

Victoria's response to a resurgence of COVID-19 has averted 9,000-37,000 cases in July 2020

Introline

COVID-19 control measures in Victoria have reduced transmission, but more is required to control the epidemic.

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Abstract

The resurgence of COVID-19 in Victoria led to multiple control measures being introduced in early July; however, the ongoing high number of daily cases has led to concern about the impact of the measures on COVID-19 transmission. We analysed daily diagnosed COVID-19 cases in Victoria, examining the effectiveness of control measures to date. We estimate that control measures have reduced the reproduction ratio from 1.75 to 1.16 and averted 9,000–37,000 infections between 2 and 30 July. Despite this reduction, there remains significant ongoing growth, with an estimated further 14% reduction in transmission required to control the epidemic.

Main paper

Since the emergence of SARS-CoV-2 in late 2019, the number of cases of COVID-19 has grown exponentially globally, causing considerable morbidity and mortality. Australia, consistent with many countries, had an initial rise in COVID-19 cases (March and April 2020) followed by a relatively sharp decline (May 2020) after federal and state governments introduced strict community controls. These measures included mandatory quarantine periods for people returning from overseas, as well as a variety of physical distancing policies, including closing pubs, bars, entertainment venues, churches/places of worship, restricting restaurants and cafes to take-away only, and limiting public gatherings to two people.

Two months after the control measures were introduced, available epidemic data indicate that they were successful in disrupting COVID-19 transmission (1). The control measures were relaxed during June 2020 in an effort to reduce their social and economic disruption. This relaxation was accompanied by a variety of public health measures to mitigate the risk of a resurgence of infection, including the introduction of the COVIDSafe smartphone app and a scale-up of testing capacity and contact tracing (2). At the time of writing (30 July), new cases of COVID-19 remains low in most jurisdictions, except for Victoria, where the case numbers rose again in late June and early July.

The resurgence of COVID-19 in Victoria led to multiple control measures being reintroduced in urban Melbourne. These included Stage 3 restrictions (closure of pubs, bars, entertainment venues, churches/places of worship, restricting restaurants and cafes to take-away only, and limiting public gatherings to two people) in 10 postcodes at 11:59 pm on 1 July 2020; expansion of Stage 3 restrictions to 12 postcodes and complete quarantine/isolation being imposed in several high-rise

public housing estates in the inner north on 3 July; and Stage 3 restrictions being extended to the whole of metropolitan Melbourne and Mitchell Shire on 8 July. The resurgence also led to the closing of borders between Victoria and other states/jurisdictions in an effort to contain the infection. Despite these restrictions, the number of daily cases continued to climb following the expansion of Stage 3 restrictions, leading to the introduction of the compulsory use of masks in public settings on 22 July.

The ongoing high number of daily cases in Victoria has led to concern in the community and the media about whether the current measures are preventing COVID-19 transmission. In this article, we examine the effectiveness of these measures to date and discuss what other long-term measures are needed to maintain control and reduce the impact of the COVID-19 epidemic in the longer-term

We used the daily diagnosed COVID-19 cases in Victoria (excluding cases in travellers in quarantine) as reported by the Victorian Department of Health and Human Services (3) to estimate infection growth rates pre- and post-introduction of the Stage 3 measures in 10 postcodes in Melbourne on 1 July 2020. We expected to see a time lag between the intervention being introduced and detecting its effect due to both the generation interval for the infection (estimated as four days) (4), and delays in testing and reporting (estimated as three days). Hence, we regarded 14 June to 7 July inclusive as the pre-intervention period. We assumed that the initial growth rates would have continued, unchanged by the Stage 3 restrictions, until the cases reported on the 7 July 2020. We then measured the impact of the Stage 3 restrictions from 10 July, and thus the post-intervention period was from the 10 July to present (30 July 2020).

For truly exponential growth, the logarithm of the daily cases should increase linearly with time. Therefore, to determine the growth rates of the epidemic, we performed a non-weighted linear regression of the natural log of the daily cases versus days since 14 June.

