Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Psychiatric Research 140 (2021) 533–544

Contents lists available at ScienceDirect

Journal of Psychiatric Research

journal homepage: www.elsevier.com/locate/jpsychires

Mental health, substance use, and suicidal ideation during a prolonged COVID-19-related lockdown in a region with low SARS-CoV-2 prevalence

Mark É. Czeisler [a,b,c,*,1], Joshua F. Wiley [a,1], Elise R. Facer-Childs [a], Rebecca Robbins [d,e], Matthew D. Weaver [a,d,e], Laura K. Barger [a,d,e], Charles A. Czeisler [a,d,e], Mark E. Howard [a,b,f], Shantha M.W. Rajaratnam [a,b,d,e]

[a] Turner Institute for Brain and Mental Health and School of Psychological Sciences, Monash University, Melbourne, Victoria, Australia
[b] Institute for Breathing and Sleep, Austin Health, Melbourne, Victoria, Australia
[c] Department of Psychiatry, Brigham and Women's Hospital, Boston, MA, United States
[d] Division of Sleep and Circadian Disorders, Departments of Medicine and Neurology, Brigham and Women's Hospital, Boston, MA, United States
[e] Division of Sleep Medicine, Harvard Medical School, Boston, MA, United States
[f] Department of Medicine, University of Melbourne, Melbourne, Victoria, Australia

ARTICLE INFO

Keywords:
Coronavirus
Anxiety
Depression
Victoria
Australia

ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic has been associated with mental health consequences due to direct (i.e., SARS-CoV-2 infection, potentially due to neuronal or astrocytic infection, microvascular, or inflammatory mechanisms) and indirect (i.e., social and economic impacts of COVID-19 prevention measures) effects. Investigation of mental health in a region with one of the longest lockdowns and lowest COVID-19 prevalence globally (Victoria, Australia) allowed for evaluation of mental health in the absence of substantial direct pandemic mental health consequences. Surveys were administered during 15–24 September 2020 to Victorian residents aged ≥18 years for The COVID-19 Outbreak Public Evaluation (COPE) Initiative. Responses were compared cross-sectionally with April-2020 data, and longitudinally among respondents who completed both surveys. Multivariable Poisson regressions were used to estimate prevalence ratios for adverse mental health symptoms, substance use, and suicidal ideation adjusted for demographics, sleep, and behaviours (e.g., screen-time, outdoor-time). In September-2020, among 1157 Victorians, one-third reported anxiety or depressive disorder symptoms, one-fifth reported suicidal ideation, and one-tenth reported having seriously considered suicide in the prior 30 days. Young adults, unpaid caregivers, people with disabilities, and people with diagnosed psychiatric or sleep conditions showed increased prevalence of adverse mental health symptoms. Prevalence estimates of symptoms of burnout, anxiety, and depressive disorder were unchanged between April-2020 and September-2020. Persistently common experiences of adverse mental health symptoms despite low SARS-CoV-2 prevalence during prolonged lockdown highlight the urgent need for mental health support services.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been associated with adverse mental health consequences directly through SARS-CoV-2 infection and COVID-19 (i.e., through neuronal or astrocytic infection, microvascular, or inflammatory mechanisms), and indirectly through disruption of socio-behavioural health and socio-economic factors (i.e., from stay-at-home orders, nonessential business closures, school closures, gathering bans, etc.). While such sequelae may seem specific to the Great Pandemic of 2019-2021, observations of both direct and indirect mental health consequences of infectious disease outbreaks date back more than six centuries (Czeisler et al., 2021 in press). Evidence of direct mental health effects of COVID-19 is emerging (Boldrini et al., 2021; Meinhardt et al., 2021; Perlis et al., 2021; Taquet et al, 2021a, 2021b; Woo et al., 2020). Analysis of U.S. electronic health records reveals that 18.1% of COVID-19 survivors were diagnosed with a neuropsychiatric condition within 14–90 days of diagnosis, including

* Corresponding author. Turner Institute for Brain and Mental Health and School of Psychological Sciences, Monash University, Melbourne, Victoria, Australia.
E-mail address: mark.czeisler@fulbrightmail.org (M.É. Czeisler).
[1] Indicates equal contribution.

https://doi.org/10.1016/j.jpsychires.2021.05.080
Received 29 January 2021; Received in revised form 11 May 2021; Accepted 29 May 2021
Available online 4 June 2021

5.8% among individuals with no psychiatric history (Taquet et al, 2021a, 2021b), consistent with evidence of neuropsychiatric symptoms following infection with other coronaviruses (Rogers et al., 2020).

Indirect mental health effects of the COVID-19 pandemic were also anticipated (Brooks et al., 2020; Galea et al., 2020). Non-pharmaceutical interventions to contain COVID-19 have necessitated considerable social and economic disruption. Simultaneously, with 3.75 million COVID-19 deaths globally (Dong et al., 2020), and considerable morbidity, many may face prolonged grief (Verdery et al., 2020). There is evidence of widespread adverse mental health symptoms (Ammerman et al., 2021), including increased prevalence of anxiety and depression symptoms, substance use, and suicidal ideation, compared with previous years (Czeisler et al, 2020, 2021a, 2021b; Ettman et al., 2020; Pierce et al., 2020; Pollard et al., 2020). Mental health disparities are apparent, with younger adults, people with pre-existing psychiatric conditions, unpaid caregivers, and essential workers disproportionately affected (Czeisler et al, 2020, 2021c; Ettman et al., 2020; Toh et al., 2021).

While evidence of adverse mental health symptoms is abundant, distinguishing between direct effects (i.e., of the disease COVID-19) and indirect effects (i.e., of SARS-CoV-2 and COVID-19 mitigation policies, COVID-19-related medical care delay or avoidance) of the pandemic is challenging, as many regions have inconsistently instituted or enforced mitigation policies alongside relatively high SARS-CoV-2 caseloads. Moreover, the U.S. Centers for Disease Control and Prevention (CDC) estimates that nearly 80% of SARS-CoV-2 infections in the U.S. in 2020 were undetected (C.D.C., 2020; Reese et al., 2020), which could complicate approaches seeking to distinguish between direct and indirect mental health effects by comparing individuals with and without histories of laboratory-confirmed SARS-CoV-2 infection. Victoria, Australia therefore presents a unique opportunity to assess robustly indirect mental health effects of the pandemic, as during 2020, the state instituted prolonged stringent lockdown policies and did not experience widespread community SARS-CoV-2 transmission. Victoria reported 20, 112 total SARS-CoV-2 cases (<1% positivity rate) between 25 January and 24 September 2020 with widespread testing, suggesting that approximately 0.32% of the population of 16.2 million Victorians contracted SARS-CoV-2 (Australian Government Department of Health, 2020). Even if the true infection prevalence were manyfold higher, it would likely remain below 2% of the population.

The low SARS-CoV-2 prevalence may be related to stringent mitigation policies (Fig. 1), including sustained border closures, enforced physical distancing, work-from-home directives, stay-at-home orders, education and industry closures, and both visitor and public gathering bans. After restrictions briefly began to ease in late May 2020, Victoria reimposed intensive restrictions following acute increases in SARS-CoV-2 cases. In August, Victoria escalated restrictions to include an 8:00pm to 5:00am curfew, 5-km distance-from-residence travel restriction, and 1-h outdoor-exercise limit. These lockdowns were maintained through the September-2020 survey interval, before staged reopening began in October.

Evidence about mental health during the COVID-19 pandemic in Victoria is sparse, though surveys have been conducted during the COVID-19 pandemic in Australia, including several that used versions of the Patient Health Questionnaire (Löwe et al, 2004, 2010) to screen for symptoms of anxiety and depression. Across Australia, in late March 2020 near the onset of the pandemic, a survey study reported prevalence estimates of anxiety and depression symptoms were 16.4% and 20.3%, respectively, with worse mental health among Australians of younger age and female gender, as well as people living with mental health disorders (Dawel et al., 2020) or employed as essential workers (Toh et al., 2021). In a survey of 1531 Australians in early April 2020, prevalence estimates of anxiety and depression symptoms were 22.1% and 21.9%, respectively, with 28.6% of respondents screening positive for symptoms of either condition (Czeisler et al., 2021a). A month-long survey study from April to May 2020 across Australia reported similar prevalence estimates, with 21.0% and 27.6% screening positive for

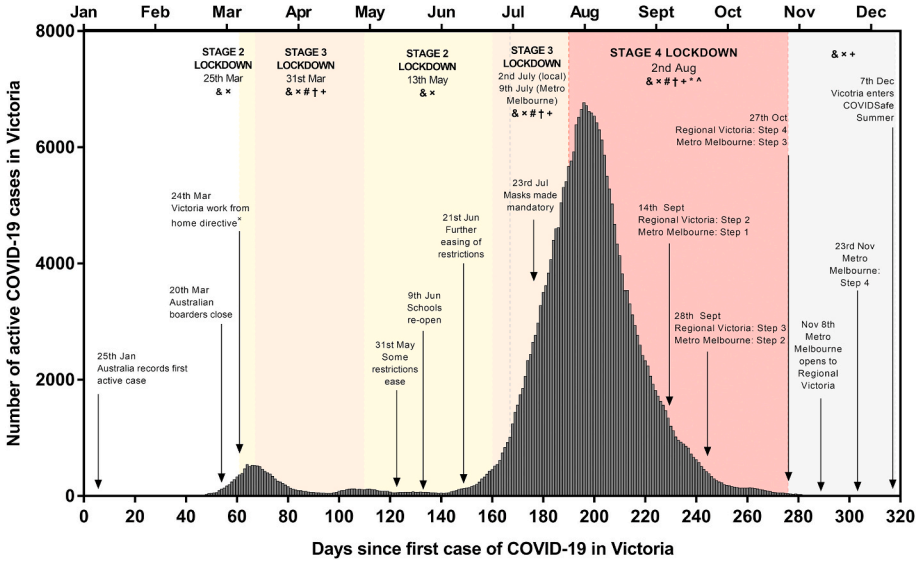

Fig. 1. Timeline of SARS-CoV-2 active cases and related restrictions in Victoria (Regional and Metropolitan Melbourne) Legend: The number of days since the first identified active case in Victoria is plotted on the horizontal axis and number of active cases per day on the vertical axis. Publicly available data were obtained from the Victorian State Government, Department of Health and Human Services. Stage 2 lockdown requirements are indicated by yellow shaded area, Stage 3 by orange and Stage 4 by red shaded area. Dotted line indicates when Stage 3 local lockdowns were imposed across Metro Melbourne. Symbols represent the type of restrictions in place as follows (only the most relevant restrictions are shown): Stage 2 lockdown: five visitors to the household, 10 people outdoors, no over-night stays, some retail industry open, hospitality is restricted to takeaway only (31 May: 20 patrons, 21 June: 50 patrons).

