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

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Relationships with demographics, sleep, and behavioural changes and comparisons with acute-phase lockdowns

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Abstract

The COVID-19 pandemic and its mitigation have been associated with direct and indirect mental health consequences. Understanding whether acutely elevated adverse mental health symptoms are sustained in a region with one of the longest lockdowns and lowest COVID-19 prevalence globally (Victoria, Australia) can help inform the extent of indirect 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 within 30 days. Young adults, unpaid caregivers, those with disabilities, and those with pre-existing psychiatric or sleep conditions showed increased prevalence of adverse mental health symptoms. Prevalence of symptoms of burnout, anxiety, and depressive disorder were unchanged between April-2020 and September-2020. Persistently elevated adverse mental health symptoms despite low SARS-CoV-2 prevalence during prolonged lockdown suggests that indirect mental health consequences of the pandemic and its mitigation are sustained over time rather than transient and self-resolving. These findings highlight the urgent need for mental health support services.

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Abstract

The 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) mechanisms. 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 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 within 30 days. Young adults, unpaid caregivers, those with disabilities, and those with pre-existing psychiatric or sleep conditions showed increased prevalence of adverse mental health symptoms. Prevalence 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.

Keywords

Main Text

Introduction

The coronavirus disease 2019 (COVID-19) pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been associated with 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 socioeconomic factors (i.e., from stay-at-home orders, nonessential business closures, school closures, gathering bans, etc.). 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., 2021; 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 5.8% among individuals with no psychiatric history (Taquet et al., 2021), consient with evidence of neuropsychiatric symptoms following infection from other coronaviruses (Rogers et al., 2020).

Indirect mental health effects of the COVID-19 pandemic were also anticipated (Galea et al., 2020). Non-pharmaceutical interventions to contain COVID-19 have necessitated considerable social and economic disruption. Simultaneously, with 2.75 million COVID-19 deaths globally, 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., 2021a; Czeisler et al., 2020; Czeisler et al., 2021b; Ettman et al., 2020; Pierce et al., 2020; Pollard et al., 2020). Mental health disparities are apparent, with younger adults, those with pre-existing psychiatric conditions, unpaid caregivers, and essential workers disproportionately affected (Czeisler et al., 2020; 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. CDC estimates that nearly 80% of SARS-CoV-2 infections in the U.S. in 2020 were undetected (CDC, 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 robustly assess 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 (2020). Even if the true infection prevalence were manifold higher, it would likely remain below 2% of the population.

The low prevalence may be related to stringent mitigation policies (Figure 1), including sustained border closures, enforced physical distancing, work-from-home directives, stay-at-home orders, education and industry closures, and visitor and public gathering bans. After restrictions briefly began to ease in late May, 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, a five-kilometre distance-from-residence travel restriction, and one-hour outdoor-exercise limit. These lockdowns were maintained through the September-2020 survey interval, before staged reopening 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 (Lowe et al., 2004; Lowe et al., 2010). Across Australia, in late March 2020 near the new of the pandemic, a survey study found the prevalence 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 those 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, the prevalence 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 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 those with diagnosed mental health conditions disproportionately experiencing symptoms (Varma et al., 2020). 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 the prevalence of common mental health conditions (predominantly anxiety and depression) was stable around 11% to 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) 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 mental health (70.0% and 54.8%, respectively of those with *vs* without a pre-existing mental health condition) (Van Rheenen et al., 2020); surveys have 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 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 high prevalence of adverse mental health symptoms persists during one of the longest 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 the prevalence of adverse mental and behavioural health during September 2020 with those during acute phase of lockdowns in Victoria. We analysed the associations between adverse symptoms and demographic characteristics, sleep, and behavioural changes, with the aim of identifying areas for targeted interventions to improve mental health.

Methods

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).

Setting and Participants

The April-2020 wave consisted of adults aged ≥18 years with Australian residence, and this analysis focused on 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 population, the September-2020 wave consisted of adults aged ≥18 years with Victorian-only residents. 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 by sex, age, and ancestry. The study was approved by the Monash University Human Research Ethics Committee. Respondents provided electronic consent. Monte Carlo simulation power analyses showed that for $\alpha=0.05$, base prevalence of adverse mental health symptoms between 15%-40% in April, a ≥9% absolute difference in the September compared to April cohort, 300 participants in April and 1200 in September cohorts provides ≥ 78% − 93% power, depending on the assumed prevalence in April and whether September is 9% absolute difference higher or lower.

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 related to the pandemic, and past-month passive suicidal ideation (i.e., wished to be dead) and serious suicidal ideation. Details are provided in the appendix (pp 1,2).

