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The concerning increasing trend of alcohol beverage sales in the U.S. during the COVID-19 pandemic

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ABSTRACT

There are some concerns regarding alcohol use behaviors during the COVID-19 pandemic. The mixed findings of the first alcohol use studies during this pandemic may reflect the lack of differentiation between on-premise and home consumption. Most of the countries adopted severe restrictions on drinking place functioning. Alcohol retail store sales temporal data were used to examine alcohol sales changes in the United States (U.S.) throughout the COVID-19 pandemic as a proxy indicator of at-home drinking. Data were sourced from the Monthly Retail Trade Survey, which has provided U.S. representative estimates of sales at retail and food services stores since 1951. In the present study, we analyzed data from seasonally adjusted beer, wine, and liquor store (BWLS) sales from January 1992 to September 2020. Poisson cubic spline models were used to assess nonlinearity in such sales during the period. These models were adjusted to the consumer price index for alcoholic beverages. There was a significant increase in retail alcohol sales during the beginning of the pandemic, reaching a plateau in the third quarter of 2020. During the COVID-19 period (March 2020 to September 2020), there were 41.9 billion dollars in BWLS sales, representing an increase of 20% compared to the same period in 2019. On the other hand, food and drinking place retail sales decreased by 27% during the same period in the same survey. These results may indicate an increase in home drinking during the period, which could potentially lead to higher alcohol consumption and alcohol-related adverse health outcomes. More aggressive efforts should be made to warn the population about the risks associated with increased home alcohol consumption during the pandemic. Additionally, tracking individual alcohol consumption and releasing real-time data at different levels are needed to better assess the effects of increased alcohol consumption during the pandemic.

Introduction

The COVID-19 pandemic places a double challenge in peoples' lives: dealing with the risk of contracting the disease and with the effects of containment mitigation strategies (Torales, O'Higgins, Castaldelli-Maia, & Ventriglio, 2020). Unfortunately, alcohol use tends to increase both during stressful situations and forced social isolation (Clay & Parker, 2020; Vlahov, Galea, Ahern, Resnick, & Kilpatrick, 2004). It is crucial to track alcohol use behaviors during such challenging times.

There are some concerns regarding alcohol use behaviors during the COVID-19 pandemic (Callinan, Mojica-Perez et al., 2021; Callinan, Smit, et al., 2021; Pan-American Health Organization, 2020; Pollard, Tucker, & Green, 2020; Rolland et al., 2020; Vanderbruggen et al., 2020). However, current evidence on changes in alcohol use during the time corresponding to the COVID-19 pandemic is conflicting. Some studies found increased alcohol use during the COVID-19 pandemic. For example, a U.S. panel survey showed an increase in any alcohol use and heavy drinking before and during the COVID-19 pandemic, compared to 2019 (Pollard et al., 2020). Similar results were found in Europe (Rolland et al., 2020; Vanderbruggen et al., 2020). In Belgium, there was an increase in alcohol use during the COVID-19 lockdown (Vanderbruggen et al., 2020). In France, a large web survey also found a rise in alcohol use during the early phase of COVID-19 containment (Rolland et al., 2020). Other studies found decreased alcohol use during the COVID-19 pandemic. For example, harmful drinking decreased during social distancing measures in Australia (Callinan, Mojica-Perez et al., 2021; Callinan, Smit, et al., 2021). A large survey with a convenience sample of individuals from several countries in Latin American and the Caribbean also showed a

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decrease in alcohol use during the pandemic (Pan-American Health Organization, 2020).

These mixed findings (Callinan, Mojica-Perez et al., 2021; Callinan, Smit, et al., 2021; Pan-American Health Organization, 2020; Pollard et al., 2020; Rolland et al., 2020; Vanderbruggen et al., 2020) on alcohol use during the COVID-19 pandemic may reflect the lack of differentiation between on-premise (e.g., bars and restaurants) and off-premise (home consumption) alcohol use. Most of the countries included in these studies adopted severe restrictions on drinking place functioning (Vandenberg, Livingston, & O'Brien, 2021). A qualitative UK study highlighted some increases in home heavy drinking during the COVID-19 pandemic, and reactivation of previous heavy alcohol use behaviors, and the importance of alcohol to mediate internet social interactions (Nicholls & Conroy, 2021). A quantitative study in Australia contradicts such an increase in home drinking during the pandemic (Vandenberg et al., 2021). Vandenberg et al. (2021) investigated seasonally adjusted estimates of beer per capita consumption disaggregated by on- and off-premises sales. They found that on-premises alcohol restriction during the COVID-19 pandemic had no significant off-premises beer consumption changes (Vandenberg et al., 2021).

