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## Quantifying the mental health burden of the most severe covid-19 restrictions: A natural experiment

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### ABSTRACT

**Background:** The COVID-19 pandemic, and the restrictions required to halt spread of the infection, are associated with increased population burden of moderate to severe symptoms of depression and anxiety. The aim was to quantify the mental health burden of the most severe COVID-19 related restrictions.

**Methods:** A natural experiment in which differences between Australian states and territories in the severity of restrictions for pandemic control, divided the population. People in Victoria experienced the most severe, and people in all other states and territories less severe or negligible restrictions. Data were collected in national, anonymously completed, online surveys (in April and in July / August 2020) of adults in Australia. Outcomes were, in the previous fortnight, experiencing clinically significant depressive symptoms (Patient Health Questionnaire 9 score  $\geq 10$ ); or symptoms of generalised anxiety (Generalised Anxiety Disorder Scale 7 score  $\geq 10$ ).

**Results:** In total, 23,749 eligible respondents contributed complete data. There were no differences in the population burden of mental health problems between Victoria and the other states and territories at Survey One. By Survey Two prevalence rates of clinically significant depressive (Adjusted Odds Ratio (aOR) 1.96; 95% CI 1.62; 2.37) and anxiety (aOR 1.87; 95%CI 1.53; 2.29) symptoms were substantially and significantly higher in Victoria than in other states and territories.

**Limitations:** Online surveys are less accessible to some groups of people. The data are self-report and not diagnostic.

**Conclusions:** The most severe COVID-19 restrictions are associated with near double the population prevalence of moderate to severe depressive and generalised anxiety symptoms.

### 1. Introduction

The mental health of general populations during the COVID-19 pandemic has been investigated widely. Since February 2020, data have been published from 32 surveys of symptoms of depression, anxiety, and acute or post-traumatic stress experienced by unselected populations in 13 countries (Banna et al., 2020; Barros et al., 2020; Casagrande et al., 2020; Dawel et al., 2020; Duan et al., 2020; Ettman et al., 2020; Fisher et al., 2020b; Fitzpatrick et al., 2020; Gao et al., 2020; González-Sanguino et al., 2020; Gualano et al., 2020; Huang and Zhao, 2020a, b; Islam et al., 2020; Li and Wang, 2020; Liu et al., 2020; Moghanibashi-Mansourieh, 2020; Naser et al., 2020; Ozamiz-Etxebarria et al., 2020; Passos et al., 2020; Pierce et al., 2020; Planchuelo-Gómez et al., 2020; Shapiro et al., 2020; Shi et al., 2020; Smith et al., 2020;

Twenge and Joiner, 2020; Verma and Mishra, 2020; Wang et al., 2020; Zhang and Ma, 2020; Zhao et al., 2020a; Zhao et al., 2020b; Zhou et al., 2020). The inclusion criteria for most were to be aged at least 18 years and a resident of the country. In Bangladesh (Banna et al., 2020; Islam et al., 2020) participants were to be Bangla-literate and, as in one of the 10 studies from China (Duan et al., 2020; Gao et al., 2020; Huang and Zhao, 2020a, b; Liu et al., 2020; Shi et al., 2020; Wang et al., 2020; Zhang and Ma, 2020; Zhao et al., 2020a; Zhao et al., 2020b) aged from 13 years (Zhao et al., 2020a). In one United Kingdom (UK) study, the lower age limit was 16 years (Pierce et al., 2020). Most recruitment was by advertisement on social or traditional media and through professional networks; one in China was to members of JoyBuy, an e-commerce service (Shi et al., 2020). Apart from inability to use the Internet, few set exclusion criteria. In China, Duan et al. (2020) required

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respondents to have at least a junior high school qualification, in Jordan, Naser et al. (2020) that they did not have a cognitive deficit, and, in the USA, Ettman et al. (2020) that they had ‘completed an AmeriSpeak survey in the previous six months’. Several recruited either part of or the full sample through established panels or survey companies (Dawel et al., 2020; Duan et al., 2020; Fitzpatrick et al., 2020; Zhao et al., 2020b; Zhou et al., 2020). In the UK, two studies used additional COVID-19-related surveys of participants in the UK Household Longitudinal Study (UKHLS) (Li and Wang, 2020; Pierce et al., 2020).

All studies collected data through online self-report surveys, most completed anonymously. Respondents were identifiable for re-contacting in the UKHLS surveys and in the first wave of planned prospective cohort studies (Dawel et al., 2020; Li and Wang, 2020; Pierce et al., 2020; Planchuelo-Gómez et al., 2020). All survey instruments included study-specific questions to ascertain demographic characteristics and, in some, to assess being affected by or infected with SARS-CoV-2/COVID-19 or self-appraised impact of public health restrictions (Banna et al., 2020; Dawel et al., 2020; Fisher et al., 2020a; Huang and Zhao, 2020a; Passos et al., 2020; Wang et al., 2020). Several measures of depressive symptoms, including the full nine-item Patient Health Questionnaire (PHQ-9) either in its original English-language form (Dawel et al., 2020; Ettman et al., 2020; Fisher et al., 2020a; Naser et al., 2020), or in a local language adaptation (Shi et al., 2020), or the short two-item PHQ-2 (González-Sanguino et al., 2020; Gualano et al., 2020; Passos et al., 2020; Shapiro et al., 2020; Twenge and Joiner, 2020; Zhao et al., 2020b) were used. Others used the full (Huang and Zhao, 2020b) or short-form (Fitzpatrick et al., 2020) Centre for Epidemiological Studies Depression Scale (CES-D), the 12-item General Health Questionnaire (GHQ-12) (Li and Wang, 2020; Pierce et al., 2020), the Beck Depression Inventory (Smith et al., 2020), or the World Health Organization-Five Wellbeing Index (Dawel et al., 2020; Gao et al., 2020). Symptoms of generalised anxiety were assessed most commonly with the seven-item Generalised Anxiety Scale (GAD-7) (Casagrande et al., 2020; Dawel et al., 2020; Fisher et al., 2020a; Fitzpatrick et al., 2020; Gao et al., 2020; Huang and Zhao, 2020a, b; Islam et al., 2020; Naser et al., 2020; Passos et al., 2020; Shi et al., 2020) or its short form GAD-2 (González-Sanguino et al., 2020; Twenge and Joiner, 2020; Zhao et al., 2020b), but also with the Beck Anxiety Inventory (Smith et al., 2020; Zhao et al., 2020a). Some assessed several symptom constellations with the full 21-item Depression, Anxiety and Stress Symptom Scale (DASS-21) (in Bangla, (Banna et al., 2020) Chinese (Shi et al., 2020; Wang et al., 2020) English, (Verma and Mishra, 2020; Zhou et al., 2020), or Spanish (Ozamiz-Etxebarria et al., 2020; Planchuelo-Gómez et al., 2020)), or used only the Anxiety sub-scale (in Farsi (Moghanibashi-Mansourieh, 2020)). Some assessed trauma-specific stress using the PTSD Checklist for DSM-5 (PCL-5) or the Impact of Events Scale (in Chinese (Wang et al., 2020; Zhang and Ma, 2020) or Spanish (Planchuelo-Gómez et al., 2020)). Sleep problems were assessed with the Pittsburgh Sleep Quality Index (Liu et al., 2020) and local scales of sleep quality (Huang and Zhao, 2020a) and positive mental health by the Posttraumatic Growth Inventory (Zhou et al., 2020) or the Short Warwick-Edinburgh Mental Wellbeing Scale (Smith et al., 2020).

