standard errors/standard deviations/p-values. The template data collection forms and data extracted from included studies are available upon request.

Quality assessment

The Cochrane Risk of Bias Tool for Nonrandomized Studies (ROBINS-I; Sterne et al., 2016) was used to assess the risk of bias in included articles. The Grades of Recommendation, Assessment, Development and Evaluation system was used to rate the evidence for an association between exposure to a pandemic and changes in alcohol consumption (Balshem et al., 2011).

Alcohol and pandemic-related policies

For cohort studies that measured changes in indicators of alcohol use, data were examined on changes in pandemic-related policies, including social distancing and alcohol-specific policies. Data on policies were obtained from Colbert et al. (2020) and Miller et al. (2020) for Australia, elDiario.es Catalonia (2020) for Spain, Public Health England (2021) for the United Kingdom, and Ritchie et al. (2020) for the United States. Changes in social distancing policies, including stay-at-home restrictions, cancellation of public events, restrictions on public gatherings, and school closures, were obtained from Ritchie et al. (2020).

RESULTS

Of 672 identified references, 189 articles were retrieved in full text; 27 articles satisfied the inclusion/exclusion criteria and were included in this review (Figure 1). Articles excluded after full article review included 11 articles that contained only two categories for changes in alcohol use: (1) same and/or a decrease in alcohol use and (2) an increase in alcohol use, compared to three categories for changes in alcohol use (a decrease, the same, and an increase). Further, some studies only examined factors that led to changes in alcohol use but did not report whether alcohol consumption decreased, increased, or stayed the same (see Eastman et al., 2021 as an example). The systematic review found two studies on the impact of previous pandemics on alcohol consumption. One study examined alcohol abuse/dependence symptoms among hospital employees exposed to the 2003 severe acute respiratory syndrome (SARS) outbreak, and found the alcohol abuse/dependence symptom counts 3 years post the outbreak were positively associated with those who had to quarantine or work in high-risk locations, including in the SARS ward in a hospital located in Beijing, China during the outbreak (Wu et al., 2008). The other study found that among 818 Hong Kong residents, 4.7% of male and 14.8% of female current drinkers reported an increase in their drinking 1 year after the SARS outbreak (Lau et al., 2005).

A total of 259,188 participants from 27 studies were included in the analysis assessing the association between the COVID-19 pandemic and alcohol use. Results of the quality assessment can be found in Table S4. The cohort studies were determined to be at low risk of exposure classification bias as the pre-COVID-19 and during COVID-19 timelines were clearly delineated and assessed at the time of occurrence. However, one-half of the articles (15 studies) were rated at critical risk of bias, mainly with respect to the critical risk of selection bias, due to the use of convenience sampling and/or snowball sampling techniques.
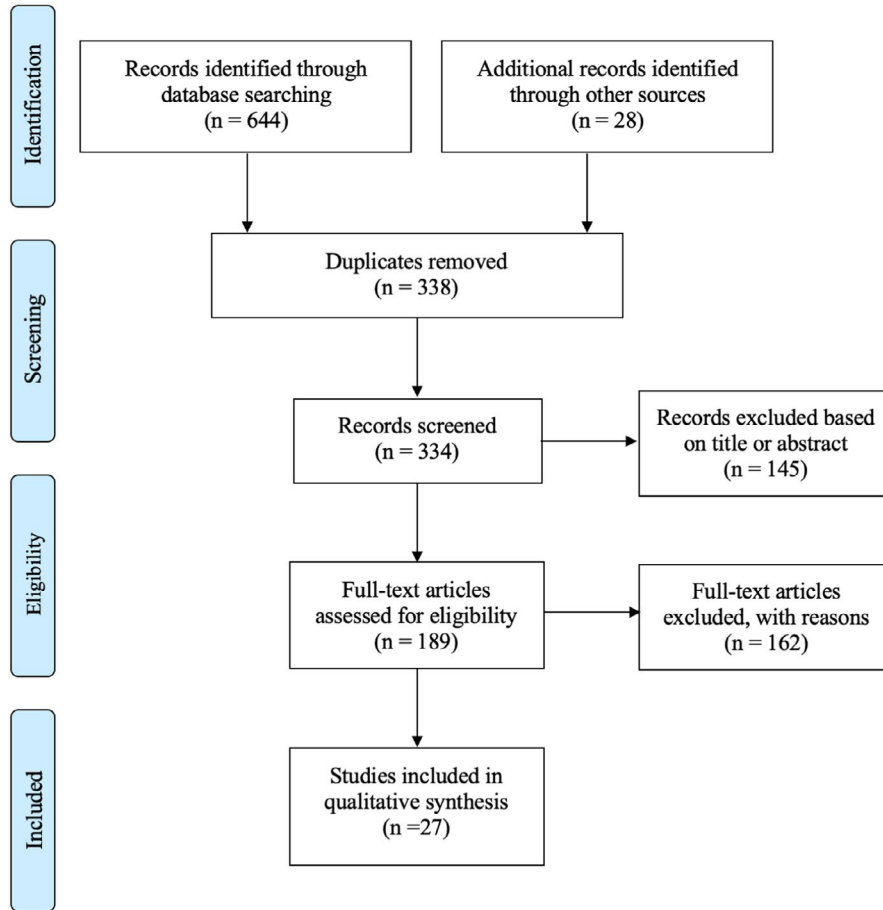
FIGURE 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart for study selection

Publication times

A total of six cohort studies and twenty-one cross-sectional studies were included in the review and in the primary narrative review. The studies were from Asia, Europe, North America, and the Oceania region. None of the included studies were conducted in South America or Africa. The largest proportion of studies, including both cohort and cross-sectional studies, was conducted in Europe (66.7%), followed by North America (18.5%). Specifically, the following countries conducted the largest proportion of studies: United Kingdom (18.5%), Germany (14.8%), Spain (14.8%), Finland (14.8%), France (11.1%), Norway (11.1%), United States (11.1%), and Canada (7.4%).