As such, there is still much left to understand about alcohol use behaviors during the COVID-19 pandemic, which could be enhanced by taking advantage of data systematically collected on alcohol consumption before and during the pandemic period (e.g., temporal series). In the present study, we used alcohol retail store sales temporal data as a proxy indicator of at-home drinking, as previously used in the literature (Foster & Ferguson, 2012; Livingston, 2011), and food services and drinking places (FSDP) sales, to test changes in alcohol sales in the U.S. during the period before and after the COVID-19 pandemic. We hypothesize that during the pandemic months of March 2020 to September 2020, alcohol retail store sales increased compared to its usual trend, and that FSDP sales decreased during the same period.

Methods

Sample

We used data from the Monthly Retail Trade Survey. The MRTS survey is designed to provide a representative sample of the sales of all the known establishments located in the U.S., which were listed in the Census Bureau's Business Register. The survey has been conducted since 1951. The MRTS data represent the legal sales made by U.S. businesses in the country. The retail companies' sample is taken from the Company Registry, which includes all Employer Identification Numbers (EINs) and locations of establishments identified. The U.S. Code approves this survey, Title 13, and responses are voluntary. MRTS uses a stratified random sampling design. The sample for MRTS uses a stratified design with primary strata defined by industry. There are 85 different types of primary strata. Annual revenue scale strata are sub-stratified from the main strata. On projected annual revenue totals and end-of-year inventory totals, sample sizes are calculated to satisfy various coefficient of variance constraints. Constraints are described at both the comprehensive and wide industry levels, all the way up to the total retail level. Within the annual sales substrata, units are selected independently between strata using simple random sampling without substitution.

This survey covers businesses with one or more facilities supplying products and related services to end customers. EINs and large, multiple-establishment firms are the two types of sampling units used for the MRTS. These sampling units represent clusters of one or more facilities owned or controlled by the same company. Companies selected for the survey are stratified first by the industry group and sub-stratified by annual revenue. All companies with sales above relevant size cutoffs are selected with certainty from the survey and report for all their retail establishments. The records of all employer establishments located in the country and classified in the retail trade, accommodation, and food services sectors are included in the sampling frame. Sales, payroll, employment, name, and address data of all these establishments, primary identifiers, and related EINs for establishments operated by multi-unit firms are considered. The establishment data for all retail establishments affiliated with the same firm identifier are summed up to construct the sampling units. No aggregation is required to place single-unit establishment information on a firm basis. The sampling units generated for single-unit companies thus reflect establishment, EIN, and firm information simultaneously. The data used for the development of these sampling units are derived from data prospectively collected in the Economic Census and records of establishments found in the Census Bureau's Business Register. More details on the MRTS methodology can be found elsewhere (https://www.census.gov/retail/mrts/how_surveys_are_collected.html).

Data collection

MRTS is a mail-out/mail-back survey. Sales and inventory data are collected using one combined survey form. From May 2020 onward, MRTS data collection occurred through online reporting and e-mail only, which could result in non-differential measurement error. However, the U.S. Census Bureau has been monitoring data quality metrics and response rates and reported ranges within normal values. More than 50% of the retailers sampled provided data for all months of the period in the section selected for the present study.

Measures

Outcomes: alcohol retail sales

We used retail alcohol sales as a proxy indicator of at-home drinking (Foster & Ferguson, 2012; Livingston, 2011). We selected MRTS seasonally adjusted data from section 4453 (Beer, Wine and Liquor Stores; BWLS) on sales in U.S. thousand dollars from retail companies to final consumers for the entire available period – January 1992 to September 2020. The last seven-month period (March 2020 to September 2020) reflects the initial period of the COVID-19 pandemic in the country.

Exposure: time

We divided each year between 1992 and 2020 into quarters (three-month periods) using a data-driven approach by fitting a cubic spline model, as recommended by the U.S. National Center for Health Statistics to assess nonlinearity in a trend (Ingram et al., 2018).

Control variables: consumer and producer price indexes

Whenever evaluating time-trend sales, inflation could play a confounder role in the relationship between exposure (time) and outcomes (sales) (Bell, Hadi, Khanal, & Paudyal, 2021; Liles et al., 2019; Moore et al., 2021). The Consumer Price Index (CPI) (Foster & Ferguson, 2012) and Producer Price Index (PPI) (Livingston, 2011) are well-recognized inflation measures, which tends to increase over time (Liles et al., 2019; Moore et al., 2021). For instance, during the period of the present study (1992–2019), CPI had positive annual increases in all the years except from 2009.