Despite methodological differences among studies, the findings are consistent. As countries experienced the early phase of the pandemic, with localised spread or relatively low numbers of infections, data from China (Gao et al., 2020; Huang and Zhao, 2020b; Liu et al., 2020; Wang et al., 2020; Zhang and Ma, 2020) Australia (Dawel et al., 2020) and the United States of America (USA) (Fitzpatrick et al., 2020) reported population prevalence rates of clinically significant moderate to severe depressive symptoms from 10.8% (Shi et al., 2020) to 25% (Fitzpatrick et al., 2020) and moderate to severe anxiety symptoms from 10.4% (Shi et al., 2020) to 28.8% (Wang et al., 2020) and that 7% (Liu et al., 2020) to 7.6% (Huang and Zhao, 2020a) met criteria for post-traumatic stress disorder.

In most nations, large scale restrictions on usual life or lockdowns, including working from home, limiting physical proximity, only

allowing people to leave their homes for essential reasons, wearing masks, avoiding social gatherings, and constraining the size of weddings and funerals, were imposed to a greater or lesser degree to contain spread of the virus (World Health Organization, 2020). There is a signal in the data that population-level mental health worsened after the imposition of restrictions. Studies from Australia (Fisher et al., 2020a), Bangladesh (Banna et al., 2020; Islam et al., 2020), Brazil (Barros et al., 2020; Passos et al., 2020), China (Gao et al., 2020; Zhao et al., 2020a), India (Verma and Mishra, 2020), Israel (Shapiro et al., 2020), Italy (Gualano et al., 2020), Portugal (Passos et al., 2020), Spain (Planchuelo-Gómez et al., 2020), the UK (Pierce et al., 2020), and the USA (Ettman et al., 2020; Twenge and Joiner, 2020; Zhou et al., 2020) reported prevalence rates of clinically significant depressive symptoms ranging from 14.8% to 57.9% and generalised anxiety symptoms of 8.8% to 47.2%. Fewer investigated acute stress, reporting prevalence rates of clinically significant symptoms ranging from 8.1% to 37.01% (Banna et al., 2020; Planchuelo-Gómez et al., 2020; Shi et al., 2020; Verma and Mishra, 2020; Wang et al., 2020; Zhou et al., 2020).

As whole populations experienced the pandemic and its associated restrictions, none had a contemporaneous unexposed comparison group. The most common comparator was data contributed by similar unselected populations from the same setting, using the same measures in previous robust surveys (Banna et al., 2020; Ettman et al., 2020; Fisher et al., 2020a; Gao et al., 2020; Gualano et al., 2020; Huang and Zhao, 2020b; Pierce et al., 2020; Twenge and Joiner, 2020; Zhao et al., 2020a). Four studies reported closely spaced repeat waves to document change as increasingly restrictive COVID-19-related orders were imposed (Duan et al., 2020; Planchuelo-Gómez et al., 2020; Twenge and Joiner, 2020; Zhou et al., 2020). Four compared regions within the country where there were higher and lower or negligible infection rates (Fitzpatrick et al., 2020; Moghanibashi-Mansourieh, 2020; Shi et al., 2020; Zhao et al., 2020a).

In a cohort study in China, Duan et al. (2020) documented a significant increase in depressive symptoms from early February to mid-March; Gao et al. (2020) and Huang and Zhao (2020b) reported that all prevalence estimates were significantly higher than those in the 2019 China Mental Health Survey. Zhao et al. (2020a) identified mean anxiety scores as higher than in pre-COVID data from the national population, but also found that more people living in Hubei, the epicentre with high infection rates, had moderate to severe anxiety than those living in provinces where these were low. Similarly, Fitzpatrick et al. (2020) found that those in the Northeast of the USA, where the fastest increases in COVID-19, were occurring had higher levels of fear and worry than those in other regions.

Surveys in Australia (Fisher et al., 2020a), Bangladesh (Banna et al., 2020), China (Huang and Zhao, 2020b) Italy (Gualano et al., 2020), the UK (Pierce et al., 2020), and USA (Ettman et al., 2020; Twenge and Joiner, 2020) all found that population prevalence rates of both mild and clinically significant moderate to severe symptoms of depression and generalised anxiety were at least double those found in prior comparison surveys conducted in a non-COVID time. In Spain, depression, anxiety, and stress scores were all significantly higher in the first two weeks of May than in the first week of April (Planchuelo-Gómez et al., 2020). The one exception was a cohort study in the USA in which data in early April and in early and late May revealed a decrease in mean scores (Zhou et al., 2020). However, attrition (nearly 60% from assessment 1 to 3) was very high.

