

Our reference: FOI20/53



DECISION ON YOUR ACCESS APPLICATION

I refer to your application under section 30 of the *Freedom of Information Act 2016* (FOI Act) received by ACT Health Directorate (ACTHD) on **Thursday 15 October 2020.**

This application requested access to:

"Australian Health Protection Principal Committee papers by or circulated to the Chief Health Officer, or their representative, between 1 May and 31 July 2020 concerning the following matters in Victoria:

- Contact tracing
- Testing approaches
- Hotel Quarantine
- Elimination/suppression strategies
- Public Health workforce capacity."

I am an Information Officer appointed by the Director-General of ACT Health Directorate (ACTHD) under section 18 of the FOI Act to deal with access applications made under Part 5 of the Act. ACTHD provided a decision on your access application on **Thursday 3 December 2020.**

Decisions

You submitted an application for Ombudsman review of my original decision for which the Directorate received notification on **Monday 7 December 2020.**

ACTHD received the decision of the Ombudsman on **Thursday 29 July 2021**. To comply with this decision, I have included at <u>Attachment A</u> to this letter, a copy of the schedule and relevant documents as decided by the ACT Ombudsman.

Charges

Processing charges are not applicable to this request.

Disclosure Log

Under section 28 of the FOI Act, ACTHD maintains an online record of access applications called a disclosure log. The scope of your access application, my decision and documents released to you will be published in the disclosure log not less than three days but not more than 10 days after the date of this decision. Your personal contact details will not be published.

https://www.health.act.gov.au/about-our-health-system/freedom-information/disclosure-log.

ACT Civil and Administrative Tribunal (ACAT) review

Under section 84 of the Act, if a decision is made under section 82(1) on an Ombudsman review, you may apply to the ACAT for review of the Ombudsman decision. Further information may be obtained from the ACAT at:

ACT Civil and Administrative Tribunal Level 4, 1 Moore St GPO Box 370 Canberra City ACT 2601 Telephone: (02) 6207 1740

http://www.acat.act.gov.au/

Further assistance

Should you have any queries in relation to your request, please do not hesitate to contact the FOI Coordinator on (02) 5124 9831 or email HealthFOI@act.gov.au.

Yours sincarely

Michael Culhane

Executive Group Manager

Policy, Partnerships and Programs

August 2021



FREEDOM OF INFORMATION SCHEDULE OF DOCUMENTS

Please be aware that under the *Freedom of Information Act 2016*, some of the information provided to you will be released to the public through the ACT Government's Open Access Scheme. The Open Access release status column of the table below indicates what documents are intended for release online through open access.

Personal information or business affairs information will not be made available under this policy. If you think the content of your request would contain such information, please inform the contact officer immediately.

Information about what is published on open access is available online at: http://www.health.act.gov.au/public-information/consumers/freedom-information

APPLICANT NAME	WHAT ARE THE PARAMETERS OF THE REQUEST	FILE NUMBER
	Australian Health Protection Principal Committee (AHPPC) papers by or circulated to the Chief Health Officer, or their representative, between 1 May and 31 July 2020 concerning the following matters in Victoria:	FOI20/53
	Contact tracing	
	Testing approaches	
	Hotel Quarantine	
	Elimination/suppression strategies	
	Public Health workforce capacity.	

Ref	Page	Description	Date	Status	Factor	Open Access
Number	Number			Decision		release status
					Out of Scope information contained in	
1.	1	Outcomes- Emergency Teleconference	11/05/20	Partial release	document.	Yes
					Schedule 2.2(a)(x)	
2	2	Outcomes- Emergency Teleconference	14/05/20	Full release	Out of Scope information contained in	Yes
2.	2	Outcomes- Emergency releconference	14/05/20	ruii reiease	document.	res
2	2	Aganda Emarganay Talaganfaranga	15/05/20	Full release	Out of Scope information contained in	Voc
3.	3	Agenda- Emergency Teleconference	15/05/20	ruii release	document.	Yes

4.	4	Agenda- Emergency Teleconference	18/05/20	Full release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
5.	5	Agenda- Emergency Teleconference	21/05/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
6.	6	Outcomes- Emergency Teleconference	29/05/20	Full release	Out of Scope information contained in document.	Yes
7.	7-21	Additional Documents Estimating temporal variation in transmission of COVID-19 and adherence to social distancing measures in Australia – Report submitted to CDNA/AHPPC 13 May 2020	13/05/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
8.	22	Outcomes- Emergency Teleconference	02/06/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
9.	23	Agenda- Emergency Teleconference	03/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
10.	24	Outcomes- Emergency Teleconference	08/06/20	Full release	Out of Scope information contained in document.	Yes
11.	25	Outcomes- Emergency Teleconference	10/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
12.	26	Outcomes- Emergency Teleconference	11/06/20	Full release	Out of Scope information contained in document.	Yes
13.	27	Outcomes- Emergency Teleconference	12/06/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No

14.	28	Outcomes- Emergency Teleconference	16/06/20	Full release	Out of Scope information contained in document.	Yes
15.	29	Outcomes- Emergency Teleconference	17/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
16.	30-31	Outcomes- Emergency Teleconference	22/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
17.	32	Outcomes- Emergency Teleconference	24/06/20	Full release	Out of Scope information contained in document.	Yes
18.	33	Outcomes- Emergency Teleconference	25/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
19.	34	Agenda- Emergency Teleconference	26/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
20.	35-37	Outcomes- Emergency Teleconference	29/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
21.	38-39	Agenda- Emergency Teleconference	30/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
22.	40	Additional Documents Implementation progress towards a COVID Safe Australia	3/06/20	Full release		Yes
23.	41-69	Additional Documents Next stage methods for estimating time-varying transmission potential of COVID-19 in Australia - Report submitted to CDNA/AHPPC 3 June 2020	3/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
24.	70-96	Additional Documents	17/06/20	Partial release	Out of Scope information contained in document.	Yes

		Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 17 June 2020			Schedule 2.2(a)(x)	
25.	97-106	Additional Documents Daily epidemiology update as at 1200h	18/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
26.	107-108	Additional Documents Statement 21 June 2020 recent clusters of COVID-19 in Victoria	21/06/20	Access refused	Schedule 2.2(a)(x)	No
27.	109-139	Additional Documents Correction and update: Estimating temporal variation in transmission of COVID19 and physical distancing behaviour in Australia- Report submitted to CDNA/AHPPC 21 June 2020	21/06/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
28.	140-142	Additional Documents Key lessons learnt from hotel quarantine in Australia	29/06/20	Access refused	Schedule 2.2(a)(x)	No
29.	143-144	Agenda- Emergency Teleconference	01/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
30.	145-146	Outcomes- Emergency Teleconference	02/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
31.	147-148	Outcomes- Emergency Teleconference	03/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes

32.	149-150	Outcomes- Emergency Teleconference	04/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
33.	151-153	Outcomes- Emergency Teleconference (with track changes)	05/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
34.	154-157	Outcomes- Emergency Teleconference	06/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
35.	158-159	Outcomes- Emergency Teleconference	08/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
36.	160-161	Outcomes- Emergency Teleconference	09/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
37.	162	Outcomes- Emergency Teleconference	10/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
38.	163-164	Outcomes- Emergency Teleconference	12/07/20	Partial Release	Out of Scope information contained in document. Schedule 1.2 Legal Professional Privilege Schedule 2.2(a)(x)	Yes
39.	165-167	Outcomes- Emergency Teleconference	13/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
40.	168	Outcomes- Emergency Teleconference	14/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
41.	169	Outcomes- Emergency Teleconference	15/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes

42.	170-171	Outcomes- Emergency Teleconference	16/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
43.	172	Agenda- Emergency Teleconference	17/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
44.	173	Agenda- Emergency Teleconference	19/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
45.	174	Outcomes- Emergency Teleconference	20/07/20	Full release	Out of Scope information contained in document.	Yes
46.	175	Outcomes- Emergency Teleconference	21/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
47.	176-178	Outcomes- Emergency Teleconference	22/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
48.	179-180	Outcomes- Emergency Teleconference	23/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
49.	181	Outcomes- Emergency Teleconference	23/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
50.	182-183	Outcomes- Emergency Teleconference	23/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
51.	184-185	Outcomes- Emergency Teleconference	28/07/20	Full release	Out of Scope information contained in document.	Yes
52.	186-187	Outcomes- Emergency Teleconference	29/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes

53.	188	Outcomes- Emergency Teleconference	31/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
54.	189-218	Additional Documents Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 1 July 2020	01/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
55.	219-224	Additional Documents Forecasting alternate scenarios of the June COVID-19 outbreak in Victoria – Report submitted to AHPPC 4 July 2020	04/07/20	Partial release	Schedule 2.2(a)(x)	Yes
56.	225-232	Additional Documents Epidemiology update as at 1200h	06/07/20	Partial release	Schedule 2.2(a)(x)	Yes
57.	233-238	Additional Documents COVID-19 Pandemic Health Intelligence Plan (PHIP) Report- Issue 4 including PHIP Report (Reporting period 22 June – 5 July 2020)	08/07/20	Access refused	Schedule 2.2(a)(x)	No
58.	239-271	Additional Documents Modelling of COVID-19 in Australia – Overall Assessment	N/A	Access refused	Schedule 2.2(a)(x)	No
59.	272-286	Additional Documents PHIP Inputs and Status as at 8 July	08/07/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
60.	287-298	Additional Documents Daily epidemiology update as at 1500h	08/07/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
61.	299-335	Additional Documents	08/07/20	Access refused	Out of Scope information contained in document.	No

		Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 8 July 2020			Schedule 2.2(a)(x)	
62.	336-370	Additional Documents COVID-19 in Australia – Forward Planning	10/07/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
63.	371-372	Additional Documents Statement from Greg Hunt MP and Richard Colbeck- Victorian aged care workers urged to wear face masks	13/07/20	Full release		Yes
64.	373-374	Additional Documents Transparency of case finding, contact tracing and isolation	14/07/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
65.	375	Additional Documents The purpose of GP led respiratory clinics	14/07/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No
66.	376-403	Additional Documents Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 15 July 2020	15/07/20	Partial release	Out of Scope information contained in document. Schedule 2.2(a)(x)	Yes
67.	404-455	Additional Documents COVID-19 Pandemic Health Intelligence Plan (PHIP) Report- Issue 5 (AHPPC Meeting 22 July 2020) - PHIP Reporting period 6-19 July Date: 22 July 2020 - PHIP Inputs and Status	22/07/20	Access refused	Out of Scope information contained in document. Schedule 2.2(a)(x)	No