The primary potential confounder considered in the present study was the CPI (Rippy, 2014) for alcoholic beverages during the present study (1992–2020), produced by the U.S. Bureau of Labor

Statistics. CPI is an indicator of the average shift over time in the prices paid to the representative basket of manufactured products and services by urban consumers. Average price details for select products, such as alcoholic beverages, are available. CPI indices are used to change social aid revenue eligibility thresholds, state tax brackets, federally imposed cost-of-living adjustments, pay and compensation increases in the private sector, welfare policies, and consumer escalations and industrial rents. More details on the CPI methodology can be found elsewhere (https://www.bls.gov/opub/hom/cpi/).

The secondary potential confounder considered in the present study was the PPI (Doherty, 2012) for alcoholic beverages, also produced by the U.S. Bureau of Labor Statistics. Unfortunately, there were no PPI data for alcoholic beverages before 2000. Thus, in the present study, it was considered from 2000 to 2020 in a sensitivity analysis. PPI is a family of indices that calculate the average change over time in market prices earned by domestic manufacturers of products and services. The U.S. Bureau of Labor Statistics estimates price adjustment from the point of view of the seller. Average price information for chosen items, such as alcoholic beverages, is also available. This compares with the CPI, which calculates price changes from the point of view of the purchaser. Sales and purchaser rates can vary due to government incentives, sales and excise taxes, and delivery costs. More details on the PPI methodology can be found elsewhere (https://www.bls.gov/ppi/ppiover.htm).

Comparison variable: food services and drinking places sales (FSDP)

We selected seasonally adjusted data from MRTS section 722 (Food Services and Drinking Places, FSDP) on sales in U.S. thousand dollars from retail companies to final consumers for the last 24 months – October 2018 to September 2020. FSDP data were used as a proxy to drinking place sales data. We compared these data with seasonally adjusted BWLS.

Statistical analysis

STATA version 16.2 and R version 3.6.2 were used for statistical analysis and figures, respectively. For descriptive purposes, we calculated annual variation in monthly sales. We show these annual differences in monthly BWLS sales between consecutive years (i.e., 2020 vs. 2019) from 1992 to 2020 in Fig. 1. In addition, we plotted a comparison graph of monthly BWLS and FDSP (divided by 10) for the last 24 months in Fig. 2.

To estimate quarter changes in BWLS sales trends, we divided each year between 1992 and 2020 into quarters (three-month periods) using a data-driven approach by fitting a cubic spline model, as recommended by the U.S. National Center for Health Statistics to assess nonlinearity in a trend (Ingram et al., 2018). Then, we adjusted this model to CPI for alcoholic beverages. A sensitivity analysis was also performed, adjusting the model to PPI for alcoholic beverages. Unfortunately, these spline models did not account for other policy changes and changes in taxes. Thus, we ran a final sensitivity analysis using a differences-in-differences model, in a pre-post design. For this analysis, we restricted our data from October 2017 to September 2020. We used a conventional linear parametric difference-in-difference estimator. We constructed a binary indicator of pre- and post-policy intervention, where the months from October to February were defined as the pre-period, and March to September as the post-policy period. Alcohol sales between October 2017 and September 2019 were used as the control group and sales from October 2019 to September 2020 were used as our exposure group. Our difference-in-difference estimator was the interaction between the post policy intervention indicator and the exposure group indicator.

Results

During the COVID-19 period (March 2020 to September 2020), there were 41.9 billion dollars in BWLS sales, an increase of 20.4% and 18.4% compared to the same period in 2019 and to the previous seven-month period (i.e., August 2019 to February 2020), respectively.

Between 1992 and 2020, we compared BWLS sales in the first three quarters as a whole period (January–September) of consecutive years (e.g., 1999 vs. 2000, 2018 vs. 2019, etc.). The highest variation was a 7.5-billion-dollar increase in BWLS sales between the first three quarters of 2019 and 2020. The mean annual BWLS sales variation for this period until 2019 was +1.1 billion dollars, ranging from −0.1 to +2.1 billion dollars.