Explanatory Measures

Demographic variables in both waves included sex, age, ancestry, education 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 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 hours, 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 outside 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.

Statistical methods

Analyses were conducted on three samples: Victorian-April (the subset of the April sample from Victoria); Victorian-September (the cross-sectional Victorian sample from September-2020); 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 education attainment according to the 2016 Census of Population and Housing General Community Profile Victorian population estimates. Prevalence was 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 sample. 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 repeated-measures sampling bias. Bonferroni adjustments were applied to account for the 13 outcome comparisons (i.e., 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, unpaid caregiver status, regional *vs* metropolitan postcode classification, political ideation, 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 (appendix pp 2-5). Exploratory longitudinal analyses are described in the appendix (p 5). Statistical significance was set at two-sided p<0.05.

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=331 [99.1%]; Victorian-September n=1249 [98.4%]; Victorian-Longitudinal n=92 [98.9%]). Demographics are summarized in Table 1.

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 within 30 days, and 110 (9.5%) reported past-month serious suicidal ideation. Asking participants to reflect on their sleep during COVID-19 compared to prior to 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 sleeping. 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-hour increased screen time and >1-hour reduced time spent outdoors during daylight hours were reported by 525 (45.4%) and 586 (50.7%), respectively, and 853 (73.7%) reported not consuming information about COVID-19, compared to 43 (3.8%) who reported spending ≥4 hours doing so daily.

There were no significant differences in prevalence of 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. A significantly greater percentage of respondents in the Victorian-September sample reported >1-hour increased screen time than the Victorian-April sample (+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 in mental health by age, disability status, unpaid caregiver status, political ideation, COVID-19 risk perception (Table 3, Figure 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 those 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 for 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 two-fold increased 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, behavioural changes (Table 4, Figure 2). For example, suicidal ideation was nearly three-fold more prevalent among respondents with *vs* without previously diagnosed psychiatric conditions (2.88, 2.07-4.01, p<0.0001), and nearly two-fold more prevalent among

those with 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 hours (e.g., suicidal ideation, 1.46, 1.02-2.08, p=0.039, *vs* >7 hours), 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 hour per day reduction in time spent outdoors during daylight (e.g., suicidal ideation, 1.47, 1.02-2.11, p=0.039), >1 hour per day increase in time on screens (e.g., substance use, 2.03, 1.29-3.17, p=0.0021), and ≥28 hours per week spent following COVID-19 media coverage (e.g., suicidal ideation, 1.44, 1.03-2.03, p=0.036).

Figure 2 shows key variables associated with increased prevalence of having experienced at least one adverse mental or behavioural health symptom, with two- to three-fold increased 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≤0.0001), 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 those with disabilities who do not qualify for NDIS *vs* without disabilities (1.52, 1.24-1.87, p<0.0001) (Figure 2, appendix pp 12,13). In the model for at least one adverse mental or behavioural health symptom, 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.

Discussion

In September 2020, during one of the longest global lockdowns in a region with low SARS-CoV-2 prevalence, approximately one-third of 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 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 September 2020 (Czeisler

et al., 2021a; Czeisler et al., 2020; Czeisler et al., 2021b; Ettman et al., 2020), and estimates from meta-analyses during COVID-19 (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 prevalence of adverse mental health symptoms were observed in a region with comparatively low SARS-CoV-2 prevalence, these findings may 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 (2020b), which may reflect greater need for and access to these resources and be one reason that the prevalence of poor mental health in Victoria has not increased from April to September, despite one of the world's longest lockdowns.

Our findings also highlight mental health disparities. Adults aged <45 years, those with disabilities, and multigenerational caregivers experienced disproportionate burdens of almost all forms of adverse mental and behavioural health symptoms, results consistent with U.S. studies of mental health during COVID-19 (Czeisler et al., 2020; Czeisler et al., 2021b). Moreover, pre-existing psychiatric or sleep disorders and insomnia symptoms were robustly associated with higher prevalence of poor outcomes, consistent with prior evidence (Czeisler et al., 2021b; Varma et al., 2020; Xiong et al., 2020). Examining behaviours, compared to April, Victorians in September spent more time on screens 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 of all assessed adverse mental health symptoms, and increased time on screens were associated with higher prevalence of anxiety or depression

symptoms. More regular sleep times and spending less time following COVID-19 were associated with lower prevalence of anxiety or depression symptoms.

These results, which are consistent with findings in 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 population to seek professional mental health care despite the high prevalence of mental health challenges (Burns and Birrell, 2014). For caregivers for adults, 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 tracing (Brody et al., 2021), and managing evolving scenarios (e.g., opportunities for remote versus in-person care) (Kahl and Correll, 2020; Kavoor et al., 2020; Moreno et al., 2020; The Lancet Infectious, 2020).