Additional Documents Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 22 July 2020 69. 487-525 COVID-19 in Australia – Forward Plan Issue 2- Executive Summary Additional Documents Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 29 July 2020 70. 526-552 Additional Documents Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 29 July 2020 71. 553-574 Additional Documents Public Transport – Victoria Contribution 72. 575 Additional Documents Statement on positive coronavirus test in person who attended protest in Victoria 73. 576 Statement on urging Victorian Aged Care Workers to wear face masks Total Number of Documents			 Status of precedent conditions Table 				
69. 487-525 COVID-19 in Australia – Forward Plan Issue 2- Executive Summary Additional Documents Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 29 July 2020 71. 553-574 Additional Documents Public Transport – Victoria Contribution 72. 575 Additional Documents Statement on positive coronavirus test in person who attended protest in Victoria 73. 576 Additional Documents Statement on urging Victorian Aged Care Workers to wear face masks 74. 576 COVID-19 in Australia – Forward Plan Issue 2-4/07/20 Access refused document. Schedule 2.2(a)(x) 75. S26-552 Additional Documents Statement on urging Victorian Aged Care Workers to wear face masks	68.	456-486	Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 22	22/07/20	Partial release	document.	Yes
Figure 29/07/20 Formal Partial release Schedule 2.2(a)(x) Formal Public Transport – Victoria Contribution 71. Span Additional Documents Statement on positive coronavirus test in person who attended protest in Victoria 73. Span Additional Documents Statement on urging Victorian Aged Care Workers to wear face masks Estimating temporal variation in transmission of COVID-19 and physical 29/07/20 Partial release Schedule 2.2(a)(x) Partial release Out of Scope information contained in document. Schedule 2.2(a)(x) Note of Scope information contained in document. Schedule 2.2(a)(x) Partial release Schedule 2.2(a)(x) Partial release Out of Scope information contained in document. Schedule 2.2(a)(x) Partial release Out of Scope information contained in document. Schedule 2.2(a)(x)	69.	487-525	COVID-19 in Australia – Forward Plan	24/07/20	Access refused	document.	No
71. 553-574 Additional Documents Public Transport – Victoria Contribution N/A Access refused document. Schedule 2.2(a)(x) N/A Full release 72. 575 Additional Documents Statement on positive coronavirus test in person who attended protest in Victoria 73. 576 Additional Documents Statement on urging Victorian Aged Care Workers to wear face masks N/A Access refused document. N/A Full release Out of Scope information contained in document. Schedule 2.2(a)(x)	70.	526-552	Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia – Report submitted to CDNA/AHPPC 29	29/07/20	Partial release	document.	Yes
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73. Statement on urging Victorian Aged N/A Access refused document. No Care Workers to wear face masks Schedule 2.2(a)(x)	72.	575	Statement on positive coronavirus test in person who attended protest in	N/A	Full release		Yes
Total Number of Decuments	73.	576	Statement on urging Victorian Aged Care Workers to wear face masks	-		document.	No
Total Number of Documents				Total Numbe	r of Documents		

Jurisdictions provided local updates.

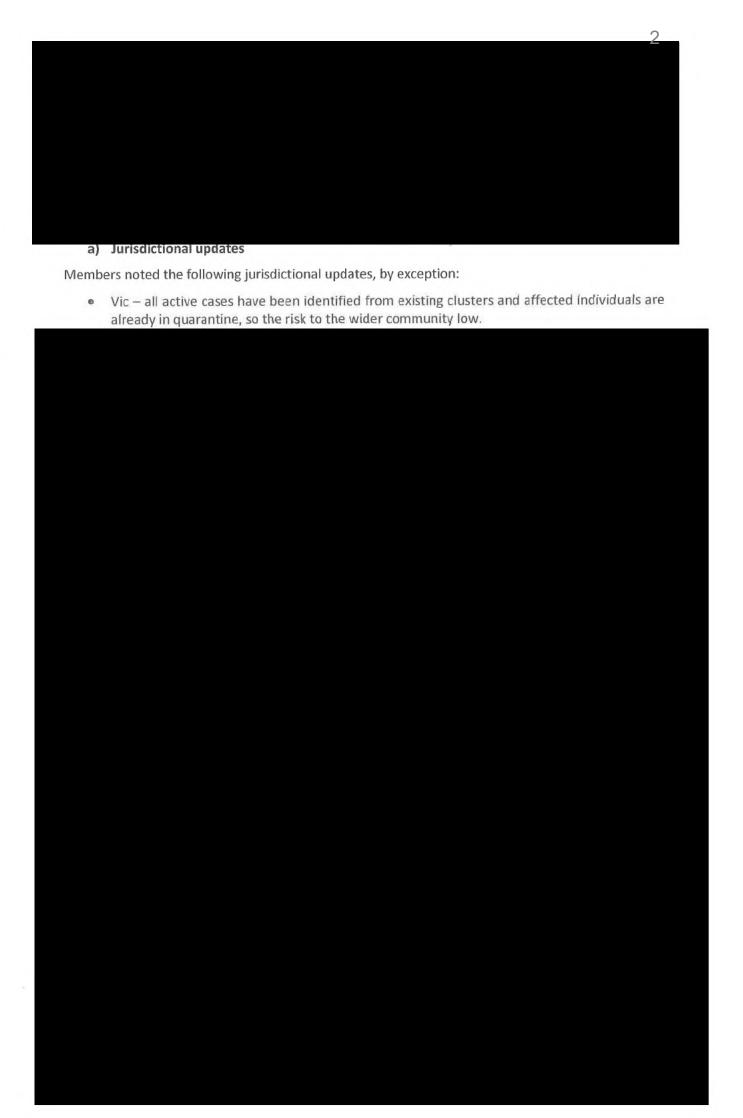
Victoria

Reflections on the testing in Victoria. The testing was targeted to healthcare and healthcare settings. Of the 14,000 tests done, there were 30 people identified, and 24 of those were in symptomatic individuals.

 The testing has identified additional community cases – already known to clusters or international travel.