Only our survey of nearly 14,000 adults in Australia investigated whether the high prevalence of mental health problems in April 2020 was related more to fear of contracting the virus or to the impact of restrictions (Fisher et al., 2020a). We found that, while both were linked to mental health, experiencing the restrictions as having a highly adverse effect on daily life was associated with substantially higher odds of clinically significant depressive and anxiety symptoms than those associated with the fear of COVID-19 infection (Fisher et al., 2020a).

The United Nations recommends that all countries plan a response to the mental health consequences of the pandemic (United Nations, 2020). The recent Lancet COVID-19 Commission Statement on the occasion of the 75th session of the UN General Assembly High identifies the need for high quality data to inform salient responses as a priority (Sachs et al., 2020). The data available to date provide a general indication of the population burden of mental health problems, but no evidence is available to inform estimates of the psychological burden associated with more compared to less severe restrictions. Our aim was to quantify the impact of the most severe restrictions on population prevalence of indicators of mental health problems in Australia.

## 2. Methods

### 2.1. Design and Setting

Australia is a federation of eight states and territories. It has a national constitution and is governed by national, state and territory, and local jurisdictions.

This study was a natural experiment, in which differences between Australian states and territories in the severity of restrictions imposed to control the pandemic, an ‘event not under the control of [the] researcher [s]’ divided the population into a group exposed to more and a group exposed to less severe restrictions, enabling us to investigate the impact on population mental health of the most severe Stage Four Restrictions (Box 1) (Craig et al., 2017).

We conducted two anonymously completed, cross-sectional, national online surveys of people living in Australia. Survey One, available from 3 April to 2 May 2020, was initiated just after a human biosecurity emergency was declared and restrictions, including closure of non-essential services and social gathering sites (places of worship, clubs, and restaurants), rules about working from home, physical distancing, and bans on international travel, were implemented in all Australian states and territories. In May some restrictions were eased Australia-wide. Survey Two, available from 1 July to 31 August, was initiated just after a second wave of infections in the state of Victoria prompted the Victorian government to mandate stringent Stage Four Restrictions for the state, which did not apply to all other states and territories (see Box 1).

### 2.2. Respondents

The inclusion criteria were to be living in Australia and aged at least 18 years.

### 2.3. Data sources

The same core self-report instrument was used in both surveys.

#### 2.3.1. Mental health

**Depressive symptoms** were assessed using the Patient Health Questionnaire 9 (PHQ-9), a self-report 9-item scale asking respondents to score each depressive symptom as “0” (not experienced) to “3” (experienced nearly every day) in the last two weeks. Item 9 asks whether the respondent has experienced ‘Thoughts that you would be better off dead or of hurting yourself in some way’. The total scale scores ranging from 0-27 yield an indication of symptom severity. PHQ-9 scores of 5-9 represent mild, 10-14 moderate, 15-19 moderately severe, and  $\geq 20$  severe depressive symptoms. The PHQ-9 was formally validated against diagnostic psychiatric interviews and a score  $\geq 10$  has sensitivity of 88% and specificity of 88% for Major Depression (Kroenke et al., 2001).

**Anxiety symptoms** were assessed by the Generalised Anxiety Disorder Scale (GAD-7), an easily understood 7-item scale assessing common symptoms of anxiety using the same response options as in the PHQ-9. Item 7 asks whether the respondent is ‘Becoming irritable or easily annoyed’. The total scale scores range from 0-21. In formal validation against psychiatric interviews, a GAD-7 score  $\geq 10$  has sensitivity of 89% and specificity of 82% to detect Generalised Anxiety Disorder (Spitzer et al., 2006). Scores of 5-9 represent mild, 10-14 moderate, and 15-21 severe anxiety.

**Optimism about the future** was assessed by a visual analogue scale from 0 (not at all optimistic) to 10 (extremely optimistic).

#### 2.3.2. Experiences of COVID-19

Experiences of COVID-19 were assessed by study-specific questions about (1) direct experience of COVID-19: whether the respondent had been diagnosed with or tested for COVID-19, or lived with or knew someone with COVID-19; and (2) extent of worry about contracting COVID-19: from 0 (not at all) to 10 (extremely worried).

#### Box 1

##### Stage Four COVID-19 Restrictions in Victoria

Only four permitted reasons for leaving home (one hour of daily outdoor exercise, essential shopping (food and medicines), caregiving, and for healthcare);

Work from home unless providing an essential service;

Compulsory wearing of face masks;

Physical distancing;

Curfew from 8pm-5am;

Closure of childcare facilities, places of worship, schools, restaurants, cafes, cinemas, performing arts and music venues, all but essential retailers, clubs, gyms, hairdressers, and beauty services;

Travel only up to 5km from home;

No visitors to the home;

Weddings restricted to five people and funerals to ten;

Not allowed to gather in public places;

No interstate or international travel; and

Policing of community adherence and fines for breaching rules.

2.3.3. Socio-demographic characteristics

Study-specific questions were used to ascertain age, postcode, gender, whether born overseas or in Australia, living circumstances, occupation, and whether a job had been lost because of COVID-19 restrictions.

Data on state, urban/rural residence, and Index of Relative Socio-economic Advantage and Disadvantage (SEIFA) were derived from respondents' postcodes using the most recent Australian Bureau of Statistics (ABS) data (Australian Bureau of Statistics, 2019).

2.4. Procedure

The surveys were built in the Qualtrics Insight Platform (Qualtrics, Provo, UT) and hosted on a dedicated page on the Monash University website. Information about each survey was distributed nationally in print, broadcast, and social media and through organisational and personal networks. In Survey Two, 2000 respondents were recruited from states other than Victoria using a Qualtrics panel.

