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## The Lancet Regional Health - Western Pacific

journal homepage: [www.elsevier.com/locate/lanwpc](http://www.elsevier.com/locate/lanwpc)

Research paper

## Changes in alcohol intoxication-related ambulance attendances during COVID-19: How have government announcements and policies affected ambulance call outs?

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## ARTICLE INFO

## Article history:

Received 25 April 2021

Revised 5 July 2021

Accepted 6 July 2021

Available online 23 July 2021

## Keywords:

Alcohol  
alcohol harms  
intoxication  
COVID-19  
paramedicine  
ambulance  
government policy

## ABSTRACT

**Background:** In response to COVID-19, government-mandated health directives including widespread lockdowns were implemented. Changes in alcohol purchasing were reported, with growing concern that alcohol may be consumed as a way to cope with pandemic-associated stressors. Hitherto, there have been limited studies examining alcohol-related harms, including acute harms requiring an ambulance, and their relationship to government announcements or policies related to COVID-19.

**Methods:** Analyses were conducted between January and September 2020, with matched months in 2019, using Victorian data from the National Ambulance Surveillance System in Australia. Interrupted time series (ITS) models with odds ratios (OR) were used to map alcohol-related harms as a function of government policies for both metropolitan and regional areas.

**Findings:** A total of 43,003 alcohol intoxication-related ambulance attendances occurred between January 2019 and September 2020. Attendances in the home increased in 2020 by 9% compared to matched 2019 months. The most socioeconomically advantaged cases showed the highest percentage change. ITS models showed decreased odds of alcohol-related attendances at the beginning of each COVID-19 wave in metropolitan (OR: 0.77; 95%CI: 0.71-0.83;  $p < 0.001$ ) and regional Victoria (OR: 0.72; 95%CI: 0.67-0.79,  $p < 0.001$ ) separately, and increased odds following the introduction of harsher restrictions in metropolitan Melbourne (OR: 1.07; 95%CI: 1.01-1.11,  $p = 0.005$ ). A 19% increase in odds of alcohol-related harms was observed at the end of the second wave lockdown period in regional Victoria (OR: 1.19; 95%CI: 1.01-1.41,  $p = 0.004$ ).

**Interpretation:** Alcohol-related attendances during COVID-19 restrictions showed a displacement to home settings. Changes in patterns of harms were evident in specific sociodemographic groups, and geographic regions when mapped to government health directives. This study is one of the first to investigate alcohol-related harms at the population level in response to a global pandemic.

**Funding:** Commonwealth Department of Health and Victorian Department of Health.

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## Research in context

**Evidence before this study**

We examined the literature for publications examining alcohol consumption, alcohol intoxication, and alcohol harms throughout the COVID-19 pandemic, in addition to previous natural disasters and financial crises. Many studies identified the detrimental mental health impacts of these events and raised concerns regarding increased alcohol use as a coping mechanism to deal with increased feelings of stress, anxiety, loss, isolation and economic uncertainty. Despite a number of previous studies investigating changes in community alcohol consumption pre- and post-COVID 19, research assessing changes in alcohol-related harms were scarce.

**Added value of this study**

The National Ambulance Surveillance System (NASS) offers an internationally unique opportunity to capture and surveil alcohol and other drug-related harms through the use of ambulance attendance records. We examined Victorian NASS data given the strict restrictions placed on citizens in this state, and conducted one of the first studies investigating the impact of COVID-19 restrictions on acute alcohol-related harms by gender, age, location (e.g., in the home versus public venues) and socioeconomic status, in both metropolitan and regional Victoria.

**Implications of all available evidence**

This comprehensive analysis of alcohol-related ambulance attendances throughout the 2020 COVID-19 period when compared to the same months in 2019, offers unique insight into alcohol harms experienced during a period of increased stress, anxiety, feelings of isolation and economic uncertainty. We found demographic and location differences, including a displacement of harms into home settings, and changes in relation to government announcements. Our findings emphasise the need for more campaigns that encourage safer alcohol consumption during times of psychological and financial stress that accompany changes in government public health policies including lockdowns.

**1. Introduction**

The COVID-19 pandemic is a worldwide public health emergency. It has resulted in substantial negative impacts on the health and wellbeing of both individuals and economies [1]. Governments around the world have implemented policies aimed at containing the spread of the virus. Measures have included social distancing (e.g., people sitting at least 1.5 metres apart in workplaces and on public transport) and lockdowns (e.g., limiting reasons for leaving home to only four reasons: shopping for food and supplies, authorised work and study, caregiving, and exercise) which have had detrimental effects on people's mental health [2]. This has led to concerns of increased alcohol and other drug use in order to cope with stress, anxiety, feelings of isolation, and economic uncertainty [3,4], which have been documented following exposure to previous natural disasters and financial crises [5,6].

**1.1. Alcohol use during COVID-19**

Changes in alcohol purchasing patterns have been reported in many parts of the world, with online alcohol sales in the US increasing by 243% compared with the same time the previous year, and an analysis of online credit and debit card transactions

showing increases in alcohol sales in Australia [7]. Some increases have been attributed to the 'panic-buying' of alcohol, and others reflect changes in the regulatory environment. For example, in response to strict social distancing guidelines, most jurisdictions in Australia relaxed liquor licencing regulations to enable any licenced premises (e.g., restaurants and cafes, small bars) that do not normally sell off-premise alcohol to sell alcohol via take-away or home delivery schemes [7,8]. These changes in alcohol availability and purchasing behaviour have led to concerns for vulnerable groups, including those with alcohol use and/or mental health disorders. While evidence on outcomes is only beginning to emerge, a recent national cross-sectional study of emergency department (ED) presentations in the US reported varied patterns of help-seeking; mental health presentations decreased initially following the declaration of a national emergency, but this decrease was to a lesser extent than total ED presentations, suggesting that acute mental health cases reflected a significant public health concern [4]. Drug overdoses presenting to ED also increased during this time, suggesting an increased burden of drug-related harms to emergency services [4].