Results from the cohort studies were all published in or after September 2020, with four studies published in 2020 and two studies published in 2021 (Figure 2). Results from the cross-sectional studies were all published in or after August 2020, with 9 studies published in 2020 and 12 studies published in 2021 (Figure 3). The number of cohort and cross-sectional study publications peaked in the periods from September 1, 2020 to November 30, 2020 and from January 1, 2021 to April 30, 2021. Five cohort studies and fifteen cross-sectional studies indicated the submission date The average length of time from article submission to publication was 94.4 and 108.8 days for cohort and cross-sectional studies,

respectively. This analysis assumed article submission date data were missing at random.

Cohort studies

An overview of the cohort studies which evaluated the impact of the COVID-19 pandemic on total alcohol consumption is presented in Table 1. Two cohort studies examined the impact of COVID-19 on changes in total alcohol consumption. An Australian study reported a significant decrease in alcohol consumption (Clare et al., 2021), and a study in the United States reported no significant change in the number of drinks consumed in the past 30 days (Pollard et al., 2020).

Three cohort studies investigated the impact of the COVID-19 pandemic on the frequency of alcohol use. An Australian study (Clare et al., 2021) reported no significant changes in the frequency of consumption; however, a United Kingdom study found a significant increase in abstention, a significant decrease in the number of people consuming 0 to 4 times per week, and a significant increase in the number of people consuming alcohol 4 or more times per week (Daly & Robinson, 2021). A significant increase in the frequency of alcohol consumed in the past 30 days was observed in a study in the United States (Pollard et al., 2020).
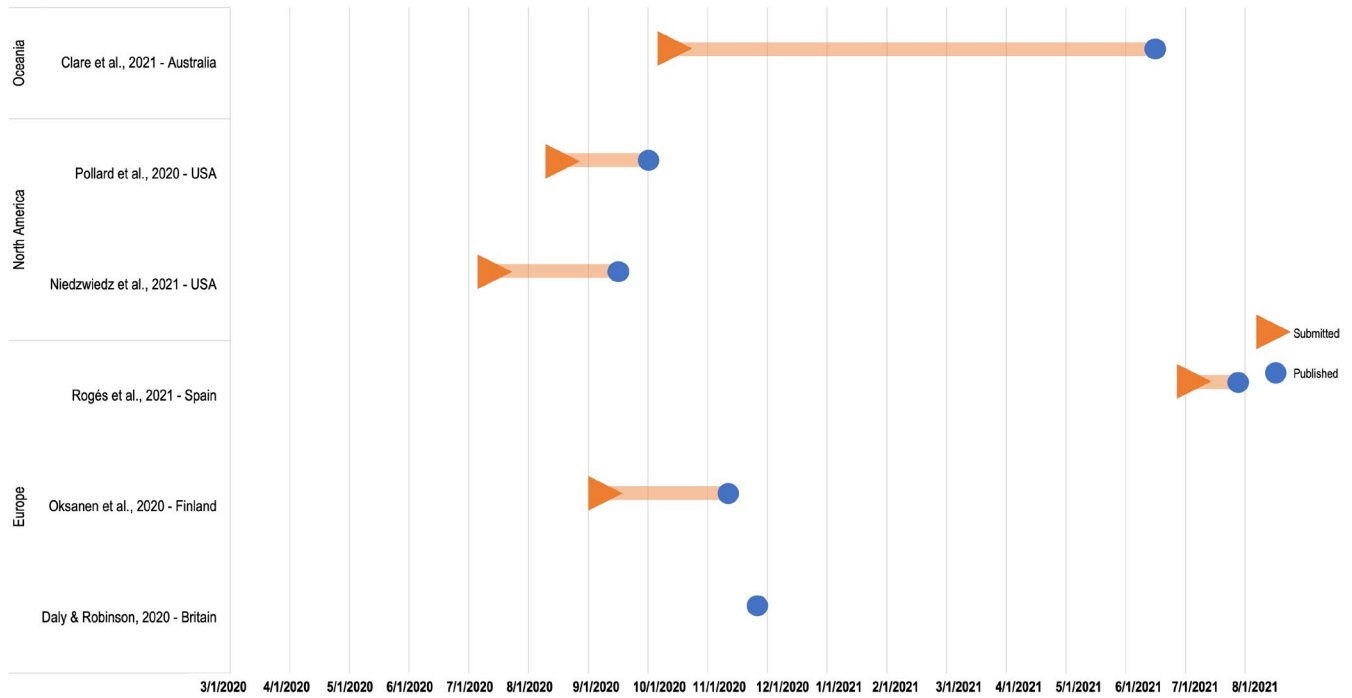
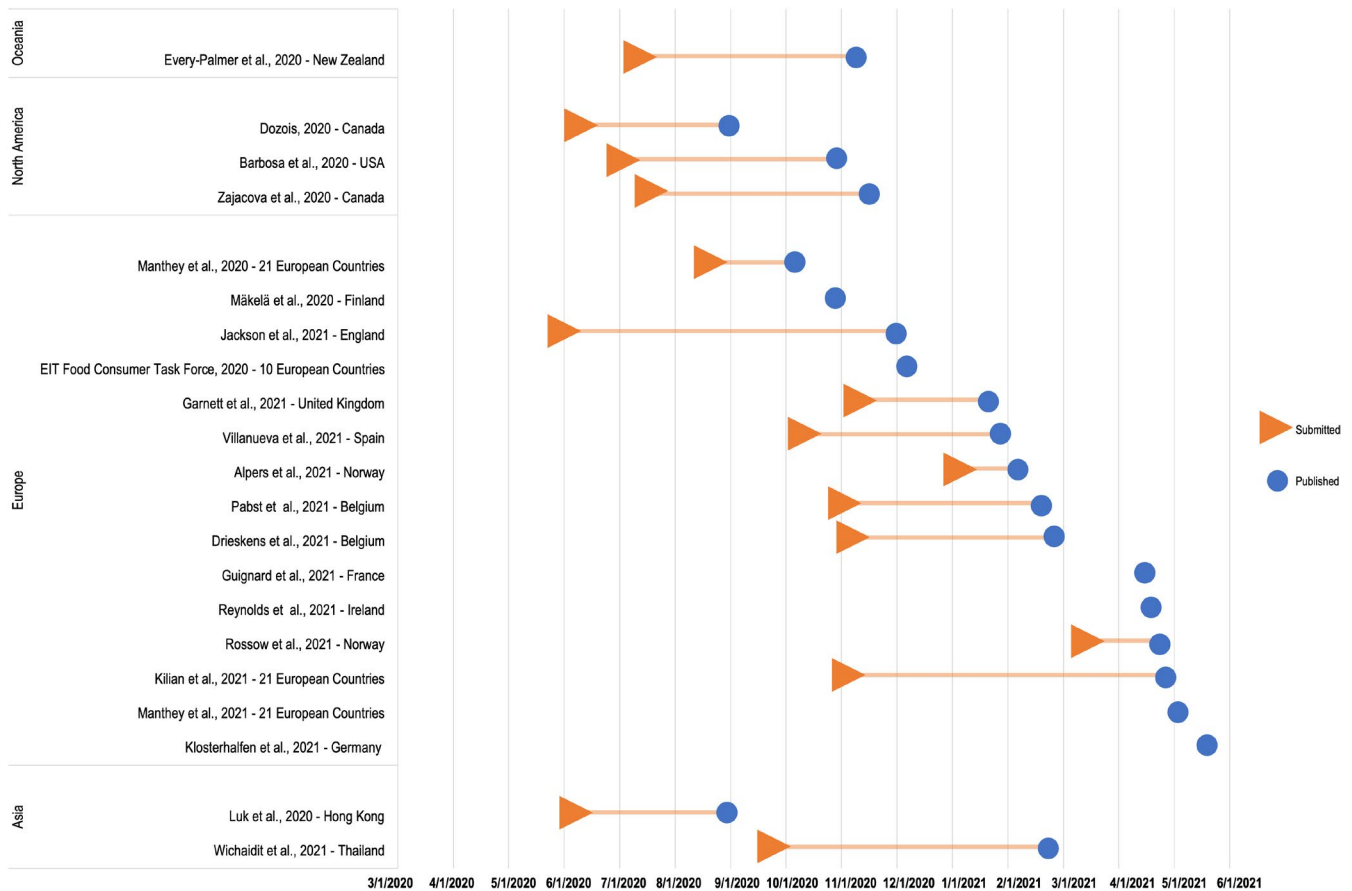**FIGURE 2** Time from article submission to publication, by region, from cohort studies