0

Implementation of the relaxation of measures has been gentle in the first instance. Messages around places of work and retail (avoid if you can still). Gatherings of 10 outside and inside. There are now five reasons to go out now — with family and friends being the new addition.



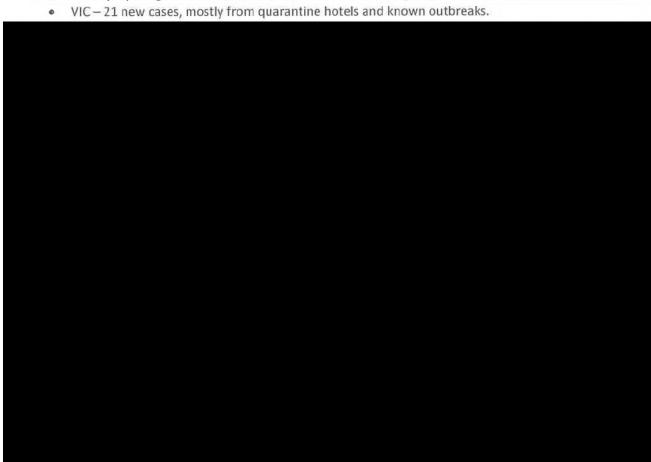


Agenda Item 5 - Other business

a) Jurisdictional updates

Members noted the following jurisdictional updates:





COMMITTEE-IN-CONFIDENCE

Agenda Item 5 - Other business

a) Jurisdictional updates

Members noted	the following	jurisdictional	updates, l	by exception:
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VIC – Taking measures in response to McDonald's outbreak with staff quarantined, close
contacts tested and a deep clean of the McDonald's restaurants that the test case visited
in progress. Cedar Meats staff have mostly recovered and are finishing quarantine but are
required to test negative before they are released from their quarantine. Residents and staff
of the Villa Maria aged care home in Bundoora are being tested for coronavirus

b) Current median time for getting test results

Members noted the following median times:

• VIC – about 48hrs but with an urgent option of 24hrs.

b) Jurisdictional updates Members noted the following jurisdictional updates: • Vic—a few cases linked to a construction site, including asymptomatic workers who tested positive 20 days after last being at the worksite.		5
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VIC- Adj Prof Sutton advised of a cluster, where eight members of an extended family, including a year 11 student. There has not much interaction outside family however there is another case in the same geographic area.

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Agenda	a Item 7 – Other business
a)	Jurisdictional update
0	Vic – Currently in step 2 (as of 1 June) and will ease additional restrictions on 22 June 2020.
1 4	
	source is unknown, including a hotspot around the inner north of Melbourne.

	24
Epidemiological reporting	
VIC: Excluding known clusters, 4 days. A student in Craigieburn was identified through up testing.	рор-

25	

Agenda Item 7 – Other Business

a) Jurisdictional Update

Members noted the following jurisdictional updates, by exception:

· VIC-

The Chair gave the floor to Adj Prof Sutton to provide an update on a person who had attended a protest in Melbourne. The person developed symptoms within 24 hours of the protest, was tested, and found to be positive. Members noted that the person wore a mask during the mass gathering, and that VicHealth were undertaking contact tracing. The source of this person's infection is not yet known.

Members agreed that it was appropriate to send out a media release to update the Australian community, to caution people against attending mass gatherings, and to advise people to get tested if they have any symptoms at all, if they have attended a protest. The members agreed to the following:

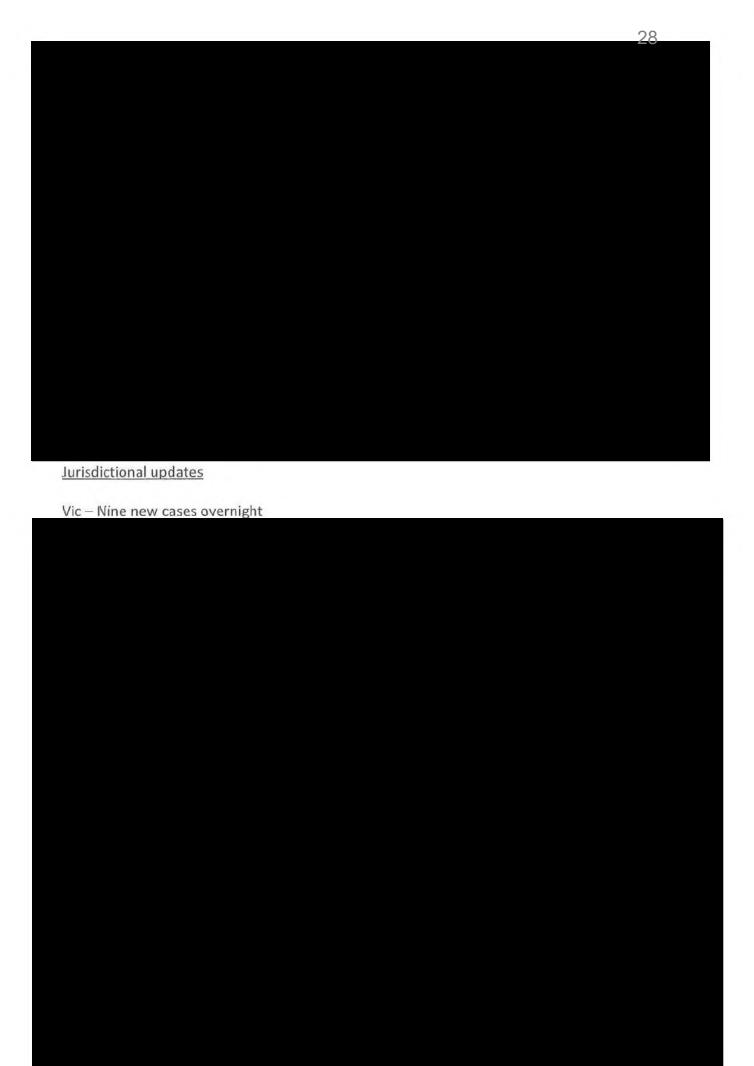
The Australian Health Protection Principal Committee (AHPPC) noted the positive coronavirus test in a person who attended the large protest in Victoria last week. It will take some days to determine whether other people have been infected. AHPPC noted Victoria's advice that a significant investigation to determine the source of the infection and identify close contacts is underway.