There has been growing concern that increased alcohol consumption in the general community may be seen as an acceptable strategy to deal with the stress, anxiety, and financial hardships associated with the COVID-19 pandemic [9,10]. An analysis comparing alcohol consumption between April-May 2020 with the same months in 2019 reported that although population per capita consumption did not change, some sub-populations did report modifying their alcohol consumption [11] with 15% of the population drinking at levels in 2020 that placed them in a higher risk category for alcohol-related harm according to national guidelines. This finding supports previous research that reported no change in weekly alcohol consumption and/or frequency of intoxication between 6 to 24 months post-tsunami in Norway, but that 18.3% of respondents had increased their alcohol consumption [12]. Such findings highlight the need to examine alcohol use beyond simple per capita figures when assessing alcohol-related changes post-disaster. Such analyses leave a gap in our understanding of which sections of the population are increasing their consumption in response to these stressors, and whether they also experience an increase in alcohol-related harms.

Recent data have suggested that changes in alcohol consumption are influenced by sociodemographic factors (e.g., age, gender, social disadvantage). An Australian study reported that young men were drinking more at home given a lack of access to public licenced venues [11], and another reported that increased alcohol consumption was associated with pre-existing mental health issues including depression, lack of social connection and income loss during the first month of COVID-19 restrictions implemented in Canada [9]. Despite this, the focus of these studies has been limited to assessing changes in *alcohol consumption* in the community compared with their drinking levels pre-pandemic. Research assessing changes in *alcohol-related harms* are sparse, and have not assessed whether these purported changes in consumption, or location (e.g., home-based drinking) have resulted in increased alcohol-related harms. This lack of focus on alcohol harms is of concern given that alcohol is a causal or component risk factor in more than 200 disease and illness categories [13], and is a leading risk factor for premature death and disability in young people [14].

Additionally, of the studies that have addressed alcohol-related harms, survey designs have been most frequently used. A significant limitation with surveys assessing COVID-19 impacts on health and behaviour is the use of self-report measures of alcohol use, and the potential for recall bias and social desirability effects. Such designs are also unable to extrapolate changes in alcohol consumption to changing policy and social environments, which have occurred frequently during COVID-19 [15]. Furthermore, surveys ad-

ministered during COVID-19 have typically used short sampling frames (e.g., one-week) that make it difficult to assess any impact of rapidly evolving policy changes on behaviour [16]. Given previous research has reported associations between changes in economic policies during recession times and daily suicides in England and Wales [17], there is a need to utilise surveillance systems that are more effectively able to track harms in relation to COVID-19 policies as they evolve.

Ambulance services are part of the frontline health response to acute crises, including alcohol harms, and are frequently the first contact a person has with health services [18,19]. In Victoria (Australia), ambulance services provide universal coverage in both metropolitan and regional areas, and therefore, utilising the surveillance, monitoring, and reporting capacity of ambulance data provides a unique opportunity to examine, and compare alcohol-related harms at the population level [18,20]. This paper aimed to: (i) investigate changes in alcohol-intoxication-related ambulance attendances from January to September 2020 compared with the same months in 2019 to determine whether there had been increases in alcohol-related harms experienced in the home matching the displacement of reported consumption following closure of licenced venues; (ii) determine whether there were sociodemographic differences in alcohol-related ambulance attendances based on age, gender and social disadvantage with expected increases in young adults (<40 years), and (iii) map alcohol-related harms as a function of government policies in response to COVID-19 that enforced social distancing measures and 'lockdowns' on citizens.

## 2. Methods

### 2.1. The National Ambulance Surveillance System (NASS)

We used data from the Victorian arm of NASS. Victoria is Australia's second most populous state with approximately 6 million residents. NASS is an ongoing surveillance system that receives a filtered dataset consisting of attendances from the electronic Victorian Ambulance Clinical Information Service (VACIS®) where alcohol or another drug play a significant and contributing factor. These data are coded by researchers following import to a customised database. NASS methodology is described in detail in methodological papers [18,20] but relevant inclusion criteria for the present study are described below. The overall project and surveillance methodology was approved by the Eastern Health Research Ethics Committee.

### 2.2. Inclusion of alcohol intoxication ambulance attendances

Alcohol intoxication-related ambulance attendances between 1 January 2020 and 30 September 2020 plus matched dates for 2019 were included.

Inclusion criteria for alcohol intoxication coding of cases was assessed using the following criterion: 'Is it reasonable to attribute the immediate or recent (the past 24-hours) over or inappropriate alcohol use as a contributing reason for the ambulance attendance?' [20]. This information was drawn from paramedic clinical notes and assessment, patient self-report, information from third parties (e.g., family, friends or bystanders), and evidence at the scene (e.g., alcohol-related products). Importantly, while alcohol consumption must be a contributor to the ambulance attendance, it may not be the primary reason for the ambulance attendance [20]. Ambulance attendances for alcohol-intoxication are a marker of alcohol 'harms' in a broad sense, and no further break down of other 'harms' experienced, or various sub-categories was undertaken in this analysis. Indeed, calling for, and requiring an ambulance for intoxication is taken as a significant harm.