Key: &Social distancing in place (1.5 m apart and 4 m^2 per person)

× Work from home directive

#Four reasons to leave home are shopping for essential supplies, care/caregiving, exercise and essential work (Step 1 = 1 h of daily exercise, Step 2 = 2 h, Steps 3 and 4 = no time limit).

†Education and Industry closed (Step 1 = all non-essential, Step 2 = schools staged return, childcare reopens, some industry reopens, Step 3 = hospitality opens for outdoor seating, some retail opens, Step 4 = most industry reopens with COVID Safe restrictions).

+No visitors or public gatherings (Step 1 = two people from one household outside and one nominated visitor to the home/single 'social bubble', Step 2 = five people from two households outside and one nominated visitor to the home/single 'social bubble', Step 3 = 10 people outdoors, five visitors to the home from two households, Step 4 = 50 people outdoors, 20 visitors to the home).

*Curfew 8pm - 5am (Steps 1 and 2 = 9pm-5am, Steps 3 and 4 = no curfew).

^Travel distance limit 5 km radius (Step 1/2 = 5 km, Step 3 = 25 km, Step 4 = no limit). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

anxiety and depression symptoms, respectively (Fisher et al., 2020). A global survey with a plurality of respondents (35.6%) from Australia found high levels of distress, depression, and poor sleep across the sample, with younger individuals and people with diagnosed mental health conditions disproportionately experiencing these symptoms (Varma et al., 2021). Though the lack of Victorian pre-pandemic survey data using these instruments makes comparisons with previous years challenging, national data from 2001 to 2014 using a validated instrument found that the combined prevalence of common mental health conditions (predominantly anxiety and depression) was stable at around 11%–13% during this interval (Harvey et al., 2017). Furthermore, evidence using other instruments (Neill et al., 2020; Toh et al., 2021; Van Rheenen et al., 2020) and longitudinal studies in other countries (Ettman et al., 2020; Pierce et al., 2020; Vahratian et al., 2020) suggest that population-level mental health has worsened during the COVID-19 pandemic. In an April 2020 convenience sample, most Australians perceived government restrictions had negatively impacted their mental health (70.0% and 54.8%, respectively, of those with *vs* without pre-existing mental health conditions) (Van Rheenen et al., 2020); surveys have also estimated that 20% (Tran et al., 2020) or 30% (Neill et al., 2020) of Australians reported drinking substantially more than pre-pandemic levels. Moreover, longitudinal data found a significantly increased prevalence of severe psychological distress in April 2020 compared with pre-pandemic data, with younger adults experiencing the largest increase (Biddle et al., 2020a). More recent data show that psychological distress worsened from May to August 2020—especially in Victoria—and that the level of psychological distress remained higher than it was prior to the pandemic (Biddle et al., 2020b).

Understanding the extent to which the high prevalence of adverse mental health symptoms persists during one of the longest and most stringent lockdowns is of critical global health importance. We sought to assess mental health, substance use, and suicidal ideation in a demographically diverse sample of Victorian adults in September 2020, before the conclusion of extended lockdowns. Cross-sectional and longitudinal surveys of the Victorian population were analysed to compare prevalence estimates of adverse mental and behavioural health during September 2020 with those during the acute phase of lockdowns in Victoria. We analysed the associations between adverse mental and behavioural health symptoms and demographic characteristics, sleep, and behavioural changes, with the aim of identifying areas for targeted interventions to improve mental health.

2. Methods

2.1. Study design

Internet-based surveys were collected during April 2–8, 2020 (April-2020) and September 15–24, 2020 (September-2020), as part of The COVID-19 Outbreak Public Evaluation (COPE) Initiative (www.thecopeinitiative.org). Surveys were administered to respondent panels maintained by Qualtrics (USA). Additional details about recruitment methodologies and quality screening are in the appendix (p 1).

2.2. Setting and participants

The April-2020 wave consisted of adults aged ≥18 years with Australian residence. This analysis focused on the subset of Victorian residents, given the extended lockdown in Victoria and potential for confounding across states due to differing lockdowns and SARS-CoV-2 prevalence. To enable cross-sectional sub-analyses within the Victorian sample the September-2020 wave consisted of adults aged ≥18 years with Victorian-only residence. Victorian residents who completed April-2020 surveys were re-contacted and invited to complete September-2020 surveys. Demographic quota sampling was used to improve sample representativeness of Victoria based on population estimates for sex, age, and ancestry. The study was reviewed and approved by the Monash University Human Research Ethics Committee. Respondents provided electronic informed consent. Monte Carlo simulation power analyses showed that for $\alpha = 0.05$, base prevalence of adverse mental health symptoms between 15% and 40% in April 2020, and ≥9% absolute difference in the September-2020 sample compared to the April-2020 sample, 300 participants in the April-2020 sample and 1200 in the September-2020 sample provided ≥78%–93% power, depending on the assumed prevalence in April and whether September had an absolute difference that was 9% higher or lower. Further details about the power analysis are provided in the appendix (p 2).

2.3. Outcome measures

Mental and behavioural health variables in both waves included anxiety or depressive disorder symptoms and burnout symptoms. In September-2020, additional variables included COVID-19-related trauma- and stressor-related disorder (COVID-19 TSRD) symptoms, psychological well-being, new or increase of substance use (e.g., alcohol, legal or illegal drugs, or prescriptions drugs) to cope with stress or emotions, past-month passive suicidal ideation (i.e., wished to be dead), and past-month serious suicidal ideation. Details are provided in the appendix (pp 3).

2.4. Explanatory measures

Demographic variables in both waves included sex, age, ancestry, educational attainment, employment status, political ideology, COVID-19 risk perception, diurnal preference, and previous medical history of psychiatric (anxiety, depression, post-traumatic stress disorder) and sleep (insomnia, narcolepsy, obstructive sleep apnoea, restless leg syndrome, shift work disorder, periodic limb movement disorder) conditions. In September-2020, sexual orientation, disability status, essential worker status, unpaid caregiver (caregiver) status, regional *vs* metropolitan postal code (corresponding to jurisdictional COVID-19 restrictions), and history of substance use disorder were also assessed. Sleep and behavioural variables in both waves included self-reported sleep duration per 24 h, insomnia symptoms, comparisons for several sleep-related variables (time in bed, trouble falling asleep, sleep regularity) during *vs* before the pandemic (October–December 2019), comparisons for time spent on screens and time spent outdoors during daylight hours during *vs* before the pandemic, and daily hours spent consuming information about COVID-19 (i.e., discussing, attending meetings, following news and announcements). Daytime sleepiness was also assessed in September 2020. Details are provided in the appendix (pp 3–6).

2.5. Statistical methods

Analyses were conducted on three samples: Victorian-April (the subset of the cross-sectional April sample from Victoria); Victorian-September (the cross-sectional September sample from Victoria); and Victorian-Longitudinal (the subset of the Victorian-September sample that completed April-2020 surveys). Iterative proportional fitting (raking) and weight trimming were employed using the R survey package (version 3.29) and R software (version 4.0.2; The R Foundation) to improve representativeness of cross-sectional samples by sex, age, and educational attainment according to the 2016 Census of Population and Housing General Community Profile Victorian population estimates. Prevalence estimates were used to summarize demographic characteristics, sleep, behavioural changes, and mental and behavioural health for samples. Rao-Scott-corrected Pearson Chi-squared tests were used to test for differences in observed and expected frequencies among groups by characteristic for sleep, behavioural changes, and mental and behavioural health variables between the Victorian-September sample and the Victorian-April samples. Given that Victorian-Longitudinal respondents completed both April-2020 and September-2020 surveys,

these respondents were included in the April samples only for cross-sectional comparisons (i.e., excluded from the Victorian-September sample) to eliminate survivorship bias. Bonferroni adjustments were applied to account for the 13 outcome comparisons (i.e., statistical significance was assessed as $p \times 13 < 0.05$).

With anxiety or depressive disorders symptoms, COVID-19 TSRD symptoms, having started or increased substance use, suicidal ideation (passive or active), and a composite outcome (i.e., one or more of these symptoms) as dependent variables for separate models, adjusted prevalence ratios (aPRs) and 95% confidence intervals (CIs) were estimated in the Victorian-September sample using weighted multivariable Poisson regressions. Models were adjusted for sex, age group, sexual orientation, ancestry, disability status, combined employment status, caregiver status, regional *vs* metropolitan postcode classification, political ideology, and COVID-19 risk perception. Additional models including all demographic explanatory variables plus one sleep- or behavioural-change variable each (to avoid collinearity) were used to estimate aPRs and 95% CIs for dependent variables. Crosstabs, bivariate Rao-Scott Pearson Chi-squared tests, and unadjusted prevalence ratios for adverse mental and behavioural health symptoms were also conducted for each explanatory variable. Exploratory longitudinal analyses are described in the appendix (p 6). Statistical significance was set at two-sided $p < 0.05$. Rounded, weighted numbers and percentages are reported unless otherwise specified.

3. Results

Overall, 1531 eligible invited adults completed surveys during April 2–8, 2020, including 334 (21.8%) Victorians, and 1269 eligible invited adults completed surveys during September 15–24, 2020, including 93 recontacted respondents. After supplementary cleaning (appendix p 1), 1580 of 1603 (98.6%) unique respondents were included in the final analysis (Victorian-April n = 331 [99.1%]; Victorian-September n = 1249 [98.4%]; Victorian-Longitudinal n = 92 [98.9%]). Demographics are summarized in Table 1 and in the appendix (pp 8–11).

Among 1157 Victorian-September adults (excluding recontacts), 387 (33.4%) reported anxiety or depressive disorder symptoms, 354 (30.6%) reported COVID-19 TSRD symptoms, and 305 (26.3%) reported burnout symptoms (Table 2). Additionally, 143 (12.3%) respondents reported having started or increased substance use to cope with the pandemic, 196 (16.9%) reported having wished they were dead in the prior 30 days, and 110 (9.5%) reported past-month serious suicidal ideation. Regarding sleep during the COVID-19 pandemic compared to before the pandemic, Victorian-September adults more commonly reported having spent more (n = 353 [30.5%]) versus less (n = 66 [5.7%]) time in bed and having more (n = 277 [23.9%]) versus less (n = 67 [5.8%]) trouble falling asleep. Insomnia symptoms were reported by 239 (20.6%) respondents, and excessive daytime sleepiness by 166 (14.3%). Regarding other behavioural changes during COVID-19 compared to before, >1-h increased screen time and >1-h reduced time spent outdoors during daylight hours were reported by 525 (45.4%) and 586 (50.7%) respondents, respectively, and 853 (73.7%) reported not consuming information about COVID-19, compared to 43 (3.8%) who reported spending ≥4 h doing so daily.