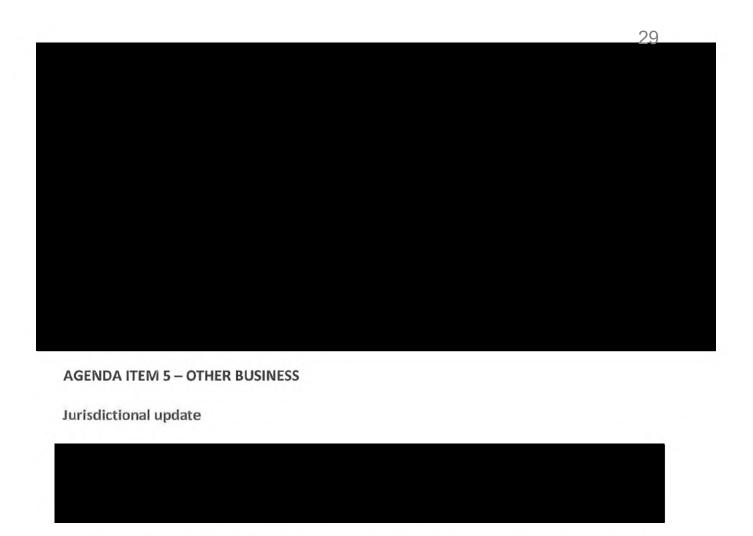
AHPPC emphasises once more the very high risk environment of a protest, with large numbers of people closely gathering and challenges in identifying all contacts.

AHPPC again urges the Australian community to not participate in mass gatherings.

Anyone who attends protests must be vigilant and ensure they get tested if they develop any <u>symptoms</u>. Anyone who is feeling unwell or with symptoms should stay home. It is particularly important to avoid any interaction with <u>people who are at greater risk of severe illness from COVID-19</u>. Currently there is no requirement for people who attended the Melbourne protest or other protests to quarantine or be tested if they remain well (unless they have been identified as a close contact).

Situations like this are a reminder of how important it is for everyone to continue to take steps to protect themselves from COVID-19. This includes practising good hand and respiratory hygiene, staying 1.5m away from other people, staying home when sick, and getting tested if they have cold or flu like symptoms. AHPPC also reinforces the importance of downloading the COVIDSafe app to help public health authorities find people exposed to the virus quickly.





In addition, Victoria has another 20 new cases, 15 from hotel quarantine, a security guard at quarantine hotel, an additional case within a known family cluster, another case in another known cluster.

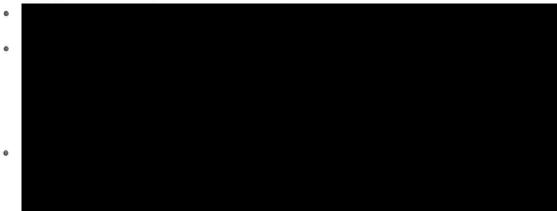
Agenda Item 2 - Quarantine

a) Hotel Quarantine

provided an overview of CDNA's options paper on hotel quarantine in Australia.

Members noted:

 CDNA was tasked by AHPPC to review the time spent in hotel quarantine, whether it would be feasible to have a one week arrangement in hotel quarantine and the remaining week at home.



Members support, in principle, a two stage testing regime which would allow testing within 48 hours of arrival and then again at day 10 -11.

Members supported the continuation of a 14 day quarantine period.

Therefore, Members agreed that hotel quarantine is still the preferred quarantine method.

ACTION

1. Prepare an AHPPC Statement in support of continuing with 14 day mandatory hotel quarantine, for consideration by AHPPC tomorrow, 23 June 2020.

2.

Members noted:

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- Vic 16 new cases (11 net cases and 5 under investigation).
 - o Number of cases from hotel quarantine;
 - Primary school outbreak 2 staff members and one child all staff and students tested;
 - H&M store outbreak 4 cases with one of those cases also linked with the Black Lives Matter protest;
 - One case a household contact of a security guard who worked at several hotels;
 - o Keilor downs 2 staff members and a close contact link back to the school.



COMMITTEE-IN-CONFIDENCE

Agenda Item 7 – Other business

Victorian update:

- o 20 new cases in last 24 hours.
- 1 death of a man in his eighties.
- Active outbreaks in a child care facility (1), a primary school (1), a dental practice
 (3), retail site (5) and a school in Epping (3).
- The large multifamily outbreak in Keilor Downs now has 16 cases.
- One more case identified as having attended the recent protests, but may be a close contact from another source.
- Linking work is currently being undertaken, with a clear picture emerging in some specific suburbs with 15 – 20 postcodes having majority of the cases.
- Vic Health will contact other jurisdictions for assistance if needed.
- Noted that school holidays start on Friday 26 June 2020, and there are currently no internal restrictions on travel.
- Large communication campaign underway to drive home the message to stay at home.
- Heavy regulation on maintaining social distancing in venues that are open.
- Group outbreak squads with social workers being rolled out to support disadvantaged with food and accommodation.
- ADF have also provided support in a number of areas.