Fig. 1 presents a heatmap showing the annual differences in monthly BWLS sales between consecutive years from 1992 to 2020. The period with the largest absolute amount of sales was from March 2020 to September 2020 – representing the COVID-19 pandemic period in the U.S. The mean annual variation in monthly BWLS sales until February 2020 was +0.12 billion dollars, ranging from −0.07 to +0.29 billion dollars. In the COVID-19 pandemic period, the mean annual variation in monthly BWLS sales was +1.00 billion dollars, ranging from +0.65 to +1.13 billion dollars.

In the multivariable Poisson restricted cubic spine regression model for BWLS adjusted for CPI for alcohol beverages (Table S1), we were only able to find significant increases in BWLS sales per quarter in the first (coef = 0.040, 95% CI = 0.027–0.053, $z = 5.99$, $p < 0.001$) and second (coef = 0.013, 95% CI = 0.000–0.026, $z = 1.98$, $p = 0.048$) quarters of 2020 among all the quarters of the period (Table S1). No significant change was found in the third quarter of 2020. These results were unchanged adjusting for PPI for alcoholic beverages (Table S2). The first (coef = 0.047, 95% CI = 0.037–0.057, $z = 8.96$, $p < 0.001$) and second (coef = 0.019, 95% CI = 0.009–0.030, $z = 2.62$, $p < 0.001$) quarters were the only periods with significant increases along the time series. In the sensitivity analysis (Table S3 – Difference in Differences model), alcohol sales were higher in the intervention period (March–September 2020) among the exposed group compared to the control group after adjusting for temporal trends in the pre-period (DiD indicator = 824.54; 95% CI = 664.72–984.37; $p < 0.001$).

BWLS and FSDP sales comparison

During the COVID-19 period (March 2020 to September 2020), there were 327.7 billion dollars in FSDP sales, a decrease of 26.9% and 27.9% compared to the same period in 2019 and to the previous seven-month period (i.e., August 2019 to February 2020), respectively.

Between 1992 and 2020, we compared BWLS sales in the first three quarters as a whole period (January–September) of consecutive years (e.g., 1999 vs. 2000, 2018 vs. 2019, etc.).

Fig. 2 presents a comparison between BWLS and FSDP retail sales in the past two years. There was a clear inverse pattern for BWLS and FSDP during the COVID-19 period. FSDP sales decreased by more than 50% from February 2020 to April 2020. After this, FSDP sales increased but have not reached the pre-COVID-19 levels. In September 2020, FSDP sales were approximately 15% below pre-COVID-19 levels. BWLS sales increased by 17% and remained around this level during the COVID-19 pandemic.

Discussion

The present study investigated changes in home drinking in the U.S. during the period before and after the COVID-19

Annual Comparison	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1993 vs. 1992	127	73	61	8	8	14	9	-59	-69	-86	-73	-83
1994 vs. 1993	-44	-27	11	40	67	48	63	54	97	84	59	68
1995 vs. 1994	36	-7	-15	-15	-49	-26	-54	-10	13	14	20	47
1996 vs. 1995	118	106	120	114	98	136	152	125	40	36	55	16
1997 vs. 1996	-11	31	43	31	70	85	57	54	107	154	141	151
1998 vs. 1997	133	173	101	133	115	37	77	126	109	81	97	114
1999 vs. 1998	73	46	71	124	109	91	96	58	96	98	79	98
2000 vs. 1999	114	132	182	78	154	217	211	224	187	215	244	77
2001 vs. 2000	237	167	117	147	100	90	57	37	35	18	37	166
2002 vs. 2001	-3	75	73	59	56	37	47	27	16	-30	-58	16
2003 vs. 2002	-32	-73	-30	3	-32	-18	20	99	140	190	139	103
2004 vs. 2003	166	164	145	162	201	171	147	96	89	94	116	61
2005 vs. 2004	21	164	97	94	51	116	100	118	130	133	166	215
2006 vs. 2005	290	248	225	210	259	209	219	203	198	161	197	164
2007 vs. 2006	139	94	216	131	224	268	234	187	174	140	110	166
2008 vs. 2007	119	67	47	134	49	58	125	151	122	198	161	69
2009 vs. 2008	179	115	110	86	103	-15	-15	54	47	24	20	127
2010 vs. 2009	19	144	121	158	57	135	57	86	106	130	119	-7
2011 vs. 2010	69	68	42	-3	51	98	146	62	116	79	124	95
2012 vs. 2011	172	132	200	223	249	165	100	74	91	121	143	279
2013 vs. 2012	121	150	97	82	94	92	230	279	203	148	158	114
2014 vs. 2013	203	112	144	193	146	291	172	171	162	246	139	212
2015 vs. 2014	156	218	275	191	234	128	203	195	176	108	203	191
2016 vs. 2015	114	212	97	171	195	224	200	197	314	303	309	87
2017 vs. 2016	293	151	216	247	207	160	146	173	98	200	151	284
2018 vs. 2017	235	260	286	230	244	224	253	175	241	164	197	217
2019 vs. 2018	141	148	140	110	79	159	153	223	131	106	134	162
2020 vs. 2019	216	239	1076	648	1129	1078	1002	1087	1069			