### 2.3. Location and social disadvantage

As a proxy for alcohol intoxication in the home, patient postcode (residential address) and scene postcode (place of ambulance attendance) were compared. Where these two postcodes matched, alcohol consumption was considered to be in the home setting. We present data separately for metropolitan Melbourne and regional Victoria given differences in restrictions imposed by government (see Supplementary file 1). Socioeconomic status was determined based on the Australian Bureau of Statistics (ABS) Socioeconomic Index for Areas (SEIFA) index of relative socioeconomic disadvantage.

### 2.4. Key events and government policy announcements

Policy measures enacted in Victoria during 2020 included social distancing (e.g., people required to sit at least 1.5 metres apart in workplaces and on public transport) and lockdowns (e.g., people only allowed to leave the home for four reasons: shopping for food and supplies, authorised work and study, caregiving, exercise, and being limited to travel within a 5km zone). The identification of key events and policies related to COVID-19 were logged on a daily basis and considered relevant if: (i) the event or policy was a public announcement linked directly to COVID-19, and (ii) the announcement was made by key members of government (e.g., Victorian State Premier or the Prime Minister of Australia) (see Supplementary file 1 for key policies or events mapped to key dates). Events were also considered when multiple media sources (online newspapers, television news) were reporting on a story of significance (for example, new clusters or peaks in COVID-19 related cases).

### 2.5. Data analyses

All descriptive and statistical analyses were performed using Stata v13.1. Frequencies, percentages and percentage change figures describe overarching socio-demographic and location of consumption patterns. Rates are calculated per 100,000 population using data provided by the Australian Bureau of Statistics [21]. For the interrupted time series, we proposed *a priori* a change in level and slope as our impact model. Linear splines were used to create the intervention periods for metropolitan Melbourne and Mitchell Shire (a local government area, 40 km north of Melbourne that was placed under the same restrictions as Melbourne, see Supplementary file), and the remainder of regional Victoria, corresponding to Victorian State Government public health directives. The interrupted time series were modelled using logistic regression with a negative binomial probability distribution, log-link function and Newey-West standard errors. Autocorrelation and partial autocorrelation were assessed using the Cumby-Huizinga test and correlograms and corrected using linear splines (Supplementary file 2). Stationarity of the time series was assessed using the Portmanteau test.

### 2.6. Role of funding source

Funders had no role in the study design, conduct, analysis, or interpretation.

## 3. Results

During the months of January to September 2019 and 2020, there were a total of 43,003 (2019 n=22,056; 2020 n=20,947) alcohol intoxication-related attendances in Victoria, with a monthly average of 2,389 attendances. Of these, 81% (2019: 78.7%, 2020:

**Table 1**

Frequencies and percentage changes in alcohol intoxication-related ambulance attendances in the home, 2019-2020, by month, age group and gender (values &gt;or &lt;5% are bolded)