There were no significant differences in the prevalence of adverse mental health symptoms assessed in both Apri-2020 and September-2020 (anxiety or depressive disorder symptoms, burnout symptoms) or sleep measures between the Victorian-April and Victorian-September samples. There were, however, significant differences in behavioural outcomes between April-2020 and September-2020. Compared with the Victorian-April sample, significantly greater percentages of respondents in the Victorian-September sample reported >1-h increased screen time (+12.0% *vs* Victorian-April, p = 0.013) and not consuming COVID-19 information (+18.4% *vs* Victorian-April, p < 0.0001).

Multivariable Poisson regression models with demographic variables only in the Victorian-September sample (n = 1249) revealed differences

Table 1
Respondent characteristics by sample.

	Victorian-April		Victorian-September[a]		Victorian-Longitudinal	
	n[b]	(%)[b]	n[b]	(%)[b]	n[b]	(%)[b]
Demographics	331	(100)	1157	(100)	92	(100)
Sex						
Male	171	(51.7)	544	(47.0)	46	(49.5)
Female	160	(48.3)	613	(53.0)	46	(50.5)
Age group, years						
18-24	42	(12.8)	123	(10.6)	11	(12.3)
25-44	123	(37.2)	436	(37.6)	34	(36.5)
45-64	105	(31.7)	379	(32.8)	29	(31.1)
≥65	61	(18.4)	219	(18.9)	19	(20.2)
Sexual Orientation						
Heterosexual	–	–	1031	(89.1)	82	(88.9)
Lesbian or gay	–	–	45	(3.9)	3	(3.3)
Bisexual	–	–	44	(3.8)	2	(1.9)
Something else	–	–	6	(0.5)	3	(2.7)
I don't know the answer	–	–	11	(1.0)	3	(3.2)
Prefer not to say	–	–	20	(1.8)	0	(0.0)
Ancestry						
Oceanian	86	(26.1)	289	(25.0)	29	(32.0)
North-West European	82	(24.8)	386	(33.4)	22	(23.7)
South-East European	32	(9.6)	106	(9.2)	12	(12.9)
North-East Asian	19	(5.8)	49	(4.3)	8	(8.5)
South-East Asian	16	(4.8)	42	(3.6)	5	(5.0)
South and Central Asian	22	(6.7)	71	(6.1)	6	(6.2)
North African and Middle Eastern	9	(2.8)	14	(1.2)	1	(0.9)
Sub-Saharan African	0	(0.1)	2	(0.2)	0	(0.0)
Peoples of the Americas	4	(1.1)	10	(0.9)	2	(1.7)
North-West European, Oceanian	34	(10.4)	100	(8.7)	6	(6.5)
Other combination	25	(7.6)	77	(6.7)	3	(2.7)
Unknown	1	(0.2)	10	(0.9)	0	(0.0)
Disability status						
None	–	–	993	(85.8)	79	(85.4)
Yes, and receive support from the NDIS	–	–	37	(3.2)	1	(1.2)
Yes, but do not receive support from the NDIS	–	–	110	(9.5)	12	(13.4)
Unknown	–	–	17	(1.4)	0	(0.0)
Highest education attainment						
Secondary diploma or less	147	(44.4)	503	(43.4)	40	(43.6)
More than secondary diploma, less than Bachelor's degree	90	(27.2)	311	(26.9)	25	(27.0)
Bachelor's degree or more	94	(28.4)	344	(29.7)	27	(29.5)
Regional vs metropolitan postal code						
Regional	–	–	255	(22.0)	23	(25.1)
Metropolitan	–	–	902	(78.0)	69	(74.9)
Employment status						
Employed	183	(55.4)	651	(56.3)	46	(50.3)
Unemployed	47	(14.2)	210	(18.2)	17	(18.4)
Retired	70	(21.2)	251	(21.7)	22	(23.5)
Student	31	(9.2)	45	(3.9)	7	(7.8)
Essential worker status (among employed respondents)						
Essential	–	–	360	(55.4)	24	(51.1)
Nonessential	–	–	291	(44.6)	23	(48.9)
Unpaid caregiver status						
None	–	–	725	(62.7)	56	(61.1)
Unpaid caregiver of adults	–	–	156	(13.5)	8	(9.0)
Unpaid caregiver of children or adolescents	–	–	125	(10.8)	17	(18.1)
Multigenerational unpaid caregiver	–	–	151	(13.0)	11	(11.8)
Political ideology						
Far left	14	(4.4)	64	(5.5)	8	(9.2)
Slightly left	69	(20.8)	221	(19.1)	15	(16.0)
Centre	106	(32.0)	399	(34.5)	33	(36.1)
Slightly right	70	(21.2)	173	(14.9)	16	(17.7)
Far right	19	(5.7)	112	(9.7)	5	(5.9)
Apolitical and/or prefer not to answer	53	(16.0)	189	(16.3)	14	(15.2)
COVID-19 risk perception						
	64	(19.3)	194	(16.7)	16	(17.0)

(*continued on next page*)

Table 1 (*continued*)

	Victorian-April		Victorian-September[a]		Victorian-Longitudinal	
	n[b]	(%)[b]	n[b]	(%)[b]	n[b]	(%)[b]
Believe to be at high risk for severe COVID-19						
Do not believe to be at high risk for severe COVID-19	267	(80.7)	963	(83.3)	76	(83.0)
Diurnal preference						
Definite morning type	90	(27.1)	296	(25.6)	20	(21.8)
Rather more of a morning type than evening type	67	(20.4)	312	(27.0)	24	(26.0)
Rather more of an evening type than morning type	98	(29.7)	332	(28.7)	23	(25.1)
Definite evening type	75	(22.8)	217	(18.7)	25	(27.1)
History of diagnosed sleep condition						
Yes	91	(27.5)	352	(30.5)	29	(31.5)
No	240	(72.5)	805	(69.5)	63	(68.5)
History of diagnosed psychiatric condition						
Yes	123	(37.1)	435	(37.6)	38	(41.4)
No	208	(62.9)	722	(62.4)	54	(58.6)

NDIS = National Disability Insurance Scheme, COVID-19 = coronavirus disease 2019.

[a] Excludes recontacted respondents.

[b] Weighted rounded counts and percentages may not sum to expected values.

in mental health by age, disability status, caregiver status, political ideology, and COVID-19 risk perception (Table 3, Fig. 2). Younger adults reported significantly higher adjusted prevalence of adverse mental or behavioural health conditions than older adults (e.g., aged 18–24 *vs* ≥ 65 years, suicidal ideation, aPR 5.59, 95% CI 2.62–11.95, $p < 0.0001$), as did people with *vs* without disabilities (e.g., individuals supported by the NDIS, suicidal ideation, 2.47, 1.70–3.58, $p < 0.0001$) and both multigenerational caregivers and caregivers of adults only *vs* non-caregivers (e.g., multigenerational caregivers, suicidal ideation, 2.95, 2.06–4.20, $p < 0.0001$). Victorians who identified as having Far Right political ideology had higher adjusted prevalence of all four adverse symptoms *vs* those who identified as Centre, including nearly twice the prevalence of suicidal ideation (1.88, 1.29–2.74, $p = 0.0010$). Finally, those who believed they were *vs* were not at high risk for severe COVID-19 also had higher prevalence of symptoms of anxiety or depressive disorder (1.28, 1.02–1.61, $p = 0.034$).

Multivariable Poisson regression models with demographic and additional variables in the Victorian-September sample revealed differences in mental and behavioural health by medical history, sleep, and behavioural changes (Table 4, Fig. 2). For example, suicidal ideation was nearly three times as prevalent among respondents with *vs* without previously diagnosed psychiatric conditions (2.88, 2.07–4.01, $p < 0.0001$), and nearly two times as prevalent among those with diagnosed sleep conditions (1.94, 1.46–2.57, $p = 0.0007$) and insomnia symptoms (1.86, 1.38–2.51, $p = 0.0001$). Adverse mental health symptoms were also significantly more prevalent among those with a self-reported sleep duration <6 h (e.g., suicidal ideation, 1.46, 1.02–2.08, $p = 0.039$, *vs* > 7 h), and those who reported spending more time in bed (1.47, 1.12–1.92, $p = 0.0054$, *vs* no change) and having more trouble falling asleep (1.66, 1.25–2.20, $p = 0.0005$, *vs* no change). Those who reported maintaining a less regular sleep-wake schedule also more commonly reported adverse mental health symptoms (e.g., anxiety or depressive disorder symptoms, 1.44, 1.17–1.79, $p = 0.0008$). With respect to behavioural changes, significantly increased prevalence of adverse mental health symptoms were found for three of the four conditions among respondents who reported >1 h per day reduction in time spent outdoors during daylight (e.g., suicidal ideation, 1.47, 1.02–2.11, $p = 0.039$), >1 h per day increase in time on screens (e.g., substance use, 2.03, 1.29–3.17, $p = 0.0021$), and ≥4 h per day spent following COVID-19 media coverage (e.g., suicidal ideation, 1.44, 1.03–2.03, $p = 0.036$).

Fig. 2 shows key variables associated with increased prevalence of having experienced one or more adverse mental or behavioural health

Table 2
Estimated prevalence of adverse mental and behavioural health conditions, sleep, and behavioural changes during the pandemic during April 2020 and September 2020.