	33
Agenda Item 4 – Other Business	
<u>Victoria update</u>	
33 new cases recorded. One additional death.	
(first Keilor Downs,	
Broadmeadows, and then testing Maidstone, Reservoir, Packenham, Albanvale, Sun Hallam, Brunswick W, Fawkner.) They intend to do about 5000 tests per suburb. At time, they will take the opportunity to reinforce public health messaging.	
Doherty – saliva testing. Less invasive, rolling out from Monday.	
Finding cases, they can quarantine at home with support,	

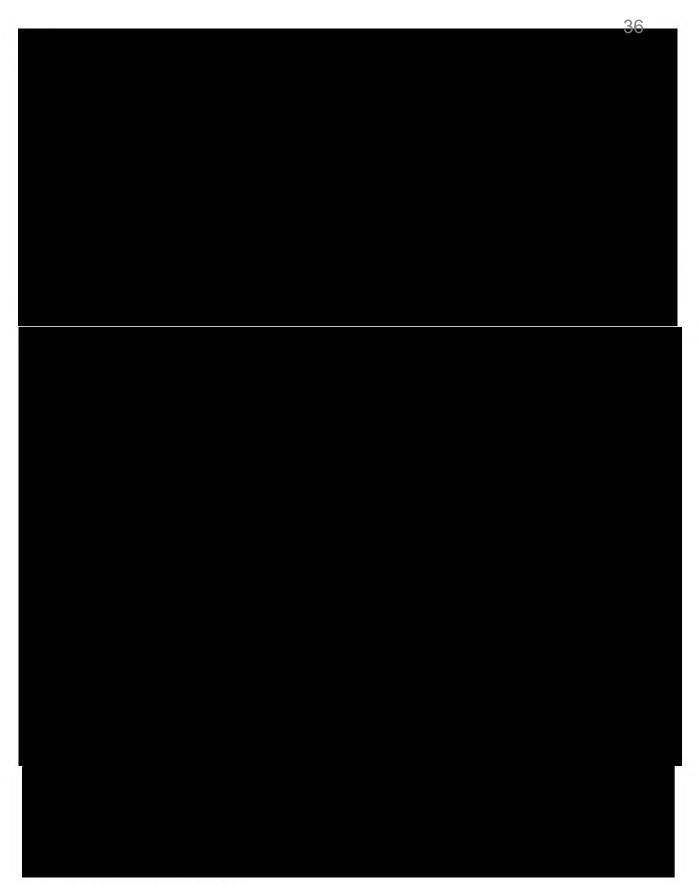
Agenda Item 5 - Other Business

Jurisdictional Update

VIC

- o 30 new cases reported.
- A number of outbreaks related to large family networks who have had gatherings. Broader community settings are being further linked by these clusters with linking of cases both epidemiological and genomic.
- Two cases now in large Coles food distribution centre.
- o Two childcare centres have also been affected.
- o Clear focus remaining on inner west suburbs.
- o Breaches of quarantine occurring, work being done to try and address

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Agenda Item 5 - Other Business

a) Jurisdictional Update

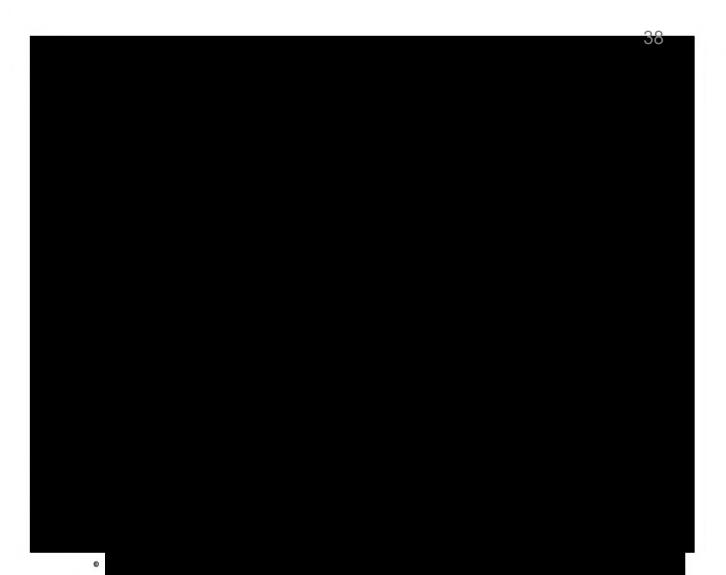
Jurisdictions provided an update by exception: *Victoria:*

- 22 cases associated with a complex extended family outbreak;
- 4 cases are linked to a funeral in a CALD community;

COMMITTEE-IN-CONFIDENCE

- 25 cases are linked to a north Melbourne cluster;
- 10 cases linked to a family cluster in a college in Epping;
- 1 case from hotel quarantine;
- 14 cases are linked with known clusters;
- Schools, child care centres, health care workers and a red cross facility have all been affected

affected
Members discussed the current outbreaks in Victoria and possible mitigation strategies, noting that family based clusters are the main issue. A proposal to limit visits at homes in Victoria and reduce public gatherings is being considered along with other options to reduce further transmission.



 Members further noted the comment made by Prof Sutton that there is no epidemiological evidence that links the cases to the Black Lives Matter protests in Victoria.

		39
		00

a) Jurisdictional update

Jurisdictions provided an update by exception:

Victoria:

- 64 new cases.
- 13 cases linked to known outbreaks.
- 31 cases under investigation.
- 321 active cases.
- · One patient in ICU, none are on ventilation.
- New public health announcements expected Tuesday 30 June 2020 with new restrictions expected state-wide.