		Jan	Feb	Mar	April	May	June	July	Aug	Sept	Total
Age group: males											
10 to 19	2019 (n)	69	38	48	43	25	49	42	47	53	414
	2020 (n)	51	60	62	25	49	48	34	48	54	431
	% change	<b>-26.1</b>	<b>57.9</b>	<b>29.2</b>	<b>-41.9</b>	<b>96.0</b>	<b>-2.0</b>	<b>-19.0</b>	<b>2.1</b>	<b>1.9</b>	<b>4.1</b>
20 to 29	2019 (n)	169	132	139	119	111	110	129	117	151	1177
	2020 (n)	142	132	127	93	139	163	149	155	149	1249**
	% change	<b>-16.0</b>	<b>0.0</b>	<b>-8.6</b>	<b>-21.8</b>	<b>25.2</b>	<b>48.2</b>	<b>15.5</b>	<b>32.5</b>	<b>-1.3</b>	<b>6.1</b>
30 to 39	2019 (n)	148	146	157	132	139	143	126	155	157	1303
	2020 (n)	188	172	164	156	173	171	137	186	180	1527
	% change	<b>27.0</b>	<b>17.8</b>	<b>4.5</b>	<b>18.2</b>	<b>24.5</b>	<b>19.6</b>	<b>8.7</b>	<b>20.0</b>	<b>14.6</b>	<b>17.2</b>
40 to 49	2019 (n)	188	156	168	151	171	218	185	190	209	1636
	2020 (n)	182	176	206	190	191	172	210	235	236	1798
	% change	<b>-3.2</b>	<b>12.8</b>	<b>22.6</b>	<b>25.8</b>	<b>11.7</b>	<b>-21.1</b>	<b>13.5</b>	<b>23.7</b>	<b>12.9</b>	<b>9.9</b>
50 to 59	2019 (n)	197	141	197	183	182	155	183	200	180	1618
	2020 (n)	197	208	195	180	174	179	199	211	210	1753*
	% change	<b>0.0</b>	<b>47.5</b>	<b>-1.0</b>	<b>-1.6</b>	<b>-4.4</b>	<b>15.5</b>	<b>8.7</b>	<b>5.5</b>	<b>16.7</b>	<b>8.4</b>
60 +	2019 (n)	225	182	216	209	175	180	216	209	210	1822
	2020(n)	277	246	205	169	205	226	206	203	197	1934
	% change	<b>23.1</b>	<b>35.2</b>	<b>-5.1</b>	<b>-19.1</b>	<b>17.1</b>	<b>25.6</b>	<b>-4.6</b>	<b>-2.9</b>	<b>-6.2</b>	<b>6.1</b>
Age group: females											
10 to 19	2019 (n)	38	38	52	44	36	47	40	54	53	402
	2020 (n)	66	54	51	19	41	56	43	41	47	418*
	% change	<b>73.7</b>	<b>42.1</b>	<b>-1.9</b>	<b>-56.8</b>	<b>13.9</b>	<b>19.1</b>	<b>7.5</b>	<b>-24.1</b>	<b>-11.3</b>	<b>4.0</b>
20 to 29	2019 (n)	103	97	102	89	92	102	90	89	86	850
	2020 (n)	98	98	103	87	100	120	104	119	159	988
	% change	<b>-4.9</b>	<b>1.0</b>	<b>1.0</b>	<b>-2.2</b>	<b>8.7</b>	<b>17.6</b>	<b>15.6</b>	<b>33.7</b>	<b>84.9</b>	<b>16.2</b>
30 to 39	2019 (n)	115	103	109	110	96	97	88	108	122	948
	2020 (n)	136	111	115	107	140	129	111	157	126	1132
	% change	<b>18.3</b>	<b>7.8</b>	<b>5.5</b>	<b>-2.7</b>	<b>45.8</b>	<b>33.0</b>	<b>26.1</b>	<b>45.4</b>	<b>3.3</b>	<b>19.4</b>
40 to 49	2019 (n)	161	105	144	123	164	120	162	163	145	1287
	2020 (n)	130	153	154	138	129	137	147	133	149	1270
	% change	<b>-19.3</b>	<b>45.7</b>	<b>6.9</b>	<b>12.2</b>	<b>-21.3</b>	<b>14.2</b>	<b>-9.3</b>	<b>-18.4</b>	<b>2.8</b>	<b>-1.3</b>
50 to 59	2019 (n)	139	99	108	118	107	109	113	105	120	1018
	2020 (n)	137	125	122	115	126	131	114	147	134	1151
	% change	<b>-1.4</b>	<b>26.3</b>	<b>13.0</b>	<b>-2.5</b>	<b>17.8</b>	<b>20.2</b>	<b>0.9</b>	<b>40.0</b>	<b>11.7</b>	<b>13.1</b>
60 +	2019 (n)	100	96	111	85	93	96	101	104	76	862
	2020 (n)	109	90	120	81	106	109	82	74	104	875
	% change	<b>9.0</b>	<b>-6.3</b>	<b>8.1</b>	<b>-4.7</b>	<b>14.0</b>	<b>13.5</b>	<b>-18.8</b>	<b>-28.8</b>	<b>36.8</b>	<b>1.5</b>
<b>Total (all)</b>	2019 (n)	1675	1351	1584	1431	1417	1447	1506	1561	1582	13554
	2020 (n)	1725	1649	1657	1386	1592	1660	1561	1725	1762	14717**
	% change	<b>3.0</b>	<b>22.1</b>	<b>4.6</b>	<b>-3.1</b>	<b>12.4</b>	<b>14.7</b>	<b>3.7</b>	<b>10.5</b>	<b>11.4</b>	<b>8.6</b>

\*p &lt;0.05, \*\* p=0.000

82.6%) were transported to hospital for ongoing care. In metropolitan Melbourne, the total rate of attendances was 629.7 per 100,000 population compared to 722.1 per 100,000 population in regional areas of Victoria.

### 3.1. Alcohol attendance in the home and sociodemographic modifiers

Table 1 shows that overall, the number of monthly alcohol intoxication-related attendances in the home increased during 2020 compared with 2019. This pattern was consistent across age groups and among males and females, but particularly those aged 30 to 39 years.

Figure 1 and Table 2 show data based on drinking location and Socioeconomic Index for Areas (SEIFA) status.

Figure 1 shows that the proportion of alcohol intoxication-related attendances in a home setting increased during 2020, from 60% in January to 81% in September. In contrast, during 2019, these figures remained stable throughout the year. On average, there was a 9% monthly increase in alcohol intoxication-related attendances occurring in the home during 2020 when compared with 2019. Table 2 shows that those in the most disadvantaged group (0-20%) had the highest number of alcohol-related ambulance attendances in the home in both 2019 and 2020, however, the group showed the least amount of change across many months examined when comparing the two years. On average, those in the most advan-

taged (81-100%) group had the highest percentage change in alcohol attendances in the home between the corresponding months in 2019 and 2020.