FIGURE 3 Time from article submission to publication, by region, from cross-sectional studies

TABLE 1 Cohort study characteristics, and the impact of COVID-19 lockdowns on total alcohol consumption, proportion of alcohol users, frequency of drinking, average number of drinks, proportion of heavy episodic drinkers, frequency of heavy episodic drinking, and alcohol problems

Author	Country	Survey dates (mm/ yyyy)[a]	Age range, years	Sample size, n	Outcome	Statistical model	Effect[b]	Effect (95% CI)	p-Value
Total alcohol consumption									
Clare et al. (2021)	Australia	B: 09/2017–07/2018; 09/2018–05/2019; 08/2019–01/2020 F: 05–06/ 2020	≥18	443	Total consumption	Negative binomial regression	IRR	0.83 (0.73, 0.95)	<0.05
Pollard et al. (2020)	United States	B: 04–06/2019 F: 05–06/2020	30 to 80	1540	Change in mean number of drinks in the past 30 days during the pandemic compared to 2019	Not specified	Absolute change	0.06 (−4.00, 4.13)	NS
Frequency of drinking									
Clare et al. (2021)	Australia	B: 09/2017–08/2018; 09/2018–04/2019; 08/2019–01/2020 F: 05–06/2020	≥18	443	Days in the past month	Negative binomial regression	IRR	1.08 (0.98, 1.19)	NS
Daly and Robinson (2021)	United Kingdom	B: 2016 to 2018 F: 05/2020	50	3358	Abstainer ≤1 time/month 2 to 4 times/month 2 to 3 times/week ≥4 times/week	Logistic regression (marginal effects)	Absolute change	4.30 (1.16, 7.44) −7.60 (−10.15, −5.05) −8.70 (−11.84, −5.56) −1.50 (−4.64, 1.64) 13.50 (10.95, 16.05)	<0.01 <0.001 <0.001 NS <0.001
Pollard et al. (2020)	United States	B: 04–06/2019 F: 05–06/2020	30 to 80	1540	Days in the past 30 days	Not specified	Absolute change	0.74 (0.33, 1.15)	<0.05
Average number of drinks per drinking occasion									
Clare et al. (2021)	Australia	B:09/2017–08/2018; 09/2018–05/2019; 08/2019–01/2020 F: 05–06/2020	≥18	443	Drinks/occasion	Negative binomial regression	IRR	0.73 (0.66, 0.80)	<0.05
Daly and Robinson (2021)	United Kingdom	B: 2016/2018 F: 05/2020	50	3358	1 to 2 drinks/occasion 3 to 4 drinks/occasion 5 to 6 drinks/occasion 7 to 9 drinks/occasion ≥10 drinks/occasion	Logistic regression (marginal effects)	Absolute Change	9.10 (5.57, 12.63) −5.30 (−8.44, −2.16) −2.90 (−5.06, −0.74) −0.60 (−1.38, 0.18) 0.20 (−0.58, 0.98)	<0.001 <0.01 <0.01 NS NS

TABLE 1 (Continued)