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 Victorian adults

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., 2021c). 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 minutes (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 could not have reasonably been done at the same time as comparing the effect of the duration of exposure to the pandemic and related lockdowns. Finally, as we did not have pre-pandemic cross-sections, our data 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, b).

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.

References

1. 2020. Coronavirus (COVID-19) current situation and case numbers.
   https://www.health.gov.au/news/health-alerts/novel-coronavirus-2019-ncov-health-alert/coronavirus-covid-19-current-situation-and-case-numbers#cases-active-cases-and-deaths-by-state-and-territory. (Accessed 24 March 2021).

2. 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.

3. Biddle, N., Edward, B., Gray, M., Sollis, K., 2020a. Mental health and relationships during the COVID-19 pandemic. COVID–19 Briefing Paper, ANU Centre for Social Research and Methods, Australian National University, Canberra.

4. Biddle, N., Edward, B., Gray, M., Sollis, K., 2020b. Tracking outcomes during the COVID-19 pandemic (August 2020) – Divergence within Australia. COVID–19 Briefing Paper, ANU Centre for Social Research and Methods, Australian National University, Canberra.

5. Boldrini, M., Canoll, P.D., Klein, R.S., 2021. How COVID-19 Affects the Brain. JAMA Psychiatry.

6. 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. Psychiatry Res 298, 113833.

7. Burns, J., Birrell, E., 2014. Enhancing early engagement with mental health services by young people. Psychol Res Behav Manag 7, 303-312.

8. CDC, 2020. Estimated Disease Burden of COVID-19. https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/burden.html. (Accessed January 27 2021).

9. 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 Psychiatry 3(5), 415-424.

10. Czeisler, M.E., 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 Public Health 21(1), 503.

11. Czeisler, M.E., 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.

12. Czeisler, M.E., 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.

13. Czeisler, M.E., Wiley, J.F., Czeisler, C.A., Rajaratnam, S.M., Howard, M.E., 2021c. Uncovering Survivorship Bias in Longitudinal Mental Health Surveys During the COVID-19 Pandemic. medRxiv.

14. 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 Psychiatry 11, 579985.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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, 2001-2014. Med J Aust 206(11), 490-493.

20. Kahl, K.G., Correll, C.U., 2020. Management of Patients With Severe Mental Illness During the Coronavirus Disease 2019 Pandemic. JAMA Psychiatry 77(9), 977-978.

21. 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.

22. Lowe, B., Kroenke, K., Herzog, W., Grafe, 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.

23. Lowe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., Schneider, A., Brahler, 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.

24. Lyall, L.M., Wyse, C.A., Celis-Morales, C.A., Lyall, D.M., Cullen, B., Mackay, D., Ward, J., Graham, N., Strawbridge, R.J., Gill, J.M.R., Ferguson, A., Bailey, M.E.S., Pell, J.P., Curtis, A.M., Smith, D.J., 2018. Seasonality of depressive symptoms in women but not in men: A cross-sectional study in the UK Biobank cohort. J Affect Disord 229, 296-305.

25. Meinhardt, J., Radke, J., Dittmayer, C., Franz, J., Thomas, C., Mothes, R., Laue, M., Schneider, J., Brunink, S., Greuel, S., Lehmann, M., Hassan, O., Aschman, T., Schumann, E., Chua, R.L., Conrad, C., Eils, R., Stenzel, W., Windgassen, M., Rossler, L., Goebel, H.H., Gelderblom, H.R., Martin, H., Nitsche, A., Schulz-Schaeffer, W.J., Hakroush, S., Winkler, M.S., Tampe, B., Scheibe, F., Kortvelyessy, P., Reinhold, D., Siegmund, B., Kuhl, 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.

26. 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., Karkkainen, H., Krystal, J.H., Lee, J., Lieberman, J., Lopez-Jaramillo, C., Mannikko, 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 Psychiatry 7(9), 813-824.

27. Murray, G., Allen, N.B., Trinder, J., 2001. A longitudinal investigation of seasonal variation in mood. Chronobiol Int 18(5), 875-891.

28. 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. Psychiatry Clin Neurosci.

29. 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.

30. 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 Psychiatry 7(10), 883-892.

31. Pollard, M.S., Tucker, J.S., Green, H.D., Jr., 2020. Changes in Adult Alcohol Use and Consequences During the COVID-19 Pandemic in the US. JAMA Netw Open 3(9), e2022942.

32. 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.

33. 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 Psychiatry 7(7), 611-627.

34. Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., Rasoulpoor, S., Khaledi-Paveh, B., 2020. Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. Global Health 16(1), 57.

35. 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.

36. Taquet, M., Luciano, S., Geddes, J.R., Harrison, P.J., 2021. Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. Lancet Psychiatry 8(2), 130-140.

37. The Lancet Infectious, D., 2020. The intersection of COVID-19 and mental health. Lancet Infect Dis 20(11), 1217.

38. 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. Psychiatry Res 298, 113822.

39. 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.

40. 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.

41. Varma, P., Junge, M., Meaklim, H., Jackson, M.L., 2020. Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: A global cross-sectional survey. Prog Neuropsychopharmacol Biol Psychiatry 109, 110236.

42. 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.

43. 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.

44. Woo, M.S., Malsy, J., Pottgen, 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), fcaa205.

45. 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.

Title

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

Subtitle

Relationships with demographics, sleep, and behavioural changes and comparisons with acute-phase lockdowns

Authors

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Table 1. Respondent characteristics by sample

	Victorian-April		Victorian-September*		Victorian-Longitudinal	
	n	**(%)**	**n**	**(%)**	**n**	**(%)**
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						
Straight	-	-	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)						
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 for adults	-	-	156	(13.5)	8	(9.0)
Unpaid caregiver for 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						
Believe to be at high risk for severe COVID-19	64	(19.3)	194	(16.7)	16	(17.0)
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)
State or territory of residence						
Victoria (VIC)	331	(100)	1157	(100)	92	(100)
New South Wales (NSW)	0	(0.0)	0	(0.0)	0	(0.0)
Queensland (QLD)	0	(0.0)	0	(0.0)	0	(0.0)
South Australia (SA)	0	(0.0)	0	(0.0)	0	(0.0)
West Australia (WA)	0	(0.0)	0	(0.0)	0	(0.0)
Tasmania (TAS)	0	(0.0)	0	(0.0)	0	(0.0)
Australian Capital Territory (ACT)	0	(0.0)	0	(0.0)	0	(0.0)
Northern Territory (NT)	0	(0.0)	0	(0.0)	0	(0.0)

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

* Excludes recontacted respondents

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 (minus recontacts)		September vs April 2020	
	n	(% [95% CI])	n	(% [95% CI])	(Δ % [95% CI])	*P**
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, 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, 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 hours	48	(14.6 [10.8, 19.6])	204	(17.6 [(15.1, 20.5)])	(3.0 [-3.5, 9.5])	>0.99
6-7 hours	87	(26.4 [21.5, 32.0])	285	(24.7 [(22.0, 27.5)])	(-1.7 [-9.6, 6.2])	>0.99
>7 hours	195	(59.0 [52.8, 64.9])	668	(57.7 [(54.4, 61.0)])	(-1.3 [-10.1, 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, 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, 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, 10.6])	>0.99
Less trouble sleeping	11	(3.4 [1.8, 6.2])	67	(5.8 [(4.4, 7.6)])	(2.4 [-1.1, 5.9])	>0.99
More regular sleep	32	(9.6 [6.8, 13.4])	154	(13.3 [(11.3, 15.7)])	(3.7 [-1.8, 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, 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, 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 hour	25	(7.5 [4.9, 11.3])	92	(7.9 [(6.2, 10.1)])	(0.4 [-4.3, 5.2])	>0.99
Reduced by less than 1 hour	11	(3.4 [1.8, 6.3])	46	(4.0 [(2.8, 5.7)])	(0.6 [-2.8, 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, -5.3])	<0.0001
Increased by less than 1 hour	22	(6.6 [4.1, 10.3])	90	(7.8 [(6.1, 9.7)])	(1.2 [-3.4, 5.7])	>0.99
Increased by more than 1 hour	111	(33.4 [28.2, 39.0])	525	(45.4 [42.1, 48.7])	(12.0 [3.4, 20.6])	0.0013
Time spent outside during daylight hours compared with before the pandemic…						
Reduced by more than 1 hour	144	(43.5 [37.6, 49.6])	586	(50.7 [(47.3, 54)])	(7.2 [-1.8, 16.1])	0.27
Reduced by less than 1 hour	26	(7.8 [5.2, 11.6])	78	(6.7 [(5.2, 8.7)])	(-1.1 [-5.9, 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, 3.9])	>0.99
Increased by less than 1 hour	5	(1.7 [0.7, 3.6])	49	(4.2 [(3.0, 6.0)])	(2.5 [-0.1, 5.2])	0.36
Increased by more than 1 hour	38	(11.4 [8.0, 16.2])	87	(7.5 [(5.9, 9.4)])	(-3.9 [-9.5, 1.6])	0.29
Weekly hours spent following COVID-19						
0	183	(55.3 [49.6, 61.2])	853	(73.7 [(70.8, 76.7)])	(18.4 [9.7, 27.2])	<0.0001
1	56	(16.9 [12.9, 21.9])	185	(15.9 [(13.7, 18.6)])	(-1.0 [-7.6, 5.8])	>0.99
2-3	59	(17.8 [13.7, 23.1])	73	(6.3 [(4.8, 8.3)])	(-11.5 [-17.9, -5.1])	<0.0001
≥4	32	(9.6 [6.7, 13.8])	43	(3.8 [(2.8, 5.0)])	(-5.8 [-10.8, -0.9])	0.0002