### 3.2. Interrupted time series

Tables 3 and 4 display the results of the interrupted time series assessing the effect of government announcements related to COVID-19 on alcohol-related attendances in metropolitan Melbourne (Table 3) and regional Victoria (Table 4). Table 3 shows that there was an initial 23% decrease in the odds of alcohol-related ambulance attendance (OR:0.77; 95%CI: 0.71-0.83, p<0.001) after the implementation of first wave Stage 3 COVID-19 restrictions, followed by an increase in odds of attendance by 15% at the end of first wave restrictions (OR: 1.15; 95%CI: 1.02-1.30, p=0.02). At the beginning of wave two Stage 3 lockdown restrictions, a statistically significant decrease in the odds of alcohol-related ambulance attendance by 10% (OR:0.90; 95%CI:0.86-0.95; p<0.001) was observed, followed by an increase in odds of attendance by 5% at the introduction of Stage 4 lockdown restrictions (OR:1.07; 95%CI:1.01-1.11, p=0.005). A significant decrease in odds of alcohol-related ambulance attendance was observed at the end of the second wave lockdown period (OR: 0.84; 95%CI: 0.78-0.91, p<0.001), to a similar magnitude to the decrease observed after the first wave of lockdown. There were minimal slope

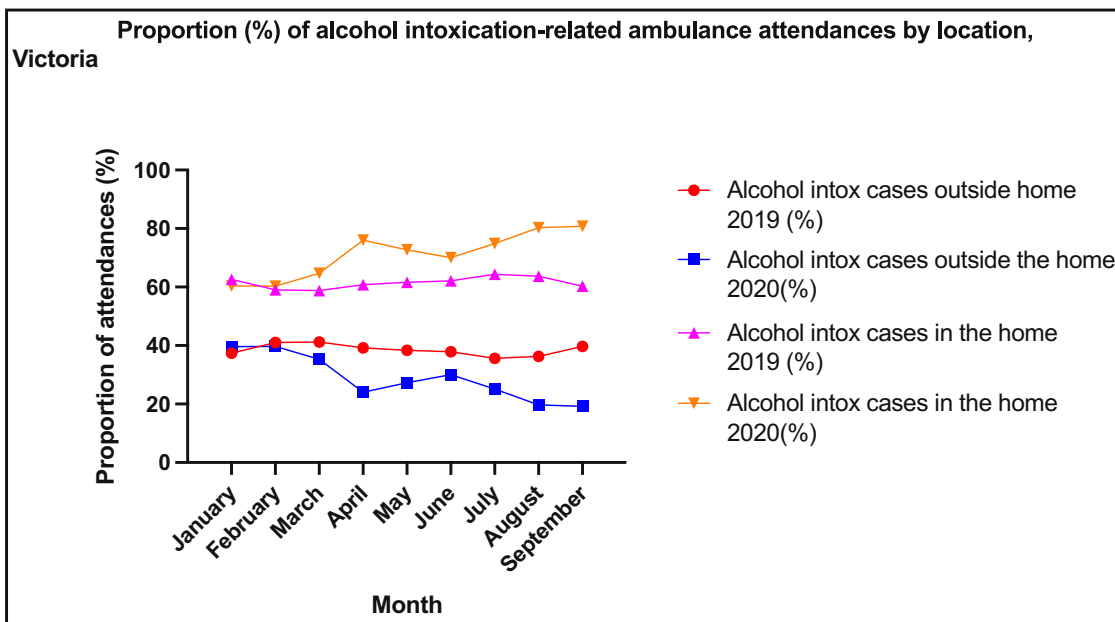


Figure 1. Proportion (%) of alcohol intoxication-related ambulance attendances by location, Victoria.

Table 2

Frequencies and percentage changes in alcohol intoxication-related ambulances attendances in the home, 2019-2020, by month and socio economic status (SEIFA)

SEIFA		Jan	Feb	Mar	April	May	June	July	Aug	Sept	Total
0-20% (most disadvantaged)	2019 (n)	452	346	442	407	376	406	406	401	461	3697
	2020 (n)	443	424	456	372	408	441	405	455	486	3890**
	% change	-2.0	22.5	3.2	-8.6	8.5	8.6	-0.2	13.5	5.4	5.2
21-40%	2019 (n)	291	260	285	271	271	244	254	294	277	2447
	2020 (n)	304	293	290	244	300	296	305	311	349	2692*
	% change	4.5	12.7	1.8	-10.0	10.7	21.3	20.1	5.8	26.0	10.0
41-60%	2019 (n)	306	246	277	231	260	238	295	282	246	2381
	2020 (n)	333	319	286	248	288	302	296	293	276	2641
	% change	8.8	29.7	3.2	7.4	10.8	26.9	0.3	3.9	12.2	10.9
61-80%	2019 (n)	349	277	294	277	256	295	280	254	324	2606
	2020 (n)	321	310	328	280	306	304	274	344	313	2780*
	% change	-8.0	11.9	11.6	1.1	19.5	3.1	-2.1	35.4	-3.4	6.7
81-100% (least disadvantaged)	2019 (n)	275	222	283	244	251	263	271	328	274	2411
	2020 (n)	323	300	293	239	289	316	279	321	338	2698
	% change	17.5	35.1	3.5	-2.0	15.1	20.2	3.0	-2.1	23.4	11.9
Total	2019 (n)	1673	1351	1581	1430	1414	1446	1506	1559	1582	13542
	2020 (n)	1724	1646	1653	1383	1591	1659	1559	1724	1762	14701**
	% change	3.0	21.8	4.6	-3.3	12.5	14.7	3.5	10.6	11.4	8.6

Note: 28 missing cases, \*p <0.05, \*\* p=0.000

Table 3

Logistic regression model assessing the effect of the Victorian Department of Health and Human Services (DHHS) COVID-19 public health response on alcohol-related harms resulting in ambulance attendance in Metropolitan Melbourne and Mitchell Shire