2.5. Outcomes

The outcomes were whether, in the last fortnight, the respondent had experienced:

- 1 Clinically significant symptoms of depression: PHQ-9 scores  $\geq 10$ .
- 2 Clinically significant symptoms of anxiety: GAD-7 scores  $\geq 10$ .
- 3 Any thoughts of being better off dead or of self-harm: PHQ-9 item 9 score  $> 0$
- 4 Becoming easily annoyed or irritable: GAD 7 item 6 score  $> 0$
- 5 High optimism about the future: scores  $\geq 8$ .

2.6. Statistical analyses

The sample size was calculated using STATA Version 16's command computing sample size for two-sample proportion tests (Stata Corp., 2019(Corp, 2019a)a). Because this study had several outcomes and a range of hypothesised proportions from 15% to 50%, a difference between the two samples of 3% was used for the calculation. With an alpha error of 5% and a power of 80%, the largest required sample size to test for differences was 4,356 people per group (Victoria versus other states and territories).

The analysis of this natural experiment was guided by the Difference-in-Differences (DiD) approach shown in the conceptual framework, in which the intervention was Stage Four Restrictions (Fig. 1). A mental health outcome at Survey Two was determined by three factors: a 'time effect', an 'area effect', and an 'intervention effect'. The time effect was any changes between Survey One and Survey Two apart from those related to the intervention. The area effect was the difference between Victoria and all other states and territories when intervention and time

effects were controlled and indicates whether or not there are intrinsic differences between the two areas. The intervention effect was the impact of the Stage Four Restrictions in Victoria compared to the lower level or minimal restrictions in the other states and territories.

In order to establish the sizes of these three effects, we combined individual data from Surveys One and Two. We used multiple logistic regression models to predict the five outcomes from Survey One to Survey Two (the time effect), Victoria versus all other states and territories (the area effect), and an interaction term between survey time and area (the true intervention effect). Socio-demographic characteristics and the experience of COVID-19 were included in the models as potential confounders to be controlled for. As sensitivity analyses, we conducted similar multiple linear regression models to predict PHQ-9, GAD-7, and Optimism About the Future continuous total scores.

The analyses took into account (using post-stratification weights) the differences in the proportions of age groups, genders, SEIFA deciles, and states in the sample and the corresponding information in the Australian population (Australian Bureau of Statistics, 2019). Only complete data were included in analyses, which were conducted using STATA Version 16 (2019(Corp, 2019b)b).

3. Results

3.1. Socio-demographic characteristics

In total, 23,749 eligible respondents (13,829 in Survey One and 9,220 in Survey Two) contributed complete data which were included in the analyses.

Both surveys had respondents from all Australian states and territories, socioeconomic positions, age groups, and living situations. Compared with the national population, the proportions of respondents born overseas were similar, but there were fewer men than women, fewer younger people, and more in higher and fewer in lower socioeconomic positions (Table 1).

There were few differences in the socio-demographic characteristics of respondents in Victoria and other states and territories in the two Surveys, but the proportions of females, people in the lowest socioeconomic positions, or who were retired were higher in the states and territories other than Victoria in Survey Two (Table 1).

3.2. Experiences of COVID-19

The proportions of respondents having any direct experience of COVID-19 were similar in the two groups in Survey One and increased threefold in Victoria and doubled in the other states and territories in Survey Two (Table 2). Similarly, the proportions of respondents who were highly worried about contracting COVID-19 were similar between the two groups in Survey One and doubled in both groups in Survey Two.

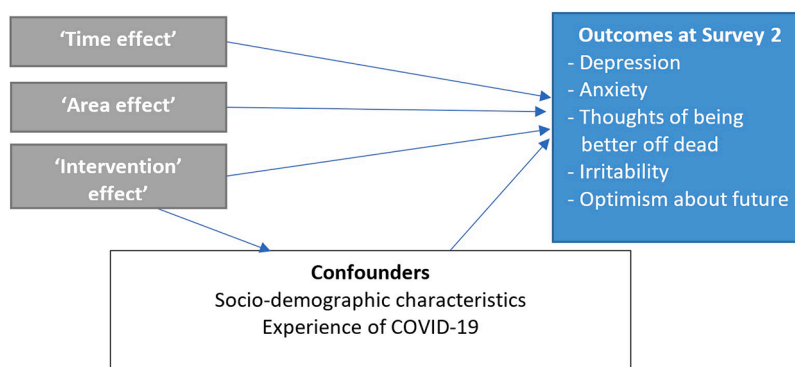


Fig. 1. Conceptual framework.

**Table 1**  
Socio-demographic characteristics by survey and state

	Survey 1		Survey 2	
	Victoria N=6,105	Other States N=7,724	Victoria N=4,844	Other States N=4,376
State				
Victoria	6105 (100)		4844 (100)	
New South Wales		2753 (35.6)		1796 (41.0)
Queensland		1939 (25.1)		972 (22.2)
Western Australia		1177 (15.2)		530 (12.1)
South Australia		836 (10.8)		533 (12.2)
Tasmania		445 (5.8)		240 (5.5)
Australian Capital Territory		465 (6.0)		261 (6.0)
Northern Territory		109 (1.4)		44 (1.0)
SEIFA quintiles				
Quintile 1 (Lowest socio-economic position)	366 (6.0)	727 (9.4)	281 (5.8)	577 (13.2)
Quintile 2	518 (8.5)	1023 (13.2)	361 (7.5)	661 (15.1)
Quintile 3	883 (14.5)	1345 (17.4)	610 (12.6)	752 (17.2)
Quintile 4	1480 (24.2)	1558 (20.2)	1289 (26.6)	869 (19.9)
Quintile 5 (Highest socio-economic position)	2858 (46.8)	3071 (39.8)	2303 (47.5)	1517 (34.7)
Gender				
Female	4739 (77.6)	5695 (73.7)	3770 (77.8)	2664 (60.9)
Male	1335 (21.9)	1993 (25.8)	1033 (21.3)	1693 (38.7)
Other	31 (0.5)	36 (0.5)	41 (0.9)	19 (0.4)
Age group				
18-29	813 (13.3)	524 (6.8)	762 (15.7)	586 (13.4)
30-39	1104 (18.1)	1190 (15.4)	1039 (21.5)	719 (16.4)
40-49	1282 (21)	1572 (20.4)	1022 (21.1)	741 (16.9)
50-59	1266 (20.7)	1798 (23.3)	987 (20.4)	884 (20.2)
60-69	1101 (18)	1732 (22.4)	727 (15)	865 (19.8)
70 +	539 (8.8)	908 (11.8)	307 (6.3)	581 (13.3)
Living situation				
On your own	1111 (18.2)	1549 (20.1)	946 (19.5)	865 (19.8)
With only your partner / your partner and children / adult family members	4259 (69.8)	5371 (69.5)	3351 (69.2)	3083 (70.5)
With children and without a partner	242 (4.0)	336 (4.4)	171 (3.5)	169 (3.9)
In a shared house with non-family members / Other	493 (8.1)	468 (6.1)	376 (7.8)	259 (5.9)
Born overseas	1312 (21.5)	1838 (23.8)	1070 (22.1)	1176 (26.9)
Main occupation				
A paid job	3833 (62.8)	4497 (58.2)	3233 (66.7)	2278 (52.1)
Doing unpaid work caring for children/ dependent relatives only or unemployed	454 (7.4)	692 (9.0)	383 (7.9)	520 (11.9)
Student	686 (11.2)	657 (8.5)	593 (12.2)	445 (10.2)
Retired	1132 (18.5)	1878 (24.3)	635 (13.1)	1133 (25.9)