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

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

Table 3. Estimated adjusted prevalence of 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)												
Disabled, 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
Disabled, 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 for 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 for 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

Table 4. Estimated adjusted prevalence of 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 hour	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 hour	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 hour	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 hour	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 hour	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 hour	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 hour	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 hour	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
Hours spent following COVID-19 (reference: 0)												
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

Figure 1. Timeline of SARS-CoV-2 active cases and related restrictions in Victoria (Regional and Metropolitan Melbourne)
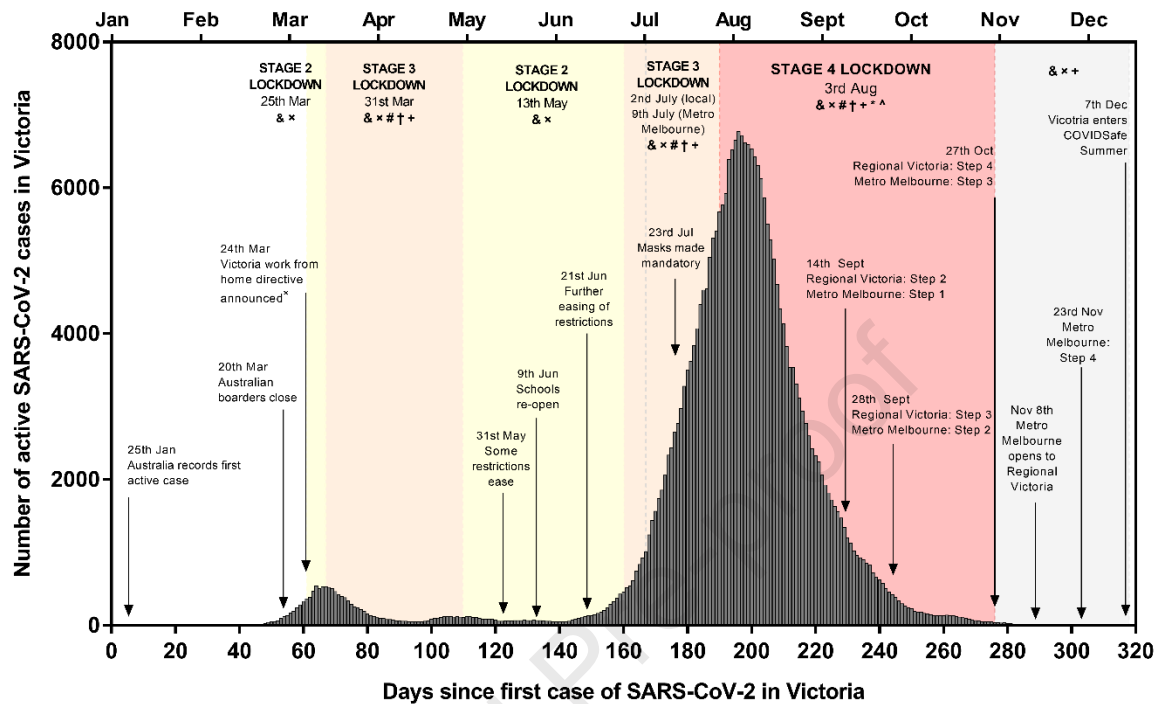

Figure 1. Timeline of COVID-19 active cases and related restrictions in Victoria (Regional and Metro Melbourne). The number of days since the first identified active case in Victoria is plotted on the horizontal axis and number of active cases per day on the vertical axis. Publicly available data were obtained from the Victorian State Government, Department of Health and Human Services. Stage 2 lockdowns are indicated by yellow shaded area, Stage 3 by orange and Stage 4 lockdown with 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 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 (1.5m apart and 4m^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 = one hour of daily exercise, Step 2 = two hours, 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 kilometre radius (Step 1/2 = 5km, Step 3 = 25km, Step 4 = no limit)

Figure 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