Author	Country	Survey dates (mm/yyyy)[a]	Age range, years	Sample size, n	Outcome	Statistical model	Effect[b]	Effect (95% CI)	p-Value
Frequency of heavy episodic drinking (HED)									
Clare et al. (2021)	Australia	B:09/2017-07/2018; 09/2018-05/2019; 08/2019-01/2020 F: 05-06/ 2020	≥18	443	HED (≥5 drinks)	Negative binomial regression	IRR	0.72 (0.63, 0.83)	<0.05
Niedzwiedz et al. (2021)	United States	B: 2015 to 2017, 2016 to 2018, 2017 to 2019 F: 04/2020	≥16	9748	HED (≥5 drinks)	Poisson regression	PR	1.02 (0.98, 1.06)	NS
Pollard et al. (2020)	United States	B: 04-06/2019 F: 05-06/2020	30 to 80	1540	HED (≤5 drinks (M) or ≥4 drinks (F)) in the past 30 days	Not specified	Absolute change	0.13 (−0.09, 0.34)	NS
Rogés et al. (2021)	Spain	B: 10/2019-02/2020 F: 06-07/2020	14 to 18	303	HED (≥6 drinks)		Absolute change	−30.4	<0.05
Alcohol problems									
Daly and Robinson (2021)	United Kingdom	B: 2016/2018 F: 05/2020	50	3358	Percent (%) with an AUDIT-PC score ≥5	Multinomial logistic regression	Absolute change	5.2 (2.4, 8.0)	<0.001
Pollard et al. (2020)	United States	B: 04-06/2019 F: 05-06/2020	30 to 80	1540	SIP score (3 months)	Not specified	Absolute change	0.09 (−0.02, 0.21)	NS
Rogés et al. (2021)	Spain	B: 10/2019-02/2020 F: 06-07/2020	14 to 18	303	Proportion with AUDIT-C scores ≥3	Not specified	Absolute change	−33.3	<0.05

Abbreviations: AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; AUDIT-PC, Alcohol Use Disorders Identification Test—primary care; HED, heavy episodic drinking; IRR, incident rate ratio; OR, odds ratio; PR, prevalence ratio; SIP score, Short Inventory of Problems score.

[a]B, baseline; F, follow-up.

[b]Adjustments are presented in Table S5.

TABLE 2 Alcohol and other public health policies implemented in response to the COVID-19 pandemic

Country	Alcohol policy changes	Social distancing policy changes
Australia	On-premise retailers (bars, pubs, nightclubs, etc.) closed on March 23, 2020; however, premises gained authorization to sell alcohol for off-site consumption On March 31, 2020, major alcohol retailers put restrictions in place on the amount of alcohol that could be purchased in one transaction, with restrictions lifting on April 28, 2020 Restrictions varied significantly by state and territory in Australia and on-premise sites, like restaurants, reopened between May 11 and 31, 2020	Stay-at-home requirement required during May and no measures during June Cancellation of public events required during May and recommended during June Restrictions on public gatherings of less than 10 people during May and 10 to 100 people during June School closures required at some levels during May and recommended during June Workplace closures required for some during the beginning of May and recommended mid-May onward
Spain	On-premise retailers, like restaurants, reopened in May (varied by area and their phases) During mid-July, certain on-premise retailers (cinemas, nightclubs, etc.) shut down, while restaurants and bars remained open but at 50% capacity inside and alcohol consumption at the bar was prohibited	Stay-at-home restrictions recommended during the beginning of June to no measures near the end of June, however, in early July it changed back to recommended and from mid-July it was required Cancellation of public events required during June and July. Restrictions on public gatherings between 10 and 100 people in early June, 100 to 1000 from late June to early July, and <10 people for the remainder of July School closures required only at some levels during June and July Workplace closures required for some during early June, recommended from mid-June to mid-July, and required for some for the remainder of July
United Kingdom	Alcohol was declared to be an essential good with premises such as alcohol retailers, supermarkets, etc. being able to remain open and sell alcohol On-premise establishments (bars, restaurants, etc.) were closed between March 23 and July 4, 2020; however, they were able to sell alcohol as an off-premise retailer	Stay-at-home restrictions required beginning of May to no measures from mid-May onward Cancellation of public events required during May and June Restrictions on public gatherings of less than 10 people during May and June School closures required at all levels during May and June. Workplace closures required for all but key workers during May and required for some during June
United States	Off-premise retailers (liquor stores) remained open as they qualified to be essential in most states On-premise retailers (restaurants, bars, etc.) closed from March 15 to 22, 2020; however on-premise establishments were able to sell alcohol through take-out as off-site consumption On-premise establishments reopened between May and June; however, rules varied by state, and restrictions on outdoor seating	Stay-at-home restrictions required from April to June Cancellation of public events required from April to June Restrictions on public gatherings of less than 10 people from April to June School closures required at all levels from April to June Workplace closures required for all but key workers during April and May and required for some mid-June onward

Two cohort studies examined changes in the number of drinks consumed per drinking occasion. A study in Australia (Clare et al., 2021) found a significant decrease in the average number of drinks consumed per drinking occasion, while a study in the United Kingdom (Daly & Robinson, 2021) found a significant increase in the number of people having 1 to 2 drinks per occasion and a significant decrease in the number of people having 3 to 6 drinks per occasion (no changes in the number of people having 7 or more drinks per occasion were observed).

With regards to heavy episodic drinking (HED), one Australian cohort study (Clare et al., 2021) observed a significant decrease in the prevalence of HED, and a cohort study from Spain (Rogés et al., 2021) also found the overall prevalence of HED decreased significantly. Two studies from the United States found no significant changes in the prevalence of HED associated with the COVID-19 pandemic (Niedzwiedz et al., 2021; Pollard et al., 2020).