Commonwealth Assistance:

Commonwealth discussions with Victoria have provided support with staff to assist with contact

Implementation progress towards a COVID Safe Australia

As of announcements @ 3 June 2020 at 0700hrs

Step 2: Current from 18 May. Still has restrictions on parts of Step 2, such as auctions, travel, salons, and entertainment venues.

Step 3: 6 June. Person limit raised to 100 per undivided space, 300 person max, alcohol can be served without food, but patrons seated. Food courts open. All health/ beauty/ gym / wellbeing services open, including contact sports. Arcades, zoos, playgrounds open. Betting TABs open, but casino floors closed. Regional travel unrestricted (pending Commonwealth approval for biosecurity zones).

Step 4: No date announced.

Elective Surgery: Up to 75% on 2 June.

Step 2: Current from 15 May. Restrictions remain on some step 2 areas. No person limits on gatherings if social distancing can be maintained (2 hour time limit).

Step 3: 5 June.

WA:

Largely

in Step

Elective Surgery: Increasing to 75% of normal elective surgical activity

> Step 2. partial

step 3. Step 3 from 5/6

NT: In

SA: in Step 2

OLD: In

Step 2

NSW: Largely still often apply),

VIC: Largely in Step COVIDSAFE



*All state and territory dates subject to their own health advice

Step 2: Current from 1 June (brought forward from 12 June)

Step 3: 10 July.

Elective Surgery: Up to 100% subject to availability of PPE.

Step 2: Current from 1 June. Regional recreational travel allowed, restaurants, pubs. cafes, clubs, casinos open for up to 50 people. Accommodation, zoos, galleries open. Gyms, yoga, pools open from 13 June (100 ppl max. 10 max/class). Community sport from 1 July.

Step 3: Partially adopted.

Elective Surgery: Aiming for 75% by 30 June.

Step 1.1: From 8 May.

Step 1.2: Current from 15 May, No. F2F TAFE classes.

Step 2.1: 29 May Step 2.2: 19 June

Stage 3: Est. mid-July

Elective Surgery: To be ramped up to 100% in a careful and staged approach

Step 2: 1 June Step 2, continuation: 22 June

Step 3: Late July

Elective Surgery: Up to 50% of normal elective surgical activity. Aiming for 75% by June 30, 100% by 31 July.

ACT: in

Step 2

Stage 1: Current from 18 May. Indoor and outdoor dining, up to 10 in each area, capped at 20.

Stage 2: 5 June (up to 40 people at dining/drinking venues. All accommodation open (inc. camping).

Stage 3: 13 July

Elective Surgery: Increasing to 100%.

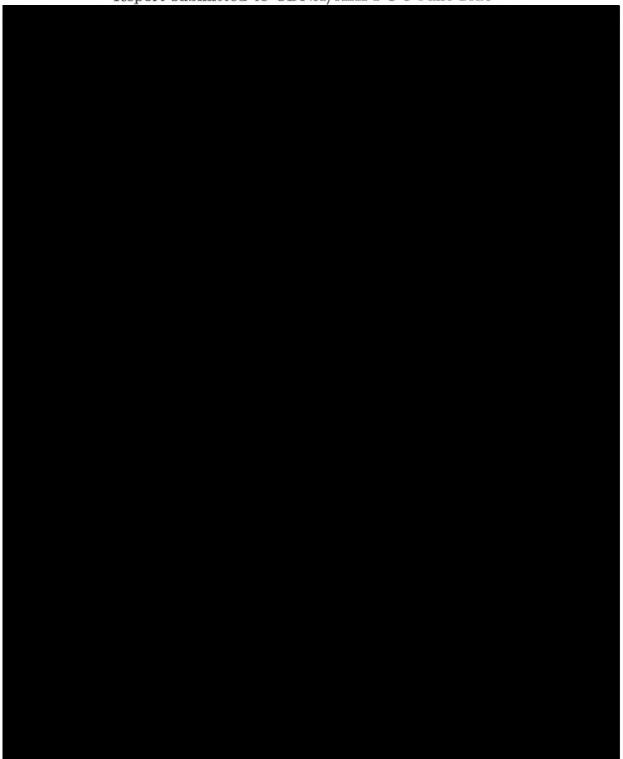
Step 2: Current from 1 June (brought forward from 8 June - announced 25 May).

Cinemas, theatres, galleries, museums, beauty salons, gyms and indoor fitness open. Up to 80 people in cafes/bars/ restaurants/pubs from 1 June (20 per room, 1 per 4m²).

Elective Surgery: 100% capacity as of 14 May.

Next stage methods for estimating time-varying transmission potential of COVID-19 in Australia

Report submitted to CDNA/AHPPC 3 June 2020

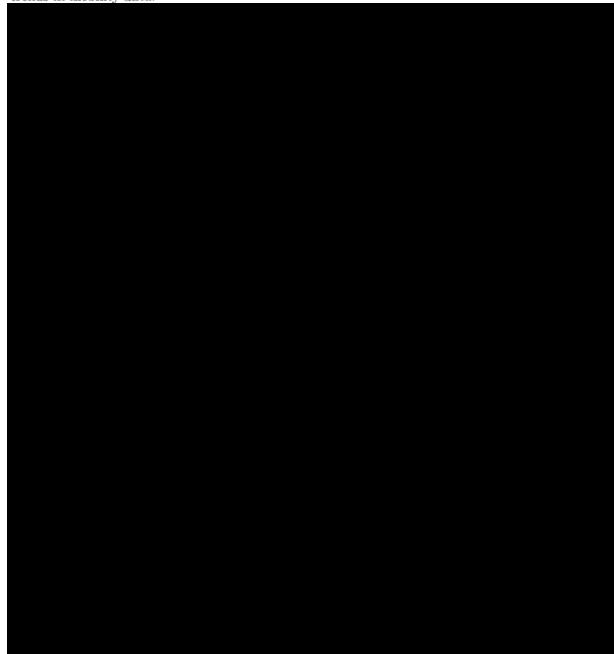




Estimating changes in distancing behaviour

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide behavioural surveys to estimate trends in specific macrodistancing measures (average daily number of non-household contacts; Figure 1) and microdistancing (proportion of the population always keeping 1.5m physical distance from nonhousehold contacts; Figure 2) behaviour over time. We used these survey data to infer trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.