Data cell: number (%).

**Table 2**  
Experiences of COVID-19.

	Survey 1		Survey 2	
	Victoria	Other States	Victoria	Other States
Any direct experience of COVID-19: being diagnosed with, or tested for COVID-19, or knew someone diagnosed, % (95% CI)	14.5 (13.2; 15.9)	15.6 (14.2; 17)	44.9 (42.9; 46.9)	31.4 (29.5; 33.3)
Lost a job because of COVID-19 restrictions, % (95% CI)	10.8 (9.7; 12.)	11.3 (9.8; 13.0)	11.4 (10.2; 12.8)	7.1 (6.2; 8.1)
Worried about contracting COVID-19 scale score, Mean (95% CI)	4.8 (4.8; 4.9)	4.7 (4.6; 4.7)	5.4 (5.3; 5.5)	5.5 (5.4; 5.6)
Highly worried about contracting COVID-19 (scale score ≥ 8), % (95% CI)	14.6 (13.4; 15.8)	13.7 (12.7; 14.9)	22.2 (20.5; 23.9)	23.8 (22.2; 25.5)

3.3. Effects of COVID-19 restrictions on mental health outcomes

The estimates of mental health outcomes in the two groups in the two surveys indicate that, while there were no differences in the population burden of mental health problems between Victoria and the other states and territories at Survey One, by Survey Two prevalence rates in Victoria were significantly higher (Table 3).

The time effects were significant in models 3 to 5 (Table 4). Compared with Survey One, in Survey Two the odds of having any thoughts of being better off dead or self-harm were higher and having high optimism about the future were lower. In the opposite direction, the odds of becoming easily annoyed or irritable were lower.

When all other factors were controlled, the area effects were not significant in any of the five models (Table 4) indicating that there were no intrinsic differences in population mental health between Victoria and the other states and territories.

The interaction analyses revealed that the ‘intervention’ effects were significant in four of the five models (Table 4). Stage Four Restrictions were associated with significantly increased odds of having clinically significant symptoms of depression and anxiety and becoming easily annoyed or irritable. They were also associated with significantly decreased odds of having high optimism about the future. However, no significant effect was found for having any thoughts of being better off dead or self-harm.

3.4. Effects of COVID-19 experiences on mental health outcomes

Direct experiences of COVID-19 were associated with higher odds of moderate to severe symptoms of anxiety and becoming easily annoyed or irritable (Table 4). Losing a job because of COVID-19 restrictions and being worried about contracting COVID-19 were associated with increased odds of all four adverse mental health outcomes and reduced odds of high optimism.

All the statistically significant results were consistent with the results of the sensitivity analyses for total PHQ-9, GAD-7, and Optimism About the Future scores (Appendix Table 2).

4. Discussion

This natural experiment has enabled us to calculate the population burden of mental health problems associated with the most severe restrictions and to document the changes in mental health that occur when lower level restrictions are in place for up to six months.

The strengths of the study are the large and generally representative samples, weighting to reflect the Australian population, use of well-established standardised measures that enable comparisons with populations in other countries experiencing the pandemic, and equivalent