Legend	-100	0	100	200	300	400	500	600	700	800	900	1000	1100

Fig. 1. Heatmap showing the annual differences in monthly Beer, Wine and Liquor sales (BWLS) between consecutive years, U.S., 1992–2020.

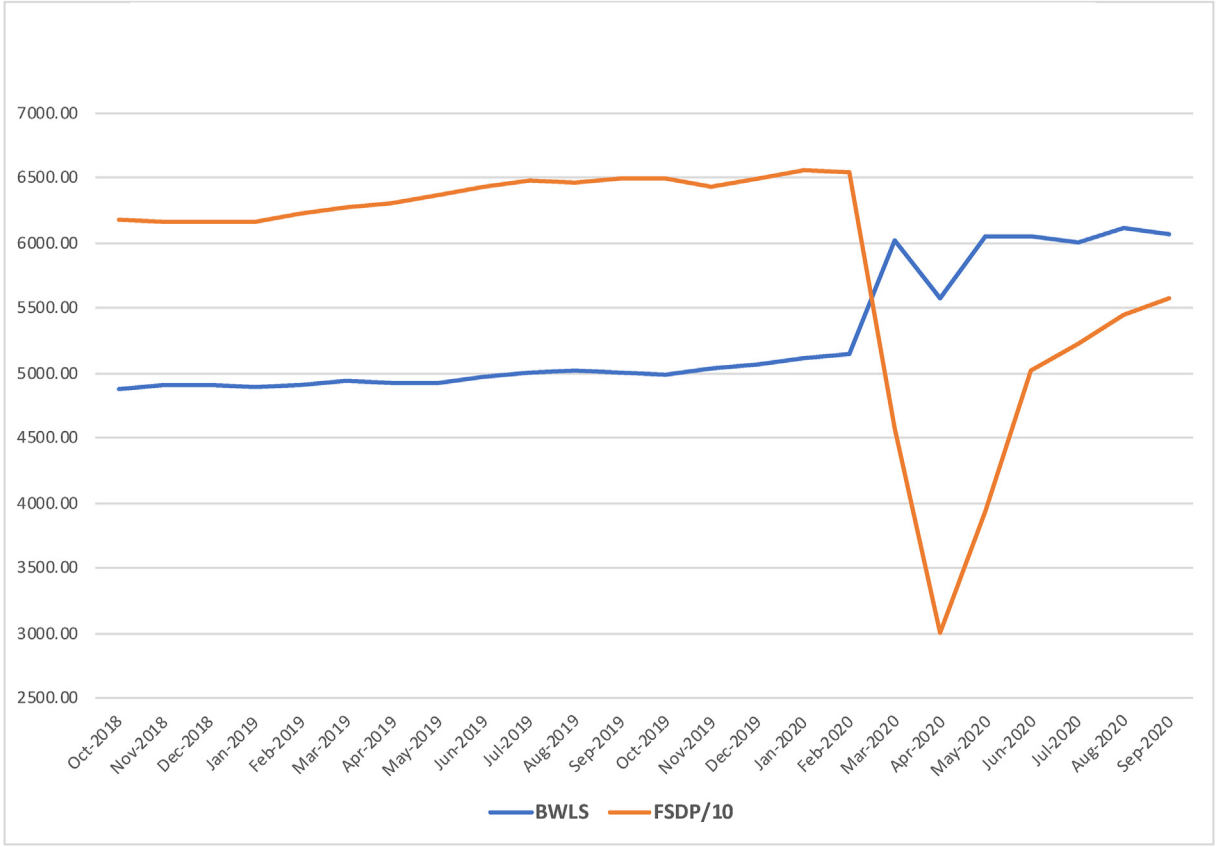

Fig. 2. Beer, Wine and Liquor (BWLS) and Food Services and Drinking Places (FSDP) retail sales in the U.S., 2018–2020 (in million US dollars).

pandemic. We found a significant increase in retail alcohol sales during the beginning of the pandemic (March 2020 to June 2020), reaching a plateau in the last three months (July 2020 to September 2020). These changes were significant even when adjusting for alcohol beverage consumer and producer price index during the period. On the other hand, food and drinking place sales markedly decreased during the same period in the same survey. Differently from Australia (Vandenberg et al., 2021), these findings indicate an increase in home drinking during the period in the U.S.