Sample	Victorian April		Victorian September (excluding recontacts)		September vs April 2020	
	n[a]	% (95% CI)[a]	n[a]	% (95% CI)[a]	Δ % (95% CI)[a]	*P*[b]
Total Respondents	331		1157			
Mental or Behavioural Health Condition						
Symptoms of anxiety or depressive disorder	104	31.3 (26.0, 37.3)	387	33.4 (30.3, 36.7)	2.1 (−6.3 to 10.5)	>0.99
Symptoms of a COVID-19 TSRD	–	–	354	30.6 (27.6, 33.8)		
Symptoms of burnout	74	22.4 (17.8, 27.9)	305	26.3 (23.4, 29.5)	3.9 (−3.7 to 11.5)	>0.99
Started or increased substance use to cope with stress or emotions	–	–	143	12.3 (10.6, 14.9)	–	–
Wished to be dead or not have woken up in previous 30 days	–	–	196	16.9 (14.5, 19.6)	–	–
Seriously considered suicide in the previous 30 days	–	–	110	9.5 (7.6, 11.8)	–	–
Seriously considered suicide or wished dead in the previous 30 days	–	–	202	17.5 (15.0, 20.2)	–	–
Psychological well-being						
0–25%	–	–	220	19.1 (16.4, 22.0)	–	–
26–50%	–	–	304	26.3 (23.5, 29.4)	–	–
51–75%	–	–	375	32.4 (29.4, 35.7)	–	–
76–100%	–	–	257	22.2 (19.7, 24.9)	–	–
Sleep Duration						
<6 h	48	14.6 (10.8, 19.6)	204	17.6 (15.1, 20.5)	3.0 (−3.5 to 9.5)	>0.99
6–7 h	87	26.4 (21.5, 32.0)	285	24.7 (22.0, 27.5)	−1.7 (−9.6 to 6.2)	>0.99
>7 h	195	59.0 (52.8, 64.9)	668	57.7 (54.4, 61.0)	−1.3 (−10.1 to 7.6)	>0.99
Comparison of sleep to before the pandemic						
Spend more time in bed	99	29.9 (24.9, 35.4)	353	30.5 (27.7, 33.5)	0.6 (−7.6 to 8.9)	>0.99
Spend less time in bed	31	9.3 (6.2, 13.7)	66	5.7 (4.4, 7.4)	−3.6 (−8.6 to 1.5)	0.28
More trouble sleeping	69	20.7 (16.3, 25.9)	277	23.9 (21.2, 26.9)	3.2 (−4.2 to 10.6)	>0.99
Less trouble sleeping	11		67			>0.99

(*continued on next page*)

Table 2 (*continued*)

Sample	Victorian April		Victorian September (excluding recontacts)		September vs April 2020	
	n[a]	% (95% CI)[a]	n[a]	% (95% CI)[a]	Δ % (95% CI)[a]	*P*[b]
		3.4 (1.8, 6.2)		5.8 (4.4, 7.6)	2.4 (−1.1 to 5.9)	
More regular sleep	32	9.6 (6.8, 13.4)	154	13.3 (11.3, 15.7)	3.7 (−1.8 to 9.2)	0.91
Less regular sleep	54	16.4 (12.6, 21.1)	186	16.1 (13.7, 18.8)	−0.3 (−7.0 to 6.3)	>0.99
Symptoms of insomnia						
Yes	55	16.8 (12.7, 21.9)	239	20.6 (18.0, 23.6)	3.8 (−3.0 to 10.7)	>0.99
Epworth Sleepiness Scale…						
Normal	–	–	835	72.2 (69.0, 75.2)	–	–
Mild to moderate sleepiness	–	–	156	13.5 (11.4, 16.0)	–	–
Excessive sleepiness	–	–	166	14.3 (12.1, 16.9)	–	–
Time spent on screens compared with before the pandemic…						
Reduced by more than 1 h	25	7.5 (4.9, 11.3)	92	7.9 (6.2, 10.1)	0.4 (−4.3 to 5.2)	>0.99
Reduced by less than 1 h	11	3.4 (1.8, 6.3)	46	4.0 (2.8, 5.7)	0.6 (−2.8 to 3.9)	>0.99
About the same	162	49.1 (43.5, 54.7)	404	34.9 (31.9, 38.1)	−14.2 (−23.1 to −5.3)	<0.0001
Increased by less than 1 h	22	6.6 (4.1, 10.3)	90	7.8 (6.1, 9.7)	1.2 (−3.4 to 5.7)	>0.99
Increased by more than 1 h	111	33.4 (28.2, 39.0)	525	45.4 (42.1, 48.7)	12.0 (3.4 to 20.6)	0.0013
Time spent outside during daylight hours compared with before the pandemic…						
Reduced by more than 1 h	144	43.5 (37.6, 49.6)	586	50.7 (47.3, 54.0)	7.2 (−1.8 to 16.1)	0.27
Reduced by less than 1 h	26	7.8 (5.2, 11.6)	78	6.7 (5.2, 8.7)	−1.1 (−5.9 to 3.6)	>0.99
About the same	118	35.6 (30.1, 41.5)	357	30.9 (28.0, 34.0)	−4.7 (−13.2 to 3.9)	>0.99
Increased by less than 1 h	5	1.7 (0.7, 3.6)	49	4.2 (3.0, 6.0)	2.5 (−0.1 to 5.2)	0.36
Increased by more than 1 h	38	11.4 (8.0, 16.2)	87	7.5 (5.9, 9.4)	−3.9 (−9.5 to 1.6)	0.29
Daily hours spent following COVID-19						
0	183	55.3 (49.6, 61.2)	853	73.7 (70.8, 76.7)	18.4 (9.7 to 27.2)	<0.0001
1	56	16.9 (12.9, 21.9)	185	15.9 (13.7, 18.6)	−1.0 (−7.6 to 5.8)	>0.99
2-3	59	17.8 (13.7, 23.1)	73	6.3 (4.8, 8.3)	−11.5 (−17.9 to −5.1)	<0.0001
≥4	32	9.6 (6.7, 13.8)	43	3.8 (2.8, 5.0)	−5.8 (−10.8 to −0.9)	0.0002

VIC = Victoria, AUS = Australia, TSRD = trauma- and stressor-related disorder, NDIS = National Disability Insurance Scheme, COVID-19 = coronavirus disease 2019.

[a] Weighted rounded counts and percentages may not sum to expected values.

[b] CI and P-values are Bonferroni-adjusted to account for multiplicity (13 comparisons).

symptom, with two to three times the prevalence among adults aged 18–24, 25–44, or 45–64 *vs* ≥ 65 years (3.25, 2.11–5.00; 3.04, 2.05–4.52; 2.08, 1.43–3.00 respectively, all $p \leq 0.0001$), and significantly higher aPRs for those with *vs* without insomnia symptoms (1.78, 1.55–2.05, $p < 0.0001$), multigenerational caregivers *vs* non-caregivers (1.55, 1.30–1.84, $p < 0.0001$), and people with disabilities who did not qualify for NDIS *vs* people without disabilities (1.52, 1.24–1.87, $p < 0.0001$) (Fig. 2, appendix pp 16,17). In the model for any adverse mental or behavioural health symptoms, significant differences were not observed by sexual orientation, ancestry, regional *vs* metropolitan postal code, diurnal preference, spending less time in bed, having less trouble falling asleep, or maintaining a more regular sleep-wake schedule.

4. Discussion

In September 2020, during one of the longest global COVID-19 lockdowns in a region with low SARS-CoV-2 prevalence, approximately one-third of surveyed Victorian adults reported anxiety or depressive symptoms and COVID-19 TSRD symptoms, and about one-tenth reported new or increased substance use to cope. Most concerningly, about one-tenth of adults reported serious past-month suicidal ideation. Prevalence estimates of poor mental health were similar to those in Victorians in April 2020, near the start of the lockdown, in the U.S. in April, June, and August 2020 through February 2021 (Czeisler et al., 2021a, 2021b, 2020; Ettman et al., 2020; Vahratian et al., 2020), and estimates from meta-analyses during the COVID-19 pandemic (Salari et al., 2020). Stability in rates of poor mental health across time and region stands in stark contrast to variation in SARS-CoV-2 infections and COVID-19 hospitalisations and deaths, suggesting that the indirect adverse mental health impact during the pandemic may be insensitive to objective COVID-19 risk. Given that high prevalences of adverse mental health symptoms were observed in a region with comparatively low SARS-CoV-2 prevalence, these findings may largely reflect indirect mental health effects of the pandemic and its mitigation.

Our findings demonstrate that poor mental health symptoms among adults in Victoria during the COVID-19 pandemic were not transient. Investment in mental health treatment, particularly for depression and anxiety, is cost-effective, with benefit-cost ratios of 2.3–3.0 for economic benefits (Chisholm et al., 2016) in addition to gains from ameliorating human misery and suffering. Australia has responded through reimbursement for telehealth delivery of mental health services, increased publicly funded mental health benefit allowances, and funding for community mental health telephone support services. Victorians have substantially increased mental health services utilization (Australian Government, 2020), which may reflect greater need for and access to these resources, and represent one reason that the prevalence of poor mental health in Victoria did not increase from April to September, despite one of the world's longest COVID-19 lockdowns.

Our findings also highlight mental health disparities. Adults aged <65 years, people with disabilities, and multigenerational unpaid caregivers experienced disproportionate burdens of almost all forms of adverse mental and behavioural health symptoms, consistent with results from U.S. studies of mental health during the COVID-19 pandemic (Czeisler et al, 2020, 2021b, 2021c). Moreover, diagnosed psychiatric or sleep disorders and insomnia symptoms were robustly associated with higher prevalence of poor outcomes, consistent with prior evidence during the pandemic (Czeisler et al., 2021b; Meaklim et al., 2021; Varma et al., 2021; Xiong et al., 2020). Examining behaviours, compared to April 2020, Victorians in September 2020 spent more time on screens

Table 3
Estimated adjusted prevalence ratios for adverse mental and behavioural health conditions among Victorian adults in September 2020, by respondent characteristics.