Parameter	Description	Odds Ratio (OR)	95% CI	p-value
Pre-intervention time slope	Pre-COVID period*	1.00	1.00	0.08
Change in time slope at first intervention	Wave 1: Stages 1-3 lockdown**	1.00	0.97-1.01	0.44
Change in level after first intervention		0.77	0.71-0.83	<0.001
Change in time slope at second intervention	End of Wave 1: Easing of lockdown***	1.00	0.98-1.02	0.75
Change in level after second intervention		1.15	1.02-1.30	0.02
Change in time slope at third intervention	Wave 2: Stage 3 lockdown <sup>α</sup>	1.00	0.98-1.01	0.35
Change in level after third intervention		0.90	0.86-0.95	<0.001
Change in time slope at fourth intervention	Wave 2: Stage 4 lockdown <sup>β</sup>	1.02	1.00-1.03	0.031
Change in level after fourth intervention		1.07	1.02-1.11	0.005
Change in time slope at fifth intervention	End of Wave 2: Easing of lockdown <sup>γ</sup>	1.06	1.04-1.07	<0.001
Change in level after fifth intervention		0.84	0.78-0.91	<0.001

Refer to greyed out cells in Supplementary 1 File

**Table 4**

Logistic regression model assessing the effect of the Victorian Department of Health and Human Services (DHHS) COVID-19 public health response on alcohol-related harms resulting in ambulance attendance in Regional Victoria

Parameter	Description	Odds Ratio (OR)	95% CI	p-value
<b>Pre-intervention time slope</b>	Pre-COVID period*	1.00	1.00	0.14
<b>Change in time slope at first intervention</b>	Wave 1: Stages 1-3 lockdown**	1.00	1.00-1.02	0.04
<b>Change in level after first intervention</b>		0.72	0.67-0.79	<0.001
<b>Change in time slope at second intervention</b>	End of Wave 1: Easing of lockdown†	1.00	0.98-1.01	0.28
<b>Change in level after second intervention</b>		1.11	1.04-1.18	0.001
<b>Change in time slope at third intervention</b>	Wave 2: Stage 3 lockdown§	1.00	0.98-1.04	0.66
<b>Change in level after third intervention</b>		0.85	0.76-0.96	0.005
<b>Change in time slope at fourth intervention</b>	End of Wave 2: Easing of lockdown¶	1.00	0.96-1.03	0.69
<b>Change in level after fourth intervention</b>		1.19	1.01-1.41	0.04

Refer to greyed out cells in Supplementary 1 File

changes following each intervention period. The Portmanteau test reported moderate evidence for stationarity ( $q=56.1$ ;  $p=0.05$ )

Table 4 shows that alcohol-related ambulance attendances in regional Victoria varied throughout the COVID-19 lockdown periods. An initial 28% decrease in the odds of alcohol-related ambulance attendance (OR: 0.72; 95%CI: 0.67-0.79,  $p<0.001$ ) was observed after the implementation of first wave Stage 3 COVID-19 restrictions, followed by an increase in odds of attendance by 11% at the end of the first wave (OR: 1.11; 95%CI: 1.04-1.18,  $p<0.001$ ). At the beginning of wave two Stage 3 lockdown restrictions, there was a 15% decrease in the odds of alcohol-related ambulance attendance (OR:0.85; 95%CI:0.76-0.96;  $p=0.005$ ), followed by a 19% increase in the odds of alcohol-related ambulance attendance at the end of the second wave lockdown period (OR:1.19; 95%CI: 1.01-1.41,  $p=0.004$ ). There was no change in slope following each of the intervention periods. The Portmanteau test reported strong evidence for stationarity ( $q= 33.9$ ;  $p=0.7$ ).

#### 4. Discussion

We utilised novel surveillance data to examine changes in alcohol intoxication-related ambulance attendances during 2020 months associated with significant COVID-19 restrictions in Victoria compared with matched months in 2019. Similar to a New Zealand based study [19], we found that overall alcohol-intoxication related attendances were comparable to, or declined, during early 2020 in response to government announcements. However, alcohol-intoxication attendances did increase as the lockdown progressed, and may represent people using greater amounts of alcohol to cope with extended periods of lockdown. In our study, there were differences in alcohol-intoxication attendances based on time relative to government announcements, sociodemographic factors, economic disadvantage, and location; each having important public policy implications.

Broadly, alcohol-related ambulance attendances decreased at the beginning of each wave of restrictions in both metropolitan and regional Victoria. Subsequent increases in these harms were seen in both geographic areas towards the end of the first wave, a pattern that was replicated following a second wave of restrictions. These changes could reflect either a rebound effect representing greater opportunities to drink with, and socialise with small groups as the easing of restrictions were approached, or alternatively may represent alcohol-related harms increasing over time as the pandemic progressed, potentially as a result of increasing anxiety or stress related to the impact of isolation and financial instability. Similar patterns in help-seeking in EDs have been observed following pandemic onset in Europe and the US [4,12] in studies examining ED-related attendances. There have been concerns that the stress associated with isolation may serve as a significant trigger for increased alcohol use [22], particularly amongst vulnerable groups (e.g., those with a mental health disorder or

who had a relationship with someone who fell ill due to COVID-19) and certain sociodemographics including older adults, and essential workers [23]. A recent review of alcohol consumption and harms noted that health organisations around the world developed recommendations on coping with social distancing and/or isolation, with advice on avoiding the use of alcohol as a coping strategy [22]. In contrast, the alcohol industry increased their advertising to encourage and normalise alcohol consumption as a means to deal with the isolation and boredom of lockdown [24]. The present study suggests that any public health messaging or advice around alcohol must counter advertising from the alcohol industry and timed towards the end of restrictions (when acute alcohol harms increased), and may best be targeted at specific demographic groups.