Three cohort studies examined the impact of the COVID-19 pandemic on the prevalence of alcohol problems. One study from the United Kingdom found a significant increase in the number of people scoring 5 or more on the AUD Identification Test (AUDIT) PC (Daly & Robinson, 2021). A study conducted in the United States found no significant change in the average Short Inventory of Problems score (Pollard et al., 2020); however, a study from Spain found a significant decrease in the number of people scoring 3 or more on the AUDIT (Rogés et al., 2021).

Alcohol-specific policies and social distancing measures implemented in Australia, Spain, the United Kingdom, and the United States are outlined in Table 2. In all four countries, on-premise

retailers (restaurants, bars, pubs, nightclubs, etc.) closed in March 2020 and reopened in May or early June 2020 (except for the United Kingdom, which reopened in July 2020). However, during this time, on-premise retailers gained authorization to sell alcohol for off-site consumption. In Australia, an additional alcohol-specific policy included restricting the amount of alcohol that could be purchased in one transaction (lifted end of April 2020) and other pandemic-related policies included a stay-at-home requirement, cancellation of public events, and school closures and work closures which ended in May 2020. The observed changes in Australia included decreases in total alcohol consumption, the average number of drinks per drinking occasion, and HED. Spain mandated stay-at-home restrictions, cancellation of public events, school closures at some levels, and workplace closures for June 2020 and most of July 2020, and the observed changes included decreases in HED and the prevalence of alcohol problems. The pandemic-related policies in the United States included stay-at-home restrictions, cancellation of public events, school closures, and workplace closures from April to the end of June 2020, and the observed changes showcased an increased frequency of alcohol consumed in the past 30 days. Notably, compared to the other three countries, the United Kingdom had the longest closure of on-premise retailers from March 23 to July 4, 2020, alongside stay-at-home restrictions during early May, and cancellation of public events, restrictions on public gatherings (≤10 people), school closures, and work closures (except for key workers) during May and June. The observed changes in the United Kingdom included increases in the number of people who consumed alcohol 4 or more times per week, the number of people who consumed 1 to 2 drinks per occasion, and the prevalence of alcohol problems.

Cross-sectional studies

An overview of the cross-sectional studies which assessed the association between the COVID-19 pandemic and changes in alcohol consumption is presented in Tables 3 and 4. A total of five cross-sectional studies assessed the association between the COVID-19 pandemic and total alcohol consumption. Among these studies, significant decreases were observed in a study of 21 European countries (Kilian et al., 2021) and a study in Belgium (Pabst et al., 2021). No significant changes were observed in the two surveys conducted in Norway (Rossow et al., 2021) and in the study in the United States (Barbosa et al., 2020). Significant increases were observed in a study in Ireland (Reynolds et al., 2021).

One cross-sectional study investigated the association between the COVID-19 pandemic and the frequency of alcohol use and the number of drinks per drinking occasion. The study from 21 European countries found significant decreases in the frequency of drinking and in the number of drinks consumed per drinking occasion (Kilian et al., 2021). With regards to HED, the study from 21 European countries observed a significant decrease in the frequency of HED (Kilian et al., 2021). Of note is a study in the United States which found a significant decrease in the number of people engaging in

HED <1 time/month, and a significant increase in the number of people engaging in HED weekly but not daily (Barbosa et al., 2020).

Two cross-sectional studies examined mean changes in scores that indicate alcohol problems. A study conducted in Spain (AUDIT-C score) found significant decreases in mean alcohol problem scores (Villanueva et al., 2021). Of note is a study performed in England which found a significant increase in AUDIT-C scores of 5 or more.

Figure 4 presents the 17 surveys conducted in Europe ($n = 13$), North America ($n = 2$), Asia ($n = 1$), and Oceania ($n = 1$) which examined the fractions of people in the population who reported an increased, decreased, or no change in alcohol use during the COVID-19 pandemic. Manthey et al. (2020) examined changes in alcohol use in (1) Germany and (2) 20 other European countries, and Rossow et al. (2021) examined changes in alcohol use in Norway measured through two different surveys (N1: European Alcohol Use and COVID-19 survey among Norwegian adults and N2: a survey conducted by the Norwegian Directorate of Health). Nine of the studies reported statistically significant decreases in alcohol consumption, five studies reported statistically significant increases, and the remaining four studies reported nonsignificant changes. Two studies from Canada reported statistically significant increases in alcohol consumption. One study from Asia reported statistically significant decreases in alcohol consumption, while one study from New Zealand reported statistically significant increases in alcohol consumption. An additional 48 studies are presented in Figure S1, showcasing changes in alcohol use observed in unweighted studies. The results vary from those shown in Figure 4, as 21 of the 48 (43.75%) studies reported statistically significant decreases in alcohol consumption, while 19 of the 48 (39.58%) studies reported statistically significant increases in alcohol consumption. The remaining 8 of the 48 (16.67%) studies reported nonsignificant changes in alcohol consumption. All but one of the North American studies were conducted in the United States, and the majority reported statistically significant increases in alcohol use (5 of 8 studies). Further, one study from Mexico reported statistically significant decreases in alcohol consumption (Levy et al., 2020). One-half of the European studies reported statistically significant decreases in alcohol use.

Sex differences in alcohol consumption changes

Tables S8 and S9 highlight the sex differences in the relationship between COVID-19 lockdowns and alcohol consumption. When examining people who increased their alcohol use compared to those whose alcohol use decreased or remained the same, females were more likely to increase their overall alcohol consumption compared to males in the United Kingdom, Germany, and other European countries (Garnett et al., 2021; Manthey et al., 2020). When examining people who decreased their alcohol use compared to those whose alcohol use increased or remained the same, males were more likely to decrease their alcohol consumption compared to females in the United Kingdom and Norway (Alpers et al., 2021; Garnett et al., 2021).