Mental or Behavioural Health Condition	Symptoms of Anxiety or Depressive Disorder		*P*	Symptoms of a COVID-19 TSRD		*P*	Started or Increased Substance Use		*P*	Suicidal ideation		*P*
Demographic	aPR	[95% CI]	–	aPR	[95% CI]	–	aPR	[95% CI]	–	aPR	[95% CI]	–
Sex (reference: Female)												
Male	0.89	[0.74, 1.08]	0.25	0.91	[0.74, 1.13]	0.39	0.83	[0.57, 1.20]	0.32	1.02	[0.76, 1.37]	0.90
Age Group, years (reference: ≥65)												
18–24	4.37	[2.48, 7.72]	<0.0001	3.00	[1.76, 5.11]	0.0001	1.89	[0.69, 5.19]	0.22	5.59	[2.62, 11.95]	<0.0001
25–44	4.03	[2.40, 6.76]	<0.0001	2.21	[1.37, 3.58]	0.0012	2.45	[1.04, 5.76]	0.04	3.51	[1.81, 6.79]	0.0002
45–64	2.35	[1.45, 3.82]	0.0006	1.56	[0.99, 2.47]	0.055	1.93	[0.86, 4.33]	0.11	2.05	[1.07, 3.95]	0.032
Disability Status (reference: None)												
Disability, with support from NDIS	1.58	[1.16, 2.14]	0.0033	1.54	[1.15, 2.08]	0.0042	2.38	[1.47, 3.85]	0.0005	2.47	[1.7, 3.58]	<0.0001
Disability, without support from NDIS	1.94	[1.51, 2.50]	<0.0001	1.40	[1.00, 1.97]	0.049	1.96	[1.11, 3.49]	0.022	2.40	[1.64, 3.52]	<0.0001
Employment Status (reference: Employed nonessential)												
Employed essential	1.15	[0.89, 1.48]	0.29	1.08	[0.83, 1.41]	0.57	0.83	[0.54, 1.29]	0.41	1.07	[0.72, 1.59]	0.72
Unemployed	1.32	[1.00, 1.75]	0.054	1.15	[0.84, 1.57]	0.38	0.65	[0.33, 1.25]	0.20	1.35	[0.84, 2.17]	0.22
Student	0.82	[0.46, 1.47]	0.51	1.05	[0.59, 1.88]	0.87	0.52	[0.17, 1.64]	0.27	0.68	[0.26, 1.74]	0.42
Retired	0.94	[0.60, 1.45]	0.77	0.66	[0.43, 1.03]	0.068	0.61	[0.28, 1.32]	0.21	1.03	[0.59, 1.81]	0.92
Unpaid Caregiver Status (reference: No)												
Unpaid caregiver of adults	1.31	[1.01, 1.71]	0.042	1.48	[1.11, 1.98]	0.0075	1.61	[0.89, 2.91]	0.12	1.55	[1.02, 2.37]	0.041
Unpaid caregiver of children or adolescents	1.01	[0.74, 1.38]	0.95	0.93	[0.61, 1.41]	0.73	3.15	[1.80, 5.51]	0.0001	1.05	[0.59, 1.89]	0.86
Multigenerational unpaid caregiver	1.54	[1.21, 1.97]	0.0005	2.11	[1.65, 2.70]	<0.0001	4.85	[2.98, 7.90]	<0.0001	2.95	[2.06, 4.20]	<0.0001
Political Ideology (reference: Centre)												
Far left	1.08	[0.75, 1.56]	0.69	0.99	[0.63, 1.56]	0.96	0.75	[0.34, 1.66]	0.48	1.78	[1.07, 2.96]	0.026
Slightly left	1.29	[0.98, 1.70]	0.069	0.97	[0.71, 1.32]	0.84	1.89	[1.13, 3.16]	0.016	1.32	[0.86, 2.03]	0.21
Slightly right	1.34	[1.02, 1.76]	0.039	1.13	[0.85, 1.50]	0.39	1.20	[0.73, 1.97]	0.47	1.55	[1.06, 2.29]	0.025
Far right	1.45	[1.08, 1.94]	0.013	1.67	[1.29, 2.18]	0.0001	2.01	[1.23, 3.30]	0.0054	1.88	[1.29, 2.74]	0.0010
Apolitical and/or prefer not to answer	1.32	[0.99, 1.75]	0.056	0.92	[0.66, 1.28]	0.62	0.98	[0.52, 1.84]	0.95	1.19	[0.72, 1.98]	0.49
Believed high risk for severe COVID-19 (reference: No)												
Yes	1.28	[1.02, 1.61]	0.034	1.11	[0.84, 1.47]	0.45	1.13	[0.75, 1.72]	0.55	1.11	[0.78, 1.59]	0.56

COVID-19 = coronavirus disease 2019, TSRD = trauma- and stressor-related disorder, aPR = adjusted prevalence ratio, CI = confidence interval, NDIS = National Disability Insurance Scheme.

and less time following COVID-19 media coverage. There was a trend, albeit not statistically significant after Bonferroni correction, for reduced outdoor time among Victorians during September compared to Victorians in April. Reduced outdoor time was associated with higher prevalence ratios for all assessed adverse mental health symptoms, and increased time on screens was associated with higher prevalence ratios for anxiety or depression symptoms. More regular sleep times and spending less time following COVID-19 were associated with lower prevalence ratios for anxiety or depression symptoms.

These results, which are consistent with findings related to mental health during the COVID-19 pandemic among Victorian athletes (Facer-Childs et al., 2021), show that a sustained lockdown does not have a unitary effect on behaviours, with some behaviour changes associated with better and others with worse mental health symptoms. Although our cross-sectional results do not demonstrate causality, they do suggest that in addition to interventions directly aimed at mental health, research should investigate whether interventions that target behaviour or the environment are associated with improved mental health. As an alternative to targeting behaviours, given the disproportionate experience of adverse mental health symptoms among younger adults, caregivers, and individuals with pre-existing psychiatric conditions, prevention and intervention resources designed for these populations could be prioritized. For younger adults, programs that promote early engagement in mental health services may be particularly beneficial, as adolescents are the least likely age group to seek professional mental health care despite a high prevalence of mental health challenges (Burns and Birrell, 2014). For caregivers, effective interventions may include cognitive behavioural approaches (Wiegelmann et al., 2021) or those with caregiving-related information and education with or without professional psychological support (Sherifali et al., 2018). Psychiatrists and mental health professionals can also provide support for individuals with psychiatric conditions by reducing interruptions to care, promoting care-seeking behaviour when advisable, ensuring safe in-person care through widespread testing and contact tracing programs (Brody et al., 2021), and managing evolving scenarios (e.g., opportunities for remote versus in-person care) (Kahl and Correll, 2020; Kavoor

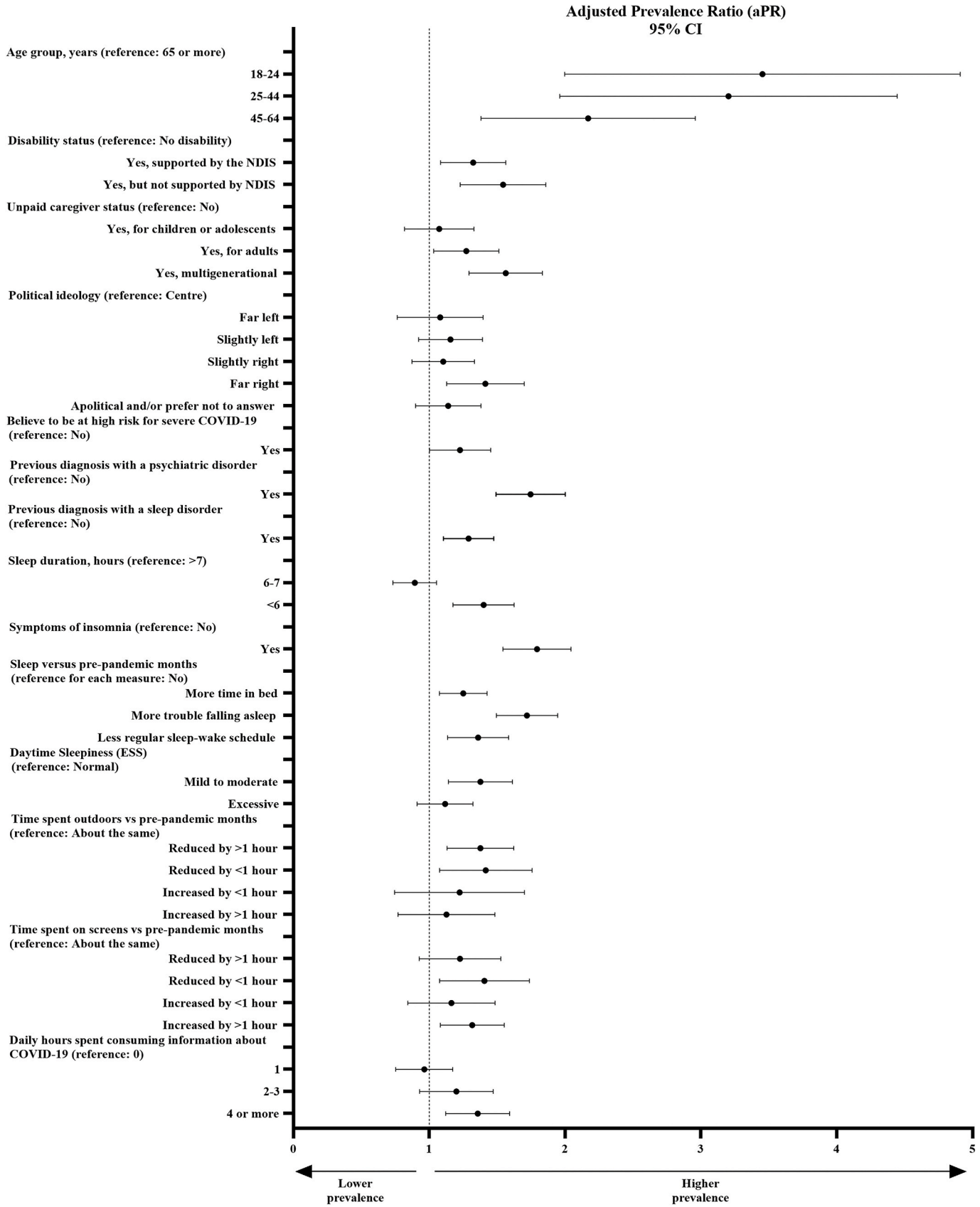

Fig. 2. Adjusted prevalence ratios for demographics, sleep, and changes in behaviour associated with at least one adverse mental and behavioural health symptom among Victorian adults in September 2020.

Table 4
Estimated adjusted prevalence ratios for adverse mental and behavioural health conditions among Victorian adults in September 2020, by medical history, sleep, and behavioural changes.