**Table 3**  
Mental health in the last two weeks.

	Survey 1		Survey 2	
	Victoria	Other States	Victoria	Other States
PHQ-9: Total score, Mean (95% CI)	6.8 (6.5; 7)	6.8 (6.6; 7.1)	9.5 (9.2; 9.8)	7.2 (6.9; 7.4)
Mild depressive symptoms (PHQ-9 score 5–9), % (95% CI)	27.8 (26.1; 29.5)	26 (24.3; 27.8)	25.8 (24.2; 27.5)	21.8 (20.3; 23.4)
Moderate, moderately severe, or severe (clinically significant) depressive symptoms, PHQ-9 score ≥ 10, % (95% CI)	26.4 (24.7; 28.2)	27.9 (26.1; 29.9)	44.1 (42; 46.1)	32.2 (30.3; 34.2)
GAD-7: Total score, Mean (95% CI)	5.5 (5.3; 5.7)	5.5 (5.3; 5.8)	7.7 (7.5; 8)	5.8 (5.5; 6)
Mild anxiety (GAD 7 score 5–9), % (95% CI)	24.5 (23; 26.1)	24.6 (23.1; 26.2)	29.5 (27.7; 31.3)	25.1 (23.3; 27)
Moderate, or severe anxiety (clinically significant) symptoms of anxiety, GAD-7 score ≥ 10, % (95% CI)	20.9 (19.3; 22.5)	21.1 (19.3; 22.9)	34.3 (32.4; 36.2)	23.4 (21.8; 25.1)
Thoughts of being better off dead or of self-harm, % (95% CI)				
Several days	9.3 (8.1; 10.6)	8.8 (7.8; 10)	14.7 (13.3; 16.2)	13.4 (12.1; 14.7)
More than half the days	2.7 (2.1; 3.4)	3.1 (2.5; 3.9)	6.3 (5.2; 7.7)	6.1 (5.1; 7.3)
Nearly every day	2.6 (1.8; 3.6)	2.8 (2.1; 3.6)	4.3 (3.5; 5.3)	4.4 (3.7; 5.4)
Any thoughts	14.6 (13.1; 16.2)	14.7 (13.3; 16.2)	25.3 (23.6; 27.3)	23.9 (22.2; 25.7)
Becoming easily annoyed or irritable, % (95% CI)				
Several days	37.5 (35.7; 39.3)	34.9 (33.1; 36.8)	36.8 (34.9; 38.7)	34.7 (32.8; 36.6)
More than half the days	14.7 (13.4; 16.2)	14.6 (13.2; 16.0)	18.8 (17.3; 20.4)	14.4 (13.0; 16.0)
Nearly every day	8.7 (7.6; 9.9)	9.3 (7.9; 10.9)	17.8 (16.2; 19.4)	9.2 (8.1; 10.4)
Any irritability	60.9 (59.0; 62.7)	58.8 (56.9; 60.6)	73.3 (71.3; 75.3)	58.3 (56.3; 60.2)
Optimism about future				
Total score, Mean (95% CI)	6.2 (6.1; 6.3)	6.1 (6; 6.2)	5.0 (4.9; 5.2)	5.6 (5.5; 5.7)
High optimism (score ≥ 8), % (95% CI)	29.1 (27.4; 30.8)	28.1 (26.5; 29.7)	16.7 (15.1; 18.4)	21.7 (20.2; 23.4)

non-COVID-19 populations. In relation to the psychological outcomes, we were able to distinguish between worry about contracting COVID-19 and the impacts of the restrictions. In order to reduce response bias, we described the surveys in neutral terms as being about experiences of living with the restrictions rather than being about mental health. The survey was short, written in plain English, and easy to complete. We also acknowledge study limitations. First, online surveys do not allow recruitment fractions to be calculated and are less accessible to people who lack internet access, computer proficiency, or local language fluency and are in lower socioeconomic positions; their experiences might not be represented. Second, these data are not diagnostic, and estimates from self-report measures are generally higher than those from clinical interviews. Third, cross-sectional surveys cannot identify causal relationships. Finally, it is possible that between-state differences in social and economic circumstances might have influenced these findings. However, as we controlled in all analyses for urban versus rural residence, Socio-Economic Indexes for Areas quintiles, gender, age, living situation, whether born overseas or not, and main occupation, we think this is unlikely.

There is consistent evidence from diverse countries that population prevalence rates of clinically significant symptoms of depression and anxiety are substantially higher in the context of any COVID-19-related restrictions than at non-pandemic times. These data indicate that the severe Stage Four Restrictions in Victoria were associated with a further near doubling (aOR 1.96) in the population prevalence rates of clinically significant symptoms of depression (to 44.1%) and anxiety (to 32.2%) and of being irritable and easily annoyed (to 73.4%) compared to the already elevated rates associated with lower level restrictions. They also reveal that, in states and territories where restrictions had eased in the four-month interval between the first and the second survey, mental health did not improve and fewer people felt highly optimistic about the future.

When the area and intervention effects were controlled, there were no effects on depression and anxiety related solely to the passage of time. However, in the sample as a whole, thoughts of being better off dead were significantly more common in Survey Two than in Survey One. We acknowledge that, as these thoughts were asked about in a single question, there was no assessment of suicide intent or plans. However, this suggests a chronicity effect in which the duration and consequences of the pandemic and essential restrictions led to hopelessness and a diminished sense of a worthwhile future in a substantial proportion (one in four respondents) of the population across the country.

We found in Survey One that the major factor contributing to mental health problems was the adverse impact on daily life of the restrictions (Fisher et al., 2020a). This exceeded the impacts of fear of contracting or direct experience of the virus or of losing a job. The people in whom mental health problems were most common were those who occupied low socioeconomic positions, lived in poorly resourced areas or alone, had caregiving responsibilities, had lost jobs, were students whose courses had been suspended, were members of marginalised minority

**Table 4**  
Multiple logistic regression models<sup>#</sup> predicting mental health outcomes (Odds ratio [95% CI]).

	Model 1 Moderate/severe Depression	Model 2 Moderate/severe Anxiety	Model 3 Thoughts better off dead	Model 4 Easily annoyed/ irritable	Model 5 Highly optimistic about the future
Time (Survey 2 vs. 1)	1.11 [0.97; 1.27]	0.96 [0.82; 1.11]	1.68 [1.44; 1.97]	0.86 [0.76; 0.97]	0.75 [0.66; 0.84]
Area (Victoria vs. other states)	0.89 [0.78; 1.02]	0.95 [0.82; 1.10]	0.97 [0.82; 1.16]	1.05 [0.94; 1.19]	1.06 [0.95; 1.19]
Intervention effect (Interaction term VIC and Survey)	1.96 [1.62; 2.37]	1.87 [1.53; 2.29]	1.11 [0.88; 1.39]	1.87 [1.56; 2.24]	0.69 [0.57; 0.83]
Any experience of COVID-19	1.1 [0.97; 1.25]	1.27 [1.12; 1.45]	1.15 [0.99; 1.32]	1.32 [1.17; 1.48]	0.96 [0.85; 1.09]
Job lost because of COVID-19 restrictions	1.74 [1.42; 2.12]	1.68 [1.37; 2.06]	1.63 [1.32; 2.01]	1.76 [1.45; 2.12]	0.61 [0.5; 0.73]
Worried about contracting COVID-19	1.12 [1.10; 1.14]	1.18 [1.15; 1.21]	1.09 [1.06; 1.11]	1.11 [1.09; 1.13]	0.94 [0.92; 0.96]

<sup>#</sup> Other factors included in the models: Urban/rural, SEIFA quintiles, gender, age, living situation, born overseas, and main occupation (Please see the full models in Appendix Table 1).

groups, or women or aged 18–29 years. These factors were associated with mental health outcomes as in Survey Two.