TABLE 3 Cross-sectional study characteristics, and the association between COVID-19 lockdowns and alcohol use

Author	Country	Survey dates	Age range, years	Sample size, n	Outcome	Statistical model/test	Effect[a]	Effect (95% CI)	p-Value
Total alcohol consumption									
Kilian et al. (2021)	21 European Countries[b]	04-07/2020	≥18	31,964	Drinks/month (ref. 12 months prelockdown)	Linear regression	Consumption change score (range of −1 decrease to +1 increase)	−0.14 (−0.18, −0.10)	<0.001
Pabst et al. (2021)	Belgium	03 to 05/2020	≥18	7711	Average volume (time period not specified) (ref: prepandemic)	Mean difference	Absolute change	−0.83 (−1.22, −0.45)	<0.05
Reynolds et al. (2021)	Ireland	04-05/2020	≥18	1362	Increased alcohol consumption (ref. no change)	Logistic Regression	OR	3.6 (1.7 to 7.7)	<0.05
					Decreased alcohol consumption (ref. no change)		OR	2.0 (0.7 to 5.6)	NS
Rossow et al. (2021)	Norway	04-07/2020	≥18	N1: 15,267	Drinks/week (ref: prepandemic)	Kolmogorov Smirnov test	Absolute change	0.1	NS
				N2: 1195	Drinks/week (ref: prepandemic)		Absolute change	−0.1	NS
Barbosa et al. (2020)	United States	05/2020	≥21	555	Drinks/day (ref: 02/2020)	Linear regression	Absolute change	0.08	NS
Frequency of drinking									
Kilian et al. (2021)	21 European Countries[b]	04-07/2020	≥18	31,964	Change in drinking frequency in the past 30 days (ref. past 12 months)	Linear regression	Consumption change score (range between −1 decrease and +1 increase)	−0.11 (−0.16, −0.05)	<0.001
Proportion of alcohol users									
Wichaidit et al. (2021)	Thailand	04-07/2020	≥18	2445	Past 30 day drinkers (ref: prepandemic)	Logistic regression	Absolute change	−14	<0.001
Average number of drinks per drinking occasion									
Kilian et al. (2021)	21 European Countries[b]	04 to 07/2020	≥18	31,964	Drinks/occasion (ref: prepandemic)	Linear regression	Consumption change score (range between −1 decrease and +1 increase)	−0.14 (−0.18, −0.10)	<0.001

Abbreviation: OR, odds ratio.

[a]Adjustments are presented in Table S6.

[b]21 European Countries: Albania, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Ukraine, and the United Kingdom.

TABLE 4 Cross-sectional study characteristics, and the association between COVID-19 lockdowns and heavy episodic drinking and alcohol problems

Author	Country	Survey dates	Age range, years	Sample size, n	Outcome	Statistical model/test	Effect[a]	Effect (95% CI)	p-Value
Proportion of heavy episodic drinkers (HED)									
Barbosa et al. (2020)	United States	05/2020	≥21	555	HED (≥5 drinks (M) or ≥4 drinks (F) drinks in a 2-h period) (ref: prepandemic)	Logistic regression	Absolute change	0.297 (−0.100, 0.690)	NS
					Heavy Drinking (>4 (M) or >3 (F) drinks in 1 day or >14 (M) or >7 (F) drinks/week) (ref: 02/2020)		Absolute change	0.413 (0.320, 0.510)	<0.05
Frequency of heavy episodic drinking									
Kilian et al. (2021)	21 European Countries[b]	04-06/2020	≥18	31,964	HED frequency (ref: prepandemic)	Linear regression	Consumption change score (range between −1 decrease and +1 increase)	−0.17 (−0.20, −0.14)	<0.001
Alcohol problems									
Jackson et al. (2021)	England	04/2019 to 02/2020; 04/2020	≥16	1674	AUDIT-C scores of ≥5 (ref: prepandemic)	Logistic regression	OR	1.85 (1.67, 2.06)	<0.001
Villanueva et al. (2021)	Spain	04-05/2020	18 to 64	2343	Mean AUDIT-C score (ref: prepandemic)	Student's *t*-test	Absolute change	−0.80	<0.001

Abbreviations: AUDIT-C, Alcohol Use Disorders Identification Test—Consumption; HED, heavy episodic drinking; OR, odds ratio.

[a]Adjustments are presented in Table S7.