COVID-19 has seen changes in alcohol consumption. In addition to initial panic buying in response to mandated stay-at-home orders, surveys have reported changes in drinking at home in specific demographic groups including young males [11], and adults with young children [9]. Some of these changes in consumption have been interpreted as displaced drinking due to restricted access to on-premise venues such as pubs and clubs [11]. To date, however, any data assessing alcohol-related harms has been limited. We found that changes in sociodemographic factors such as age and gender may be particularly important. Indeed, 30-39 year old male and female groups showed increases between 18% and 45% in these harms during the middle of the year compared with the same months in 2019. Conversely, there were decreases in younger age groups, with 20-29 year old males having fewer alcohol-related harms early during restrictions (to the magnitude of between 8% and 21%), however these were not sustained with subsequent months showing rebounds of 25% and 48% in ambulance attendances for alcohol intoxication. While there has been relatively stable per-capita alcohol consumption and decreases in drinking among young adults in many Western countries including Australia, the proportion of heavy alcohol consumers has also increased [25], and this group is likely responsible for the higher rates of harm seen in this study. Targeting heavy drinkers and/or those with alcohol dependence is vital given this population may have poorer outcomes if infected by COVID-19 due to compromised respiratory or immune systems [3,26].

Socio-economic disadvantage was an important driver of acute alcohol harms reported on in this study. Although the most disadvantaged groups (determined using SEIFA scores) experienced the most alcohol-related ambulance attendances in both 2019 and 2020, the greatest change occurred in the least disadvantaged groups, placed in the top 20% of the community. This was also compounded by age, with older cohorts more likely to call an ambulance for an alcohol-related concern. The increase in harms seen in more advantaged groups over time in our dataset may reflect a larger disposable income as a result of travel/socialising restrictions, and job security. This is concerning given the increases in al-

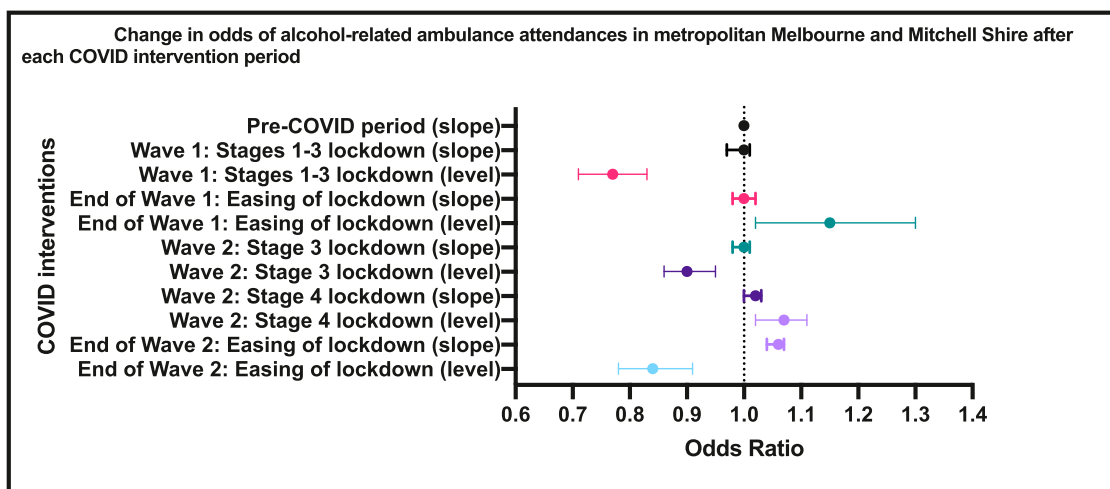


Figure 2.1. Change in odds of alcohol-related ambulance attendances in metropolitan Melbourne and Mitchell Shire after each COVID intervention period.

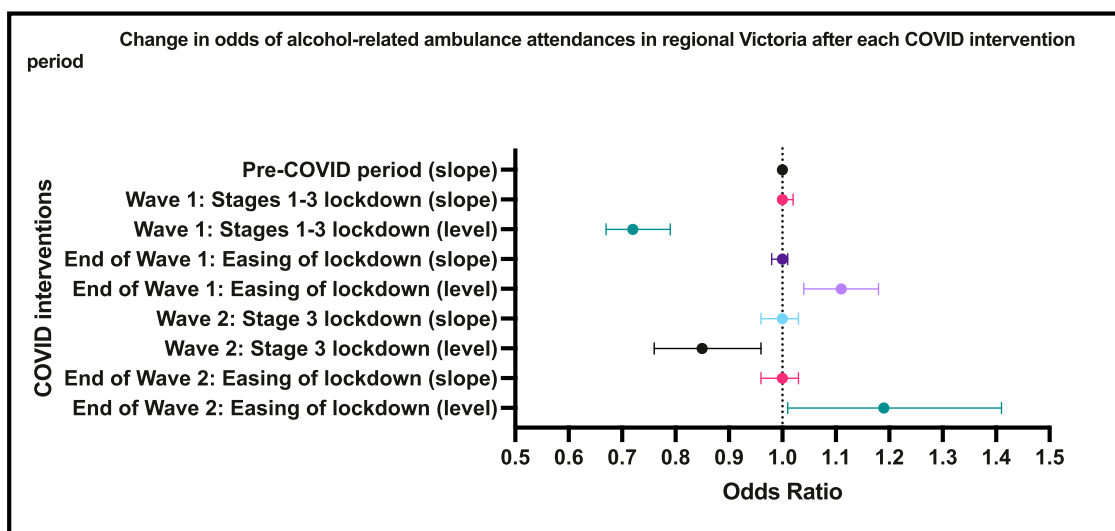


Figure 2.2. Change in odds of alcohol-related ambulance attendances in regional Victoria after each COVID intervention period.