The strong relationships between the most severe restrictions and the very high population-level burden of adverse mental health outcomes, lower but nevertheless substantial burden associated with long-term less severe restrictions, and characterisation of more vulnerable sub-groups demonstrated in this study provide reliable evidence to inform policy planning for social and economic recovery and for future pandemic preparations in Australia and other high-income countries (Sachs et al., 2020).

Since early in the pandemic, Australia has invested substantially in mental health services, including increased access to telehealth consultations with medical practitioners and allied health professionals, a larger number of publicly funded consultations per patient and increased support for telephone helplines. Despite these, the prevalence of mental health problems remained high in states and territories with persistent lower-level restrictions and was substantially higher in Victoria.

Together, these findings suggest that an expanded conceptual framework of the nature of the problems and their implications for policy actions that might be needed. Rather than seeing these as pathological responses, we think they are more appropriately seen as normal human adjustments to abnormal and threatening circumstances over which individuals have had little agency and which have disrupted protective social connections and engagement with purposeful activities. Loss is pervasive. Some have been bereaved, but restrictions on local, interstate, and international travel have prevented direct contact with family members, including people who are ill, frail, or dying. Normal milestone celebrations have been prohibited or contracted. Policing of adherence has been implemented. Losses of liberty, autonomy, privacy and accustomed ways of living contribute to these many sources of disenfranchised grief, which is characterised by yearning, uncertainty, and sadness (Fisher and Kirkman, 2020). Experiences of loss do not resolve spontaneously when restrictions ease. Demoralisation is experienced when people feel powerless and without agency when confronting pervasive and difficult life circumstances. Loss of a job or difficulty in finding work and home education of school students contribute to feelings of subjective incompetence, lack of capacity to act and demoralisation. There is inevitable anxiety, both for the self and for loved ones, about the risks of contracting the virus and the consequences of infection in the absence of a vaccine or treatments. These psychological states are all associated with reduced energy, functional efficiency, optimism, creativity, engagement, and capacities to concentrate and solve problems, all of which are needed for social and economic participation.

Many nations are experiencing rapid and substantial increases in infections which are requiring containment with more severe restrictions. All nations need to plan population-level responses to the mental health consequences of the pandemic (United Nations, 2020).

## Appendix

**Table 1** Multiple logistic regression models predicting mental health outcomes (Odds ratio [95% CI])

	Model 1 Moderate/severe Depression	Model 2 Moderate/severe Anxiety	Model 3 Thoughts better off dead	Model 4 Easily annoyed/ irritable	Model 5 Highly optimistic about the future
Time (Survey 2 vs. 1)	1.11 [0.97; 1.27]	0.96 [0.82; 1.11]	1.68 [1.44; 1.97]	0.86 [0.76; 0.97]	0.75 [0.66; 0.84]
Area (Victoria vs. other states)	0.89 [0.78; 1.02]	0.95 [0.82; 1.10]	0.97 [0.82; 1.16]	1.05 [0.94; 1.19]	1.06 [0.95; 1.19]
Intervention effect (Interaction term VIC and Survey)	1.96 [1.62; 2.37]	1.87 [1.53; 2.29]	1.11 [0.88; 1.39]	1.87 [1.56; 2.24]	0.69 [0.57; 0.83]
Any experience of COVID-19	1.1 [0.97; 1.25]	1.27 [1.12; 1.45]	1.15 [0.99; 1.32]	1.32 [1.17; 1.48]	0.96 [0.85; 1.09]
Job lost because of COVID-19 restrictions	1.74 [1.42; 2.12]	1.68 [1.37; 2.06]	1.63 [1.32; 2.01]	1.76 [1.45; 2.12]	0.61 [0.5; 0.73]
Worried about contracting COVID-19	1.12 [1.10; 1.14]	1.18 [1.15; 1.21]	1.09 [1.06; 1.11]	1.11 [1.09; 1.13]	0.94 [0.92; 0.96]

(continued on next page)

These data can guide the estimates of mental health consequences of severe restrictions or stay-at-home orders and inform policy planning to promote population-wide psychological recovery, and strategies, to protect the most vulnerable. As recommended by the World Health Organization (World Health Organization, 2018), these data also indicate that it is essential to involve the education, labour, justice, transport, environment, housing, and welfare sectors in initiatives to promote mental health in addition to the health sector.

## Contributors

JF, MK, KH and TT designed and conducted the survey. JF and TT conceptualised this study. HN managed the data. TT and HN conducted the statistical analysis. JF and TT wrote the draft of this paper. All authors contributed to the design of this study, provided the interpretation of results and critically reviewed the draft.

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## Ethics approval

Approval to conduct the study was provided by Monash University Human Research Ethics Committee (2020-24080-42716)

## Availability of data and materials

The data and analysis syntax will be shared on reasonable request to the corresponding author.

## Declaration of Competing Interest

All authors declare that they have no conflicts of interest.

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(continued)