Mental or Behavioural Health Condition	Anxiety or Depressive Disorder Symptoms		*P*	Symptoms of a COVID-19 TSRD		*P*	Started or Increased Substance Use		*P*	Suicidal Ideation		*P*
Medical conditions, Sleep, and Behavioural Changes	aPR	[95% CI]	–	aPR	[95% CI]	–	aPR	[95% CI]	–	aPR	[95% CI]	–
HISTORY OF OR CURRENT HEALTH CONDITIONS												
Diagnosed with a psychiatric condition (reference: No)												
Yes	2.19	[1.79, 2.66]	<0.0001	1.90	[1.53, 2.37]	<0.0001	1.85	[1.28, 2.68]	0.0011	2.88	[2.07, 4.01]	<0.0001
Diagnosed with a sleep condition (reference: No)												
Yes	1.77	[1.47, 2.13]	<0.0001	1.36	[1.11, 1.66]	0.0035	1.55	[1.10, 2.18]	0.012	1.94	[1.46, 2.57]	<0.0001
SLEEP MEASURES												
Diurnal preference (reference: Definite morning type)												
Rather morning type	1.17	[0.91, 1.49]	0.23	0.99	[0.78, 1.26]	0.96	0.73	[0.50, 1.05]	0.093	0.94	[0.68, 1.29]	0.70
Rather evening type	1.26	[0.97, 1.62]	0.082	1.02	[0.78, 1.33]	0.91	1.23	[0.80, 1.89]	0.34	0.87	[0.60, 1.26]	0.47
Definite evening type	1.15	[0.84, 1.57]	0.38	0.96	[0.69, 1.32]	0.80	0.71	[0.36, 1.42]	0.33	0.84	[0.51, 1.38]	0.49
Sleep duration, hours (reference: >7)												
<6	1.44	[1.15, 1.80]	0.0016	1.42	[1.11, 1.81]	0.0054	1.43	[0.92, 2.23]	0.11	1.46	[1.02, 2.08]	0.039
6–7	0.90	[0.72, 1.14]	0.40	0.76	[0.58, 0.99]	0.046	1.06	[0.70, 1.62]	0.78	0.85	[0.59, 1.22]	0.37
Symptoms of insomnia (reference: No)												
Yes	1.97	[1.63, 2.37]	<0.0001	2.23	[1.83, 2.72]	<0.0001	2.06	[1.49, 2.86]	<0.0001	1.86	[1.38, 2.51]	0.0001
Compared with October through December 2019…												
More time in bed (reference: No)												
Yes	1.39	[1.16, 1.66]	0.0003	1.39	[1.14, 1.69]	0.0011	1.44	[1.04, 1.99]	0.030	1.47	[1.12, 1.92]	0.0054
Less time in bed (reference: No)												
Yes	0.94	[0.69, 1.29]	0.71	0.99	[0.71, 1.36]	0.93	1.04	[0.66, 1.62]	0.88	1.15	[0.81, 1.63]	0.43
More trouble falling asleep (reference: No)												
Yes	2.14	[1.80, 2.55]	<0.0001	1.83	[1.52, 2.21]	<0.0001	1.64	[1.19, 2.26]	0.0026	1.66	[1.25, 2.20]	0.0005
Less trouble falling asleep (reference: No)												
Yes	0.94	[0.68, 1.32]	0.73	0.91	[0.64, 1.28]	0.58	1.05	[0.65, 1.70]	0.85	0.76	[0.53, 1.09]	0.14
More regular sleep schedule (reference: No)												
Yes	0.72	[0.54, 0.96]	0.024	1.00	[0.78, 1.29]	0.98	1.06	[0.68, 1.64]	0.80	0.76	[0.51, 1.15]	0.20
Less regular sleep schedule (reference: No)												
Yes	1.44	[1.17, 1.79]	0.0008	1.52	[1.20, 1.92]	0.0005	1.62	[1.08, 2.44]	0.019	1.31	[0.92, 1.85]	0.13
Daytime sleepiness (reference: Normal)												
Mild to moderate	1.67	[1.34, 2.09]	<0.0001	1.48	[1.16, 1.88]	0.0018	0.88	[0.60, 1.29]	0.51	1.28	[0.92, 1.78]	0.15
Excessive	1.21	[0.94, 1.55]	0.14	1.31	[1.02, 1.70]	0.038	0.92	[0.62, 1.37]	0.70	1.36	[0.93, 1.97]	0.11
BEHAVIOURAL CHANGES												
Compared with October through December 2019…												
Time spent outdoors (reference: About the same)												
Reduced by more than 1 h	1.42	[1.12, 1.80]	0.0041	1.25	[0.97, 1.60]	0.082	1.69	[1.08, 2.64]	0.021	1.47	[1.02, 2.11]	0.039
Reduced by less than 1 h	1.53	[1.10, 2.14]	0.012	1.36	[0.97, 1.91]	0.075	1.03	[0.58, 1.82]	0.93	1.55	[0.93, 2.58]	0.096
Increased by less than 1 h	0.84	[0.43, 1.65]	0.61	1.12	[0.69, 1.81]	0.65	1.83	[0.96, 3.50]	0.066	0.98	[0.50, 1.94]	0.96
Increased by more than 1 h	1.02	[0.66, 1.57]	0.94	1.06	[0.66, 1.69]	0.81	1.96	[0.98, 3.89]	0.057	1.53	[0.82, 2.86]	0.18
Time spent on screens (reference: About the same)												
Reduced by more than 1 h	1.47	[1.09, 1.99]	0.012	1.24	[0.89, 1.72]	0.20	1.45	[0.83, 2.52]	0.19	1.08	[0.70, 1.67]	0.73
Reduced by less than 1 h	1.21	[0.79, 1.85]	0.38	1.31	[0.90, 1.90]	0.16	1.49	[0.73, 3.04]	0.27	1.11	[0.67, 1.85]	0.69
Increased by less than 1 h	1.06	[0.74, 1.52]	0.75	1.07	[0.71, 1.61]	0.75	1.05	[0.55, 2.00]	0.88	1.24	[0.76, 2.00]	0.39
Increased by more than 1 h	1.28	[1.01, 1.62]	0.04	1.30	[1.01, 1.69]	0.044	2.03	[1.29, 3.17]	0.0021	0.84	[0.58, 1.23]	0.38
Daily hours spent following COVID-19 (reference: 0)												

(*continued on next page*)

Table 4 (*continued*)

Mental or Behavioural Health Condition	Anxiety or Depressive Disorder Symptoms		*P*	Symptoms of a COVID-19 TSRD		*P*	Started or Increased Substance Use		*P*	Suicidal Ideation		*P*
Medical conditions, Sleep, and Behavioural Changes	aPR	[95% CI]	–	aPR	[95% CI]	–	aPR	[95% CI]	–	aPR	[95% CI]	–
1	0.92	[0.69, 1.24]	0.60	0.74	[0.51, 1.07]	0.11	0.81	[0.44, 1.50]	0.51	0.92	[0.56, 1.51]	0.73
2–3	1.19	[0.86, 1.64]	0.30	1.12	[0.75, 1.67]	0.58	0.95	[0.46, 1.95]	0.89	1.09	[0.61, 1.94]	0.78
≥4	1.25	[0.97, 1.62]	0.084	1.39	[1.06, 1.82]	0.016	1.82	[1.27, 2.59]	0.0010	1.44	[1.03, 2.03]	0.035

COVID-19 = coronavirus disease 2019, TSRD = trauma- and stressor-related disorder, aPR = adjusted prevalence ratio, CI = confidence interval.

et al., 2020; Moreno et al., 2020; The Lancet Infectious Diseases, 2020).

4.1. Limitations

This study had several limitations. Outcomes were self-reported rather than determined via diagnostic interviews, and it is possible that the survey instrument did not capture some changes in prevalence of adverse mental health symptoms. We did, however, use validated questionnaires for common mental health outcomes (anxiety, depression), which have shown high correspondence with diagnoses. Furthermore, data from participants willing to undergo lengthy diagnostic interviews may be less generalisable. Additionally, although quota sampling and survey weighting to Census data were used to strengthen generalisability, the sample may not generalise to the 2020 Victorian adult population due to potential residual differences between responders compared to the general population. Moreover, because we measured a cross-section of primarily different participants at each timepoint, we had limited power to examine longitudinal changes within individuals; however, evidence of significant survivorship bias in longitudinal mental health surveys may reduce the representativeness of such studies (Czeisler et al., 2021d). Seasonal variation in mood is a potential cofounding factor in our study. Our data were, however, collected in April (mid-autumn) and September (spring), with photoperiod length differences of 46 min (longer in September than April) and average temperature differences of 2 °C (warmer in April than September). Previous longitudinal studies in Victoria found no seasonal variation in negative affect (Murray et al., 2001) and a population-based study of more than 150,000 participants in the UK suggest very small variations in depressive symptoms in women and none in men (Lyall et al., 2018). It is therefore unlikely seasonal variations in adverse mental health symptoms meaningfully altered our results. Assessment of this was not feasible while comparing the effect of the duration of exposure to the pandemic and related lockdowns. Finally, as we did not have pre-pandemic cross-sections of data, our findings do not answer the question as to whether these prevalence estimates represent increases compared with previous years; however, longitudinal surveys suggest that the prevalence of psychological distress increased in Australia, and particularly in Victoria (Biddle et al, 2020a, 2020b).

5. Conclusions

Despite a relatively low prevalence of SARS-CoV-2 and efforts to increase availability of mental health services, poor mental and behavioural health symptoms were common in Victoria, Australia in September 2020, during one of the longest lockdowns globally. Given evidence of direct mental health effects of COVID-19, policymakers should not subscribe to the false choice between COVID-19 containment and mental health, as failing to control the former could significantly worsen the latter. However, our findings suggest that adverse mental health symptoms were common, even in a region with low SARS-CoV-2 prevalence. Therefore, as policymakers worldwide deliberate about the duration and intensity of COVID-19 mitigation policies now and during future waves of SARS-CoV-2 and other pathogens, it is essential that they account for the indirect mental health effects of such actions and implement strategies to attenuate them.

Funding statement

Primary support for the September survey data was provided by the Turner Institute for Brain and Mental Health, Monash University. The study was also supported in part by the Institute for Breathing and Sleep, Austin Health; and by a gift to the Harvard Medical School and Brigham and Women's Hospital from Philips Respironics, Inc; by a gift to Brigham and Women's Hospital from Alexandra Drane, the CEO of ARCHANGELS; by a contract from WHOOP, Inc., to Monash University; and by an Australian-American Fulbright Scholarship funded by The Kinghorn Foundation. The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation or approval of the manuscript; and decision to submit the manuscript for publication.

CRediT authorship contribution statement

Mark É. Czeisler: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. **Joshua F. Wiley:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Elise R. Facer-Childs:** Methodology, Visualization, Writing – review & editing. **Rebecca Robbins:** Methodology, Writing – review & editing. **Matthew D. Weaver:** Methodology, Writing – review & editing. **Laura K. Barger:** Methodology, Writing – review & editing. **Charles A. Czeisler:** Conceptualization, Investigation, Methodology, Writing – review & editing. **Mark E. Howard:** Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing. **Shantha M.W. Rajaratnam:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

M.É. Czeisler, C.A. Czeisler, M.E. Howard, and S.M.W. Rajaratnam reported receiving institutional contracts to Monash University to support The COVID-19 Outbreak Public Evaluation (COPE) Initiative from the CDC Foundation with funding from BNY Mellon and from WHOOP, Inc., as well as a gift from Hopelab, Inc. M.É. Czeisler reported receiving grants from the Australian-American Fulbright Commission administered through a 2020–2021 Fulbright Future Scholarship funded by The Kinghorn Foundation during the conduct of the study and receiving personal fees from Vanda Pharmaceuticals outside the submitted work. E.R. Facer-Childs reported a grant from the Science and Industry Endowment Fund Ross Metcalf STEM+ Business Fellowship administered by the Commonwealth Scientific and Industrial Research Organisation, Canberra, Australia. R. Robbins reported personal fees from