Excessive home drinking could be a dysfunctional way of coping with stress related to the need to quarantine and worries about an uncertain future (Callinan & MacLean, 2020; Clay & Parker, 2020). Alcohol use may impair the immune system response and, consequently, increase the risk of contracting viral lung infections like SARS-CoV-2 (Testino, 2020). There is evidence that the sociodemographic characteristics of people who have been drinking more at home during the pandemic could be significantly different from those of people who formerly engaged in on-premise drinking (e.g., bars, restaurants, pubs, hotels, and parties). Wardell et al. (2020) investigated alcohol behaviors during the early stages of the COVID-19 pandemic in Canada. They found that living alone and experiencing income loss during this period were associated with increased solitary drinking and alcohol use, respectively (Pan-American Health Organization, 2020). These findings are in agreement with those from quantitative and qualitative studies carried out in recent past times, which differentiate the correlates of home drinking and social drinking (Brierley-Jones et al., 2014; Meque et al., 2020; Meque, Salom, Betts, Najman, & Alati, 2021).

Another critical issue is that drinking at home has been associated with domestic violence (Finlay & Gilmore, 2020; Livingston, 2011). During the pandemic, increases in alcohol use at home could potentially exacerbate the effects of social isolation on domestic violence (Livingston, 2011). For example, data from the U.S. police department illustrate that there was a 10–27% increase in calls concerning domestic violence during COVID-19 stay-at-home orders across different and diverse locations in the country (i.e., Alabama, New York, Oregon, Texas) (Boserup, McKenney, & Elkbuli, 2020). It is not clear whether home drinking could have played a role in such outcomes in this study. Further studies should explore the mediation role of alcohol use for such outcomes during the pandemic.

There are differences between home drinking and on-premise drinking. Alcohol consumption at home may start earlier in the day and be more frequent (i.e., more drinking days per month) (Brierley-Jones et al., 2014). However, it may be less excessive (i.e., less pressure to consume from a social context, heavy episodic drinking culture) (Meque et al., 2020). It is difficult to define whether there is more consumption overall and whether particular individuals, especially those most at risk for adverse consequences, are consuming more during the COVID-19 pandemic, based on the findings of the present and previous studies (Callinan, Mojica-Perez et al., 2021; Callinan, Smit, et al., 2021; Nicholls & Conroy, 2021; Pan-American Health Organization, 2020; Pollard et al., 2020; Rolland et al., 2020; Vandenberg et al., 2021; Vanderbruggen et al., 2020). We lack insight into the distribution of consumption across time and people. For this, individual-level data are needed.

A potential limitation of this study is the use of retail alcohol sales as a proxy for alcohol consumption, as individuals may buy alcohol in high quantities or store alcohol during a pandemic, such as for other products. However, buying alcohol in high quantities (buying in bulk) may increase alcohol sales in the short term after lockdown measures are implemented, and a previous Australian study showed that among those who stockpiled alcohol when COVID-19 social isolation measures took place, there was an increase in alcohol consumption (Callinan, Mojica-Perez et al., 2021). In addition, there were considerable differences across U.S. states in terms of stay-at-home orders (Raifman et al., 2021). We could not parse out specific effects for particular COVID-19 policies because the MRTS does not provide state identifiers. Future studies should focus on the effect of particular COVID-19 policies.

Conclusion

In sum, more aggressive efforts should be made to warn the U.S. population about the risks associated with increased home drinking during the pandemic. Additionally, tracking individual alcohol consumption and releasing real-time data at different levels (state, county, international) are needed to better assess the effects of increased alcohol consumption during the pandemic. It is also important to investigate alcohol use behaviors among individuals at high risk of infection by SARS-CoV-2 (i.e., frontline workers and patients' relatives) and among those most affected by social distancing measures (i.e., those living alone, in restricted private housing spaces, for longer isolation periods, or heavily dependent on others).

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Credit author statement

João M. Castaldelli-Maia: Conceptualization, Methodology, Writing- Original draft preparation.

Luis E. Segura: Conceptualization, Methodology, Writing – Support.

Silvia S. Martins: Conceptualization, Methodology, Editing, Supervision.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.alcohol.2021.06.004.

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