	Model 1 Moderate/ severe Depression	Model 2 Moderate/ severe Anxiety	Model 3 Thoughts better off dead	Model 4 Easily annoyed/ irritable	Model 5 Highly optimistic about the future
Urban	1.01 [0.88; 1.16]	0.98 [0.85; 1.14]	0.96 [0.82; 1.13]	1.08 [0.96; 1.22]	0.95 [0.84; 1.08]
SEIFA quintiles					
Quintile 1 (lowest socioeconomic position)					
Quintile 2	0.77 [0.62; 0.96]	0.88 [0.69; 1.12]	0.83 [0.65; 1.06]	0.93 [0.78; 1.11]	1 [0.83; 1.21]
Quintile 3	0.73 [0.6; 0.89]	0.78 [0.62; 0.97]	0.83 [0.66; 1.03]	0.88 [0.74; 1.04]	1.11 [0.93; 1.32]
Quintile 4	0.77 [0.63; 0.93]	0.81 [0.64; 1.01]	0.86 [0.69; 1.08]	0.82 [0.68; 0.98]	1.16 [0.96; 1.4]
Quintile 5 (highest socioeconomic position)	0.68 [0.55; 0.83]	0.79 [0.63; 0.99]	0.82 [0.65; 1.02]	0.93 [0.78; 1.10]	1.11 [0.93; 1.33]
Gender					
Female					
Male	0.83 [0.75; 0.93]	0.78 [0.69; 0.88]	1.37 [1.2; 1.55]	0.66 [0.6; 0.72]	1.03 [0.94; 1.14]
Other	1.34 [0.9; 1.98]	1.57 [1.04; 2.36]	2.29 [1.54; 3.42]	0.93 [0.61; 1.44]	0.77 [0.47; 1.26]
Age (years)	0.97 [0.96; 0.97]	0.97 [0.96; 0.97]	0.97 [0.97; 0.98]	0.97 [0.96; 0.97]	1.01 [1.01; 1.02]
Living situation					
On your own					
With partner and/or children; with adult family members	0.55 [0.48; 0.63]	0.78 [0.67; 0.9]	0.48 [0.41; 0.56]	1.2 [1.07; 1.36]	1.29 [1.13; 1.47]
With children and without a partner	0.83 [0.65; 1.05]	1.18 [0.92; 1.52]	0.63 [0.47; 0.85]	1.31 [1.02; 1.68]	1.03 [0.8; 1.34]
With non-family members/Other	0.85 [0.66; 1.11]	1.18 [0.89; 1.56]	0.68 [0.52; 0.9]	1 [0.79; 1.27]	1.06 [0.82; 1.38]
Born overseas vs. born in Australia	0.79 [0.7; 0.89]	0.84 [0.73; 0.95]	0.81 [0.7; 0.92]	0.8 [0.72; 0.89]	1.14 [1.01; 1.27]
Main occupation					
A paid job					
Doing unpaid work caring for children/dependent relatives/or were unemployed	1.96 [1.67; 2.31]	1.9 [1.6; 2.26]	2.24 [1.86; 2.71]	1.37 [1.17; 1.61]	0.7 [0.58; 0.85]
Student	1.4 [1.16; 1.68]	1.25 [1.02; 1.52]	1.26 [1.03; 1.55]	0.96 [0.79; 1.16]	1.14 [0.95; 1.38]
Retired	1.06 [0.9; 1.25]	0.85 [0.71; 1.02]	1.19 [0.98; 1.45]	0.97 [0.85; 1.10]	1.04 [0.91; 1.19]

Table 2 Multiple regression models predicting mental health outcomes (standardised coefficient [95% CI])

	Model 6 PHQ-9 score	Model 7 GAD-7 score	Model 8 Optimism about future scale score
Time (Survey 2 vs. 1)	-0.01 (-0.07; 0.04)	-0.05 (-0.1; 0.01)	-0.16 (-0.22; -0.1)
Area (Victoria vs. other states)	-0.03 (-0.08; 0.02)	-0.03 (-0.08; 0.03)	0.05 (0; 0.1)
Intervention effect (Interaction term VIC and Survey)	0.38 (0.3; 0.46)	0.36 (0.27; 0.44)	-0.32 (-0.4; -0.24)
Any experience of COVID-19	0.08 (0.02; 0.13)	0.09 (0.04; 0.15)	-0.04 (-0.09; 0.02)
Job lost because of COVID-19 restrictions	0.35 (0.26; 0.44)	0.3 (0.21; 0.39)	-0.3 (-0.39; -0.21)
Worried about contracting COVID-19	0.06 (0.05; 0.07)	0.08 (0.07; 0.09)	-0.02 (-0.03; -0.01)
Urban	0.02 (-0.04; 0.08)	0.03 (-0.03; 0.09)	0.02 (-0.04; 0.07)
SEIFA quintiles			
Quintile 1 (lowest socioeconomic position)			
Quintile 2	-0.11 (-0.2; -0.03)	-0.09 (-0.19; 0.01)	0.04 (-0.05; 0.13)
Quintile 3	-0.13 (-0.21; -0.05)	-0.16 (-0.25; -0.06)	0.09 (0.01; 0.17)
Quintile 4	-0.12 (-0.2; -0.03)	-0.14 (-0.25; -0.03)	0.09 (0.01; 0.18)
Quintile 5 (highest socioeconomic position)	-0.15 (-0.23; -0.07)	-0.15 (-0.26; -0.04)	0.11 (0.03; 0.2)
Gender			
Female			
Male	-0.11 (-0.16; -0.07)	-0.18 (-0.23; -0.13)	-0.07 (-0.11; -0.02)
Other	0.2 (0.02; 0.39)	0.14 (-0.05; 0.33)	-0.52 (-0.73; -0.31)
Age (years)	-0.02 (-0.02; -0.02)	-0.02 (-0.02; -0.01)	0.01 (0; 0.01)
Living situation			
On your own			
With partner and/or children; with adult family members	-0.28 (-0.33; -0.22)	-0.11 (-0.16; -0.06)	0.18 (0.12; 0.24)
With children and without a partner	-0.02 (-0.13; 0.1)	0.06 (-0.05; 0.18)	0.11 (0; 0.22)
With non-family members/Other	-0.06 (-0.18; 0.05)	0.06 (-0.09; 0.21)	0.09 (-0.02; 0.21)
Born overseas vs. born in Australia	-0.11 (-0.16; -0.06)	-0.07 (-0.12; -0.02)	0.05 (0; 0.1)
Main occupation			
A paid job			
Doing unpaid work caring for children/dependent relatives/or were unemployed	0.4 (0.32; 0.48)	0.29 (0.21; 0.37)	-0.32 (-0.41; -0.23)
Student	0.21 (0.12; 0.29)	0.15 (0.04; 0.25)	0.06 (-0.03; 0.14)
Retired	0.08 (0.02; 0.14)	-0.02 (-0.07; 0.04)	-0.04 (-0.11; 0.03)

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