[b]21 European Countries: Albania, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Norway, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Sweden, Ukraine, and the United Kingdom.
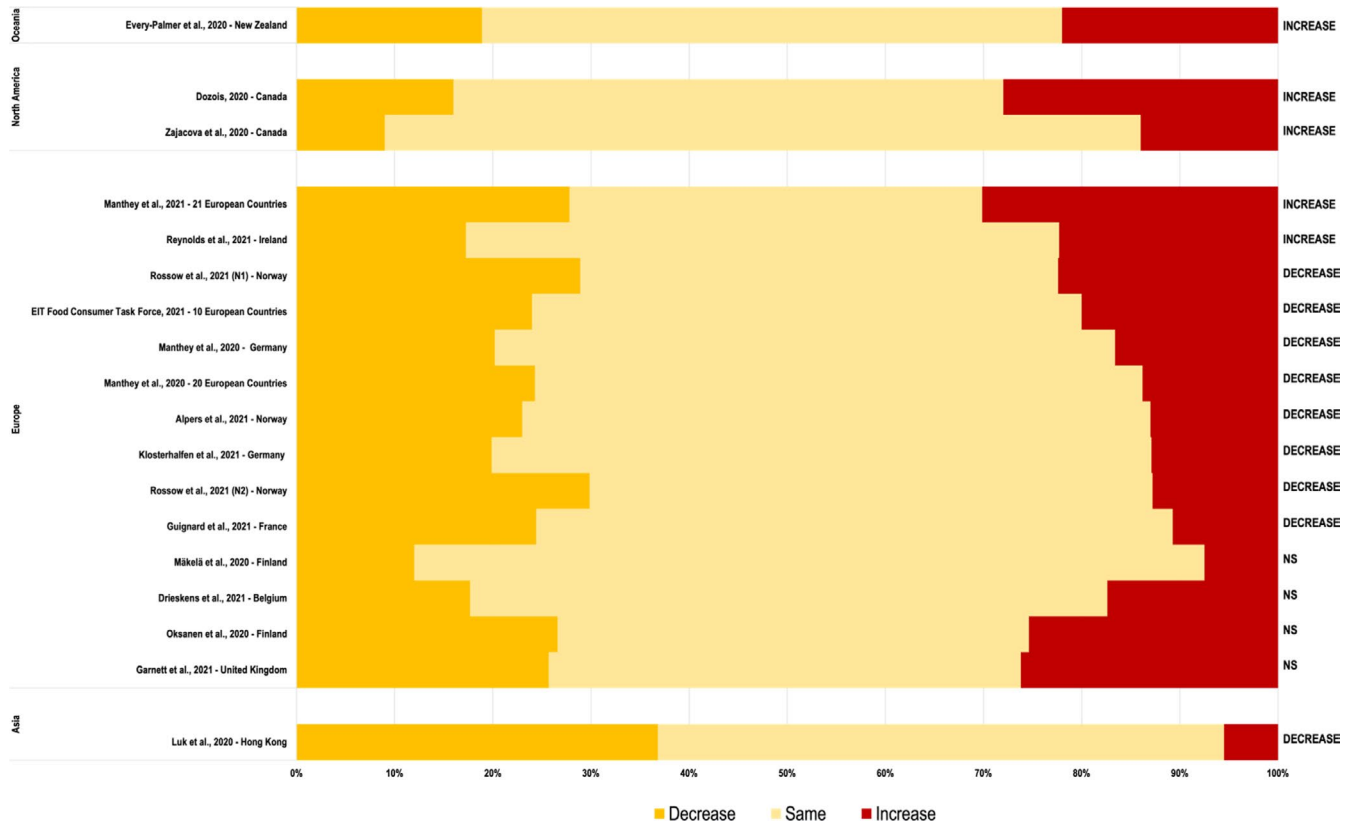
Point estimates, sample sizes and p-values are reported in Supporting Table S1

FIGURE 4 Changes in the prevalence of alcohol use from population-representative studies. Point estimates, sample sizes and *p*-values are reported in Table S1

Significant decreases in overall alcohol consumption were observed among both males and females in Thailand (Wichaidit et al., 2021), and only among females in Australia (Clare et al., 2021). No significant changes in overall alcohol consumption were seen in Finland or Canada (Oksanen et al., 2021; Zajacova et al., 2020). A study in the United States found that the frequency of alcohol consumption increased for females more than it did for males (Pollard et al., 2020); however, no significant changes were found in a study from Australia (Clare et al., 2021). For an average number of drinks per drinking occasion, there was a significant increase among males in Belgium (Pabst et al., 2021) and the United States (Barbosa et al., 2020); however, another study from the United States found no significant changes (Pollard et al., 2020). In Australia, significant decreases were reported for both males and females (Clare et al., 2021). For HED, significant increases were seen among both males and females in the United States (Barbosa et al., 2020; Pollard et al., 2020). In a study from Australia, there were significant decreases in HED for both males and females (Clare et al., 2021). The findings for alcohol problems varied, with an increase among males and females in the United Kingdom (Daly & Robinson, 2021), a decrease among both sexes in Spain (Villanueva et al., 2021), and an increase among females only in the United States (Pollard et al., 2020).

DISCUSSION

The heterogeneity of the findings from this systematic review indicates that the impact on alcohol use of the COVID-19 pandemic and pandemic-related policies, including social distancing and alcohol-specific policies, appears to be variable and dependent on multiple factors. In particular, the cohort studies presented in this systematic review indicate that alcohol use may have decreased in some countries, while HED and the proportion of people with problematic alcohol use may have increased in some countries.

The reduced availability of alcohol, including the inability to drink alcohol on-site (e.g., at restaurants and bars) has led to reductions in alcohol consumption; however, growth in other forms of alcohol sales, such as in retail stores and e-commerce sales, may offset reductions in on-site sales. Therefore, changes in alcohol consumption may be dependent upon the proportion of alcohol consumed on-site and off-site before the pandemic and the ability of other forms of alcohol sales to offset reductions in on-site sales. Second, the COVID-19 pandemic has led to economic crises, resulting in psychological distress (leading to increases in alcohol consumption) and decreased incomes (leading to decreases in alcohol consumption) (De Goeij et al., 2015). The impact of the economic crises on incomes is dependent upon the stimulus programs

established by governments. Third, an association has been found between mental health symptoms, like generalized anxiety disorder or depression, and an increase in HED frequency during the COVID-19 pandemic (Valente et al., 2021; Weerakoon et al., 2021).

A total of six cohort studies were included in the review, and the findings of these studies are limited to the effects of the beginning of the pandemic on alcohol consumption. In particular for the cohort studies, Australia, Spain, the United Kingdom, and the United States allowed off-premise sales of alcohol without restrictions (with the exception of Australia which restricted the amount of alcohol that could be purchased in one transaction), and all countries limited on-premise sales.

Furthermore, with respect to the cross-sectional studies, most of the evidence for the association between pandemic-related policies (including social distancing and alcohol-specific policies) and alcohol consumption is from high-income North American and European countries. The highlighted gap in research for low-income countries, especially in Africa, is concerning as the magnitude of the association differs depending on the country, and the majority of the world's population lives in low- and middle-income countries (The World Bank, 2021). Additionally, the lack of evidence from countries that enacted prohibitions on alcohol sales, such as in South Africa (Matzopoulos et al., 2020), should be addressed as the enactment of these policies has been linked in the media to a 65% reduction in trauma cases arriving at emergency departments (BBC News, 2020b). In contrast, in countries such as Australia, China, and France, where alcohol sales have not been restricted, domestic violence has increased (Usher et al., 2020). These observed reductions and increases in trauma cases may be linked to levels of alcohol consumption among men, and changes in both alcohol consumption and domestic violence should be examined in these countries.