Denihan Hospitality, Rituals Cosmetics, SleepCycle, Dagmejan, and byNacht. L.K. Barger reported a grant from the National Institute for Occupational Safety and Health and personal fees from the University of Pittsburgh, CurAegis, Casis, Puget Sound Pilots, Boston Children's Hospital, and Charles A. Czeisler. C.A. Czeisler reported receiving grants to support The COPE Initiative and grants from Brigham and Women's Physician's Organization during the conduct of the study; being a paid consultant to or speaker for Ganésco, Institute of Digital Media and Child Development, Klarman Family Foundation, M. Davis and Co, Physician's Seal, Samsung Group, State of Washington Board of Pilotage Commissioners, Tencent Holdings, Teva Pharma Australia, and Vanda Pharmaceuticals, in which C.A. Czeisler holds an equity interest; receiving travel support from Aspen Brain Institute, Bloomage International Investment Group, UK Biotechnology and Biological Sciences Research Council, Bouley Botanical, Dr. Stanley Ho Medical Development Foundation, Illuminating Engineering Society, National Safety Council, Tencent Holdings, and The Wonderful Co; receiving institutional research and/or education support from Cephalon, Mary Ann and Stanley Snider via Combined Jewish Philanthropies, Harmony Biosciences, Jazz Pharmaceuticals PLC, Johnson and Johnson, Neurocare, Peter Brown and Margaret Hamburg, Philips Respironics, Regeneron Pharmaceuticals, Regional Home Care, Teva Pharmaceuticals Industries, Sanofi S.A., Optum, ResMed, San Francisco Bar Pilots, Schneider National, Serta, Simmons Betting, Sysco, Vanda Pharmaceuticals; being or having been an expert witness in legal cases, including those involving Advanced Power Technologies; Aegis Chemical Solutions; Amtrak; Casper Sleep; C and J Energy Services; Complete General Construction; Dallas Police Association; Enterprise Rent-A-Car; Steel Warehouse Co; FedEx; Greyhound Lines; Palomar Health District; PAR Electrical, Product, and Logistics Services; Puckett Emergency Medical Services; South Carolina Central Railroad Co; Union Pacific Railroad; UPS; and Vanda Pharmaceuticals; serving as the incumbent of an endowed professorship provided to Harvard University by Cephalon; and receiving royalties from McGraw Hill and Philips Respironics for the Actiwatch-2 and Actiwatch Spectrum devices. C.A. Czeisler's interests were reviewed and are managed by the Brigham and Women's Hospital and Mass General Brigham in accordance with their conflict of interest policies. S.M.W. Rajaratnam reported receiving institutional consulting fees from CRC for Alertness, Safety, and Productivity; Teva Pharmaceuticals; Vanda Pharmaceuticals; Circadian Therapeutics; BHP Billiton; and Herbert Smith Freehills; receiving grants from Teva Pharmaceuticals and Vanda Pharmaceuticals; and serving as chair for the Sleep Health Foundation outside the submitted work. No other disclosures were reported.

Acknowledgements

M.É. Czeisler was supported by The Kinghorn Foundation through a 2020 Australian-American Fulbright Scholarship. J.F. Wiley was supported by a NHMRC fellowship (1178487). E.R. Facer-Childs was supported by the Department of Industry, Innovation and Science (Australian Government, ICG000899), and a Science Industry Endowment (SEIF) Fund Ross Metcalf STEM+ Business Fellowship administered by the Commonwealth Scientific Industrial Research Organisation (CSIRO). R. Robbins was supported by the National Heart, Lung, and Blood Institute (K01HL150339). M.D. Weaver was supported in part by the National Institute for Occupational Safety and Health (R01OH011773) and the National Heart, Lung, and Blood Institute (R56HL151637). L.K. Barger and C.A. Czeisler were supported in part by the National Institute for Occupational Safety and Health (R01OH011773) and the National Institute on Aging (2R01 AG044416). C.A. Czeisler was supported in part by the National Institute on Aging (5P01AG 009975) and is the incumbent of an endowed professorship provided to the Harvard Medical School by Cephalon, Inc. The authors thank The COPE Initiative survey respondents, and Qualtrics research services team that supported the data collection: Mallory Colys, Rebecca Toll, Sneha Baste, and Daniel Chong.

References

Ammerman, B.A., Burke, T.A., Jacobucci, R., McClure, K., 2021. Preliminary investigation of the association between COVID-19 and suicidal thoughts and behaviors in the U.S. J. Psychiatr. Res. 134, 32–38. https://doi.org/10.1016/j.jpsychires.2020.12.037.

Australian Government, 2020. Mental Health Services in Australia, Mental Health Impact of COVID-19. Australian Institute of Health and Welfare accessed 6.1.21. https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia/report-contents/mental-health-impact-of-covid-19.

Australian Government Department of Health, 2020. Coronavirus (COVID-19) Current Situation and Case Numbers. Australian Government Department of Health [WWW Document]. https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert/coronavirus-covid-19-current-situation-and-case-numbers. accessed 3.24.21.

Biddle, N., Edwards, B., Gray, M., Sollis, K., 2020a. ANU Poll 2020: COVID-19 attitudes and behaviours. Wavelength 2 (May). https://doi.org/10.26193/GNEHCQ.

Biddle, N., Edwards, B., Gray, M., Sollis, K., 2020b. ANU Poll 2020: COVID-19 attitudes and behaviours. Wavelength 3 (August). https://doi.org/10.26193/ZFGFNE.

Boldrini, M., Canoll, P.D., Klein, R.S., 2021. How COVID-19 affects the Brain. JAMA Psychiatr. 78 (6), 682–683. https://doi.org/10.1001/jamapsychiatry.2021.0500.

Brody, B.D., Shi, Z., Shaffer, C., Eden, D., Wyka, K., Alexopoulos, G.S., Parish, S.J., Kanellopoulos, D., 2021. COVID-19 infection rates in patients referred for psychiatric admission during a regional surge: the case for universal testing. Psychiatr. Res. 298, 113833. https://doi.org/10.1016/j.psychres.2021.113833.

Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., Rubin, G.J., 2020. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 395, 912–920. https://doi.org/10.1016/S0140-6736(20)30460-8, 10227.

Burns, J., Birrell, E., 2014. Enhancing early engagement with mental health services by young people. Psychol. Res. Behav. Manag. 7, 303–312. https://doi.org/10.2147/PRBM.S49151.

C.D.C., 2020. Estimated disease burden of COVID-19. accessed 1.24.21. https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/burden.html.

Chisholm, D., Sweeny, K., Sheehan, P., Rasmussen, B., Smit, F., Cuijpers, P., Saxena, S., 2016. Scaling-up treatment of depression and anxiety: a global return on investment analysis. Lancet Psychiatr. 3, 415–424. https://doi.org/10.1016/S2215-0366(16)30024-4.

Czeisler, M.É., Howard, M.E., Rajaratnam, S.M.W., 2021. Direct and indirect mental health consequences of the COVID-19 pandemic parallel prior pandemics. Am. J. Public Health 111 (9). https://doi.org/10.2105/AJPH.2021.306460 (in press).

Czeisler, M.É., Lane, R.I., Petrosky, E., Wiley, J.F., Christensen, A., Njai, R., Weaver, M. D., Robbins, R., Facer-Childs, E.R., Barger, L.K., Czeisler, C.A., Howard, M.E., Rajaratnam, S.M.W., 2020. Mental health, substance use, and suicidal ideation during the COVID-19 pandemic - United States, June 24-30, 2020. MMWR Morb. Mortal. Wkly. Rep. 69 (32), 1049–1057. https://doi.org/10.15585/mmwr.mm6932a1.

Czeisler, M.É., Howard, M.E., Robbins, R., Barger, L.K., Facer-Childs, E.R., Rajaratnam, S. M.W., Czeisler, C.A., 2021a. Early public adherence with and support for stay-at-home COVID-19 mitigation strategies despite adverse life impact: a transnational cross-sectional survey study in the United States and Australia. BMC Publ. Health 21, 503. https://doi.org/10.1186/s12889-021-10410-x.

Czeisler, M.É., Lane, R.I., Wiley, J.F., Czeisler, C.A., Howard, M.E., Rajaratnam, S.M.W., 2021b. Follow-up survey of US adult reports of mental health, substance use, and suicidal ideation during the COVID-19 pandemic, September 2020. JAMA Netw. Open 4 (2), e2037665. https://doi.org/10.1001/jamanetworkopen.2020.37665.

Czeisler, M.É., Rohan, E.R., Melillo, S., Matjasko, J.L., DePadilla, L., Patel, C.G., Weaver, M.D., Drane, A., Winnay, S.S., Capodilupo, E.R., Robbins, R., Wiley, J.F., Facer-Childs, E.R., Barger, L.K., Czeisler, C.A., Howard, M.E., Rajaratnam, S.M.W., 2021c. Mental health among parents of children aged <18 Years and unpaid caregivers of adults during the COVID-19 pandemic — United States, December 2020 and February-March 2021. MMWR Morb. Mortal. Wkly. Rep. 70 (24), 879–887. https://doi.org/10.15585/mmwr.mm7024a3.

Czeisler, M.É., Wiley, J.F., Czeisler, C.A., Rajaratnam, S.M.W., Howard, M.E., 2021d. Uncovering survivorship bias in longitudinal mental health surveys during the COVID-19 pandemic. Epidemiol. Psychiatr. Sci. 30, e45. https://doi.org/10.1017/S204579602100038X.

Dawel, A., Shou, Y., Smithson, M., Cherbuin, N., Banfield, M., Calear, A.L., Farrer, L.M., Gray, D., Gulliver, A., Housen, T., McCallum, S.M., Morse, A.R., Murray, K., Newman, E., Rodney Harris, R.M., Batterham, P.J., 2020. The effect of COVID-19 on mental health and wellbeing in a representative sample of Australian adults. Front. Psychiatr. 11, 579985. https://doi.org/10.3389/fpsyt.2020.579985.

Dong, E., Du, H., Gardner, L., 2020. An interactive web-based dashboard to track COVID-19 in real time. Lancet Infect. Dis. 20 (5), 533–534. https://doi.org/10.1016/S1473-3099(20)30120-1.

Ettman, C.K., Abdalla, S.M., Cohen, G.H., Sampson, L., Vivier, P.M., Galea, S., 2020. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. JAMA Netw. Open 3 (9), e2019686. https://doi.org/10.1001/jamanetworkopen.2020.19686.

Facer-Childs, E.R., Hoffman, D., Tran, J.N., Drummond, S.P.A., Rajaratnam, S.M.W., 2021. Sleep and mental health in athletes during COVID-19 lockdown. Sleep 44 (5), zsaa261. https://doi.org/10.1093/sleep/zsaa261.

Fisher, J.R., Tran, T.D., Hammarberg, K., Sastry, J., Nguyen, H., Rowe, H., Popplestone, S., Stocker, R., Stubber, C., Kirkman, M., 2020. Mental health of people in Australia in the first month of COVID-19 restrictions: a national survey. Med. J. Aust. 213 (10), 458–464. https://doi.org/10.5694/mja2.50831.