Both the pre- and post-intervention data closely fit an exponential model (Figure 1). The daily pre-intervention growth constant was 0.140 (standard error 0.008); the post-intervention growth constant was 0.0379 (standard error 0.009). This indicates that epidemic growth continued during the post-intervention period ($p = 0.0007$), but was significantly lower than the pre-intervention period ($p = 0.0000000003$). Assuming a 4-day generation interval as reported (4), these growth rates correspond to effective pre- and post-intervention reproduction ratios (R_{eff}) of 1.75 and 1.16,

The model projected 27,000 cases (95% CI: 17,000 to 45,000) would occur from July 1 to 30 if the growth rate had continued unchanged ($R_{\text{eff}} 1.75$), as opposed to the 8,314 cases diagnosed in Victoria during this period.

The linearity of the exponential growth was assessed by fitting a second-order polynomial model to the log-transformed data. There was no evidence of any curvature in either the pre- or post-intervention regressions ($p=0.60$ and 0.74 , for the difference of the second order coefficient to zero for pre- and post-intervention data, respectively).

Our results show that the control measures introduced by the Victorian Government in early July were highly effective in reducing the resurgence in COVID-19 transmission, leading to a reduction in R_{eff} from an estimated 1.75 to 1.16. Despite this reduction, Victoria is still experiencing a slow but significant ongoing post-intervention growth in cases. To achieve a genuine “flattening of the curve” ($R_{\text{eff}} < 1$), a further 14% reduction in transmission is needed..

Victoria faces a huge challenge to reduce transmissions to the level needed to get the COVID-19 epidemic under control. There is hope that the introduction of compulsory face coverings alone will be sufficient to achieve the estimated 14% additional reduction required. A recent systematic review and meta-analysis (5) suggested that masks could reduce COVID-19 transmission by 85%, although the real-world impact is expected to be less given that most evidence comes from the use of surgical masks in healthcare settings rather than face coverings or masks in community settings. While there has not been an observable impact of masks (22 July) on transmission in Victoria, this is not surprising as the generation interval combined with delays between symptom onset, test-seeking and case reporting all create a time-lag of about one week between the introduction of an intervention and observation of its effect.

Another challenge for Victoria is community fatigue and reduced adherence to this second round of government control measures compared to the first (6, 7). To date, most of the initial measures to control COVID-19 — restrictions on personal, business and community activities, mass media campaigns and translated resources in selected minority languages — have been top-down control responses. Whilst successful in the short term, this approach is unlikely to be sustainable for the length of the epidemic; community cooperation is essential. To gain and sustain community cooperation, rapid research and community engagement approaches are needed to both identify and address specific needs and information gaps, and to empower civil society groups to lead in selected elements of the response themselves

A limitation of this analysis is that a single post-intervention period was used, even though the geographical area of restrictions expanded on three occasions. Given that about seven days are required to observe the impact of an intervention, and that there was only a few days between the various geographical expansion of restrictions, we considered a single time period to be the most appropriate way to measure the intervention effect. We did not observe an impact of the further expansion of the restrictions, but this may be due to a high proportion of cases continuing to arise from the original 10 suburbs even after the restrictions were expanded. The inherent variability in the daily case numbers can mask the effect of an intervention over short time periods. Similarly, measuring the total number of cases, as opposed to the number of new community transmissions, potentially underestimates of the effect of interventions in the short term as these data do not account for clusters of infection.

In conclusion, the control measures introduced in Victoria from 1 July reduced the transmission of COVID-19, averting 9,000–37,000 infections between 2 and 30 July. Importantly, however, there remains small but significant ongoing growth with further work needed to bring the Victorian epidemic under control. A broader and sustainable effort, involving community and government together is needed to optimise the uptake of all of the non-pharmaceutical interventions available to us.

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Figure 1. Victorian COVID-19 cases per day. Dots: Observed daily cases. Solid thick lines: fitted exponential growth curves, thinner lines: upper and lower 95% confidence intervals on the fitted growth curves. Dashed lines: projected exponential increase in daily cases, with upper and lower 95% confidence intervals assuming no intervention. Blue: pre-intervention period; orange: post-intervention period; grey: transition period. Vertical black line marks the time when initial 10 postcode Stage 3 restrictions could begin to influence daily cases.