Comparison of results from cohort studies with alcohol sales data

Survey and cohort studies encounter numerous biases which may lead to the studies not being representative of the general population and to the underestimation of alcohol use (Dawson, 2003; Groves, 2004; Shield & Rehm, 2012). Accordingly, global surveillance efforts which are directed at alcohol use monitor alcohol sales (i.e., adult per capita consumption [APC]). APC provides a more accurate estimate of trends in total alcohol consumption in a country; however, APC does not directly reflect the number of drinkers in a country, HED, and/or changes in alcohol use among subgroups in different subgroups in a population (World Health Organization, 2016). The heterogeneity observed among the cohort study results is also observed in APC data. In Spain, recorded APC data decreased from 10.77 L/adult in 2019 to 7.76 in 2020 (Gobierno de España Ministerio de Hacienda y Funcion Pùblica, 2021). In the United Kingdom, the recorded APC was relatively stable, changing from 9.80 L/adult in 2019 to 9.75 in 2020 (HM Revenue & Customs, 2021).

Alcohol consumption data for 2020 were unavailable for Australia and the United States.

The decrease in APC for Spain is in agreement with the findings that the prevalence of HED and the prevalence of people with problematic alcohol use decreased. The stable APC in the United Kingdom and the cohort study findings that there was increased abstention in alcohol use, increased use of alcohol ≥4 times per week, and increased problematic alcohol use may suggest a polarity of the effects of the COVID-19 on alcohol use, increasing alcohol use among heavy users, and decreasing alcohol use among nonheavy users of alcohol.

Future research is required to systematically collect survey data and APC data during the pandemic and to compare these estimates to the prepandemic period. These efforts can shed light on how pandemic-related factors, stressors, and alcohol-related policies may have influenced changes in alcohol consumption. The World Health Organization is scheduled to publish updated global alcohol data in 2022 for 2020. A systematic review of the COVID-19 social distancing and alcohol-specific policies and their effects on APC should be performed in conjunction with this update to provide clear evidence of the effects of these policies on alcohol use and health.

Time to publication and the need for timely information for policy formation

The prolonged time from article submission to publication demands a contingency plan of a speedy review process since the ever-changing circumstances of the pandemic will continue to evolve rapidly around the world. With the spread of variants of concern, responses to the pandemic, such as public health measures of restrictions, lockdowns, and so on, may impact future alcohol consumption. Thus, it is important to acquire evidence-based information in a timely manner to guide policy-making decisions which can address changing drinking behaviors and consumption levels.

Limitations of this study

There are several limitations in terms of the studies included in this review. First, most of the studies were conducted within the first few months of the pandemic, and observed changes in alcohol consumption may not be sustained over time or applicable to cases where social distancing restrictions have been lifted. Therefore, there is a need to study ongoing changes in alcohol consumption during the pandemic. Second, for cross-sectional studies which only used one survey, the assessment of changes in alcohol consumption is dependent upon respondents' subjective evaluations. Third, cohort studies and cross-sectional studies which used multiple measurements to determine changes in alcohol consumption assumed that the changes were due to COVID-19 and social distancing policies; however, there are numerous factors that can influence alcohol use that may have changed between measurements.

There are also limitations to this systematic review. The systematic review covers changes in alcohol use at the population level; however, trends at the total population level may not be applicable to subpopulations. In particular, there is a need to assess separately the impact of the pandemic in the context of gender and race. Furthermore, the pandemic may have had a differential impact on the use of alcohol by people with different socio-demographic characteristics (Chartier & Karriker-Jaffe, 2021), people who have and who do not have an AUD (Seddon et al., 2021; Yazdi et al., 2020), people who have preexisting mental health problems (Capasso et al., 2021; Davis et al., 2021), and people who used or did not use in-person support groups prior to the pandemic and whose support networks were disrupted by the pandemic (Seddon et al., 2021). These potential differential impacts of the pandemic on alcohol use should be investigated. In addition, it is crucial to assess people who are younger in age (and therefore who were more likely to consume alcohol on-site prepandemic compared to people who are older in age and were more likely to consume alcohol off-site prepandemic), as a study conducted in the United Kingdom found individuals who were thirty years old (millennials) and 50 years old (Generation X) were more likely to report increased drinking compared to 19-year-olds (Generation Z) and 62-year-olds (Baby Boomer generation) (Clay et al., 2021).

The diverging evidence indicates that many factors have influenced alcohol consumption during the COVID-19 pandemic; however, the pandemic may have greatly impacted those who previously participated in HED or have an AUD, as they were found in some studies to be more likely to increase their alcohol consumption during the pandemic (Boschuetz et al., 2020; Daly & Robinson, 2021; Weerakoon et al., 2021). In particular, more heavy episodic drinkers increased their alcohol consumption during the pandemic than non-heavy episodic drinkers, and every 1-week increase in time spent at home during the pandemic had greater odds of HED (Weerakoon et al., 2021). This may be due to a decrease in access to treatment services for AUDs and conditions which are associated with alcohol consumption (e.g., depression) during the shutdowns associated with the COVID-19 pandemic (Capasso et al., 2021; Moreno et al., 2020; Valente et al., 2021).

CONCLUSIONS

The findings of the systematic review provide initial insights into changes in alcohol consumption during the first year of the COVID-19 pandemic, with indications of substantial heterogeneity in alcohol consumption. These initial data indicate the necessity to improve strategies that aim to prevent the harmful use of alcohol during the ongoing pandemic, as the proportion of individuals engaging in HED has increased. It is imperative to collect comprehensive population-level data on alcohol consumption by socio-demographic characteristics, such as age, gender, race/ethnicity, education, socio-economic status, and mental health status, to better understand the impact of the ongoing pandemic and to aid policy responses across different countries.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.