cohol purchases reported in many jurisdictions during COVID-19<sup>7</sup>, and suggests that increased alcohol availability resulting from easing of licencing restrictions allowed greater access to alcohol in the community, and this policy change should be reviewed based on accumulating harm data. Equally, re-iterating safe drinking guidelines is important at the community level, but also in older adults given that excess alcohol consumption has been associated with an increased incidence in falls [27]. Although the present study did not assess increasing incidence of any illness or injury type, the overall acute nature of the response, and severity in requiring an ambulance suggests that the harm experienced was not trivial. The nature of these cases may also impact upon paramedics themselves, and future studies should examine the impact of these cases on emergency personnel, and whether any extra support or training is needed.

#### 4.1. Limitations and Future directions

While representing a novel and rich data source, ambulance records likely present an under-representation of all alcohol-related harms, as they only include cases that were serious enough to require an ambulance attendance, thus excluding cases where people sought assistance via their local doctor or directly through

the hospital system, noting that in 2020 access to these services may have been reduced during lockdown restrictions. Additionally, this dataset is primarily morbidity-focussed, and therefore fatal events (including suicide) are under-represented, as ambulances do not attend all deaths. A further limitation is that data are collected for operational rather than research purposes with paramedics only recording information they deem clinically relevant to patient care and/or stabilisation en route to hospital, with only one-year of comparison data included in this study. Our Victorian dataset is filtered to capture attendances associated with acute alcohol, other drug, suicide, self-harm and mental health related attendances, and does not include all primary diagnoses, and is therefore likely to be an under-estimation of total alcohol-attributable harms. Future analyses could also examine the types of harms experienced (e.g., related to falls, mental health crises or loss of consciousness) in order to determine the sub-types of harm experienced in these attendances.

Additionally, the monthly changes, when broken by age group should be treated with caution given that the numbers of incidents in certain cell sizes are low. Despite these limitations, the dataset is derived from electronic patient care records written, on scene, by paramedics. These records document observations relevant to patient care, and can include information like the presence

of empty bottles or drug paraphernalia, suicide notes, other persons on scene and their demeanour or role in the incident. This detailed information complements existing population health metrics (e.g., hospital and ED presentations), particularly given their state-wide coverage. A further strength of the data source is that all information is collected in a manner that is not intrusive, nor does it place further demands of additional data collection by, or interactions with, already burdened health services. This data source provides a novel, and unique way to map population alcohol-related harms over time, providing more robust evidence than studies reliant on small windows of data collection. Other jurisdictions should be encouraged to utilise ambulance data as part of a public health approach to monitor alcohol-related harms, although may face challenges when faced with (i) incomplete population coverage, (ii) lack of common electronic records or, (iii) financial barriers to access [20].

It should also be noted that the key policy announcements and events are not exhaustive, and the policy and community environments were dynamic during this time, with changes announced at daily intervals during the peak lockdown period (see Supplementary file 1). Therefore, causation between policy announcements/key events and alcohol-related attendances cannot be determined from this study alone, given that dates for different schemes and/or restrictions don't always align with the beginning of a month and implementation of those schemes may not have coincided exactly with their announcement.

## 5. Conclusion

This study examined changes in alcohol-related harms during months in 2020 associated with significant COVID-19 restrictions compared with matched months in 2019, and demonstrated displacement of alcohol harms to home settings compared with public venues, and changes in alcohol-related harms in specific sociodemographic groups. Changes were also evident at both the population and sub-population levels with respect to key government announcements that restricted citizen's movement. Importantly, this is one of the first studies to measure alcohol-related harms at the population level in response to a public health pandemic.

Figure 2.1., Figure 2.2.

## Author Contributions

Conceptualisation: Ogeil, Scott, Manning, Lubman  
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 Investigation: Ogeil, Scott, Faulkner  
 Methodology: Ogeil, Scott, Faulkner, Wilson, Beard, Smith, Manning, Lubman  
 Project administration: Ogeil, Scott  
 Resources: Lubman  
 Supervision: Manning, Lubman  
 Validation: Faulkner, Beard  
 Writing – original draft: Ogeil  
 Writing – review & editing: Scott, Faulkner, Wilson, Beard, Smith, Manning, Lubman  
 Authors Ogeil, Scott, Faulkner and Beard have access to all of the data and take responsibility for integrity of the data reported and the accuracy of the data analysis.

## Funding Statement

The NASS project is funded by the Commonwealth Department of Health, and Department of Health and Human Services, Victoria. DIL is the recipient of an NHMRC (Australia) Investigator Grant.

## Declaration of Competing Interest

DIL has received speaking honoraria from AstraZeneca, Camurus, Janssen, Servier and Lundbeck, and has provided consultancy advice to Lundbeck and Indivior. All other authors report no conflicts.

## Acknowledgements

The authors thank Dr Paul Sanfilippo for his advice and comments on a previous draft of this manuscript.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.lanwpc.2021.100222](https://doi.org/10.1016/j.lanwpc.2021.100222).

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