Galea, S., Merchant, R.M., Lurie, N., 2020. The mental health consequences of COVID-19 and physical distancing: the need for prevention and early intervention. JAMA Intern. Med. 180 (6), 817–818. https://doi.org/10.1001/jamainternmed.2020.1562.

Harvey, S.B., Deady, M., Wang, M.-J., Mykletun, A., Butterworth, P., Christensen, H., Mitchell, P.B., 2017. Is the prevalence of mental illness increasing in Australia? Evidence from national health surveys and administrative data. Med. J. Aust. 206 (11), 490–493. https://doi.org/10.5694/mja16.00295, 2001-2014.

Kahl, K.G., Correll, C.U., 2020. Management of patients with severe mental illness during the coronavirus disease 2019 pandemic. JAMA Psychiatr. 77 (9), 977–978. https://doi.org/10.1001/jamapsychiatry.2020.1701.

Kavoor, A.R., Chakravarthy, K., John, T., 2020. Remote consultations in the era of COVID-19 pandemic: preliminary experience in a regional Australian public acute mental health care setting. Asian J. Psychiatr. 51, 102074. https://doi.org/10.1016/j.ajp.2020.102074.

Löwe, B., Kroenke, K., Herzog, W., Gräfe, K., 2004. Measuring depression outcome with a brief self-report instrument: sensitivity to change of the Patient Health Questionnaire (PHQ-9). J. Affect. Disord. 81 (1), 61–66. https://doi.org/10.1016/S0165-0327(03)00198-8.

Löwe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., Schneider, A., Brähler, E., 2010. A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. J. Affect. Disord. 122 (1–2), 86–95. https://doi.org/10.1016/j.jad.2009.06.019.

Lyall, L.M., Wyse, C.A., Graham, N., Ferguson, A., Lyall, D.M., Cullen, B., Celis Morales, C.A., Biello, S.M., Mackay, D., Ward, J., Strawbridge, R.J., Gill, J.M.R., Bailey, M.E.S., Pell, J.P., Smith, D.J., 2018. Association of disrupted circadian rhythmicity with mood disorders, subjective wellbeing, and cognitive function: a cross-sectional study of 91 105 participants from the UK Biobank. Lancet Psychiatr. 5 (6), 507–514. https://doi.org/10.1016/S2215-0366(18)30139-1.

Meaklim, H., Junge, M.F., Varma, P., Finck, W.A., Jackson, M.L., 2021. Pre-existing and post-pandemic insomnia symptoms are associated with high levels of stress, anxiety and depression globally during the COVID-19 pandemic. J. Clin. Sleep Med. https://doi.org/10.5664/jcsm.9354.

Meinhardt, J., Radke, J., Dittmayer, C., Franz, J., Thomas, C., Mothes, R., Laue, M., Schneider, J., Brünink, S., Greuel, S., Lehmann, M., Hassan, O., Aschman, T., Schumann, E., Chua, R.L., Conrad, C., Eils, R., Stenzel, W., Windgassen, M., Rößler, L., Goebel, H.-H., Gelderblom, H.R., Martin, H., Nitsche, A., Schulz-Schaeffer, W.J., Hakroush, S., Winkler, M.S., Tampe, B., Scheibe, F., Körtvélyessy, P., Reinhold, D., Siegmund, B., Kühl, A.A., Elezkurtaj, S., Horst, D., Oesterhelweg, L., Tsokos, M., Ingold-Heppner, B., Stadelmann, C., Drosten, C., Corman, V.M., Radbruch, H., Heppner, F.L., 2021. Olfactory transmucosal SARS-CoV-2 invasion as a port of central nervous system entry in individuals with COVID-19. Nat. Neurosci. 24 (2), 168–175. https://doi.org/10.1038/s41593-020-00758-5.

Moreno, C., Wykes, T., Galderisi, S., Nordentoft, M., Crossley, N., Jones, N., Cannon, M., Correll, C.U., Byrne, L., Carr, S., Chen, E.Y.H., Gorwood, P., Johnson, S., Kärkkäinen, H., Krystal, J.H., Lee, J., Lieberman, J., López-Jaramillo, C., Männikkö, M., Phillips, M.R., Uchida, H., Vieta, E., Vita, A., Arango, C., 2020. How mental health care should change as a consequence of the COVID-19 pandemic. Lancet Psychiatr. 7 (9), 813–824. https://doi.org/10.1016/S2215-0366(20)30307-2.

Murray, G., Allen, N.B., Trinder, J., 2001. A longitudinal investigation of seasonal variation in mood. Chronobiol. Int. 18 (5), 875–891. https://doi.org/10.1081/cbi-100107522.

Neill, E., Meyer, D., Toh, W.L., van Rheenen, T.E., Phillipou, A., Tan, E.J., Rossell, S.L., 2020. Alcohol use in Australia during the early days of the COVID-19 pandemic: initial results from the COLLATE project. Psychiatr. Clin. Neurosci. 74 (10), 542–549. https://doi.org/10.1111/pcn.13099.

Perlis, R.H., Ognyanova, K., Santillana, M., Baum, M.A., Lazer, D., Druckman, J., Della Volpe, J., 2021. Association of acute symptoms of COVID-19 and symptoms of depression in adults. JAMA Netw. Open 4 (3), e213223. https://doi.org/10.1001/jamanetworkopen.2021.3223.

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., Kontopantelis, E., Webb, R., Wessely, S., McManus, S., Abel, K.M., 2020. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. Lancet Psychiatr. 7 (10), 883–892. https://doi.org/10.1016/S2215-0366(20)30308-4.

Pollard, M.S., Tucker, J.S., Green, H.D., 2020. Changes in adult alcohol use and consequences during the COVID-19 pandemic in the US. JAMA Netw. Open 3 (9), e2022942. https://doi.org/10.1001/jamanetworkopen.2020.22942.

Reese, H., Iuliano, A.D., Patel, N.N., Garg, S., Kim, L., Silk, B.J., Hall, A.J., Fry, A., Reed, C., 2020. Estimated incidence of COVID-19 illness and hospitalization - United States, February-September, 2020. Clin. Infect. Dis. 72 (12), e1010–e1017. https://doi.org/10.1093/cid/ciaa1780.

Rogers, J.P., Chesney, E., Oliver, D., Pollak, T.A., McGuire, P., Fusar-Poli, P., Zandi, M.S., Lewis, G., David, A.S., 2020. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. Lancet Psychiatr. 7 (7), 611–627. https://doi.org/10.1016/S2215-0366(20)30203-0.

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, Shna, Mohammadi, M., Rasoulpoor, Shabnam, Khaledi-Paveh, B., 2020. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. Glob. Health 16 (1), 57. https://doi.org/10.1186/s12992-020-00589-w.

Sherifali, D., Ali, M.U., Ploeg, J., Markle-Reid, M., Valaitis, R., Bartholomew, A., Fitzpatrick-Lewis, D., McAiney, C., 2018. Impact of internet-based interventions on caregiver mental health: systematic review and meta-analysis. J. Med. Internet Res. 20 (7), e10668 https://doi.org/10.2196/10668.

Taquet, M., Geddes, J.R., Husain, M., Luciano, S., Harrison, P.J., 2021a. 6-month neurological and psychiatric outcomes in 236 379 survivors of COVID-19: a retrospective cohort study using electronic health records. Lancet Psychiatr. 8 (5), 416–427. https://doi.org/10.1016/S2215-0366(21)00084-5.

Taquet, M., Luciano, S., Geddes, J.R., Harrison, P.J., 2021b. Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. Lancet Psychiatr. 8 (2), 130–140. https://doi.org/10.1016/S2215-0366(20)30462-4.

The Lancet Infectious Diseases, 2020. The intersection of COVID-19 and mental health. Lancet Infect. Dis. 20 (11), 1217. https://doi.org/10.1016/S1473-3099(20)30797-0.

Toh, W.L., Meyer, D., Phillipou, A., Tan, E.J., Van Rheenen, T.E., Neill, E., Rossell, S.L., 2021. Mental health status of healthcare versus other essential workers in Australia amidst the COVID-19 pandemic: initial results from the collate project. Psychiatr. Res. 298, 113822. https://doi.org/10.1016/j.psychres.2021.113822.

Tran, T.D., Hammarberg, K., Kirkman, M., Nguyen, H.T.M., Fisher, J., 2020. Alcohol use and mental health status during the first months of COVID-19 pandemic in Australia. J. Affect. Disord. 277, 810–813. https://doi.org/10.1016/j.jad.2020.09.012.

Vahratian, A., Blumberg, S.J., Terlizzi, E.P., Schiller, J.S., 2020. Symptoms of anxiety or depressive disorder and use of mental health care among adults during the COVID-19 pandemic - United States. MMWR Morb. Mortal. Wkly. Rep. 70 (13), 490–494. https://doi.org/10.15585/mmwr.mm7013e2.

Van Rheenen, T.E., Meyer, D., Neill, E., Phillipou, A., Tan, E.J., Toh, W.L., Rossell, S.L., 2020. Mental health status of individuals with a mood-disorder during the COVID-19 pandemic in Australia: initial results from the COLLATE project. J. Affect. Disord. 275, 69–77. https://doi.org/10.1016/j.jad.2020.06.037.

Varma, P., Junge, M., Meaklim, H., Jackson, M.L., 2021. Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: a global cross-sectional survey. Prog. Neuro-Psychopharmacol. Biol. Psychiatry 109, 110236. https://doi.org/10.1016/j.pnpbp.2020.110236.

Verdery, A.M., Smith-Greenaway, E., Margolis, R., Daw, J., 2020. Tracking the reach of COVID-19 kin loss with a bereavement multiplier applied to the United States. Proc. Natl. Acad. Sci. U. S. A. 117 (30), 17695–17701. https://doi.org/10.1073/pnas.2007476117.

Wiegelmann, H., Speller, S., Verhaert, L.-M., Schirra-Weirich, L., Wolf-Ostermann, K., 2021. Psychosocial interventions to support the mental health of informal caregivers of persons living with dementia - a systematic literature review. BMC Geriatr. 21 (1), 94. https://doi.org/10.1186/s12877-021-02020-4.

Woo, M.S., Malsy, J., Pöttgen, J., Seddiq Zai, S., Ufer, F., Hadjilaou, A., Schmiedel, S., Addo, M.M., Gerloff, C., Heesen, C., Schulze Zur Wiesch, J., Friese, M.A., 2020. Frequent neurocognitive deficits after recovery from mild COVID-19. Brain Commun. 2 (2) https://doi.org/10.1093/braincomms/fcaa205 fcaa205.

Xiong, J., Lipsitz, O., Nasri, F., Lui, L.M.W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., McIntyre, R.S., 2020. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. J. Affect. Disord. 277, 55–64. https://doi.org/10.1016/j.jad.2020.08.001.