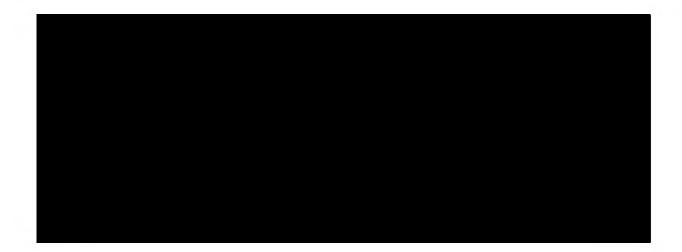


Figure 1: Estimated trends in macro-distancing behaviour, i.e., reduction in the rate of non-household contacts, in each state/territory.

Macro-distancing trend

Rate of non-household contacts

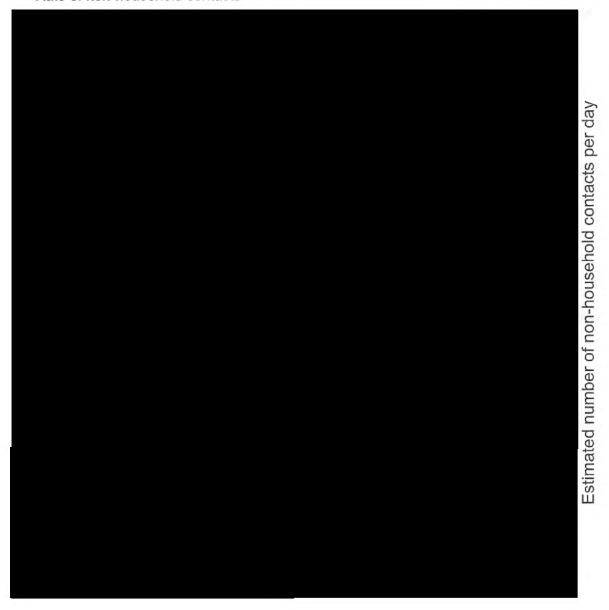
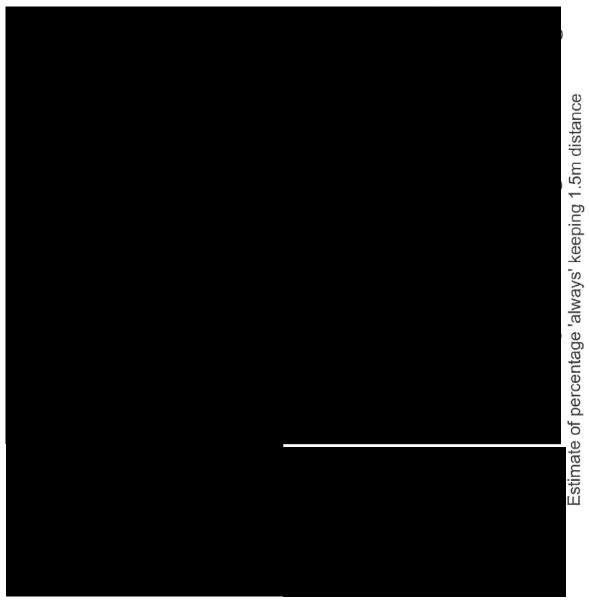


Figure 2: Estimated trends in micro-distancing behaviour, *i.e.* reduction in transmission probability per non-household contact, in each state/territory.

Micro-distancing trend

Calibrated against self-reported adherence to physical distancing



Estimating the impact of distancing behaviour on transmission

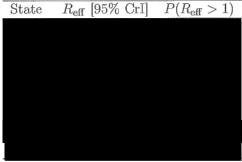
We separately model local to local transmission (Figure 8) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} that is driven by interventions (namely changes in macro- and micro-distancing behaviour over time and quarantine and isolation of overseas acquired cases);
- short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics of transmission, such as clusters of cases and short periods of low transmission.

We have previously reported three model components where component 1 represented national trends in local transmission due to distancing behaviour. With state-level macro- and micro-distancing survey data now available, we have simplified the model structure. The model now consists of two components: state-level effects of distancing behaviour, and temporal variation representing case clusters. Further, daily spikes in numbers of new cases (indicating clumped reporting or individual variation in transmission rates rather than clusters) is removed from component 2, resulting in a smoother clustering component.

Component 1 now reflects the average local transmission potential at state level (Figure 6), and component 2 (previously component 3) captures transmission within the sub-populations that have the most active cases at a given point in time 3. Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure 7).

Table 1: Estimates of average local transmission potential of active cases for each state/territory as of 1 June, using case data up to and including 26 May (due to a delay from symptom onset to reporting, the trend in estimates after 26 May is inferred from mobility data).



Interpretation

Where there is epidemic activity, the estimates of local transmission potential may be interpreted as the effective reproduction number, R_{eff} . In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Figure 3: Depiction of how R_{eff} analysis components 1 and 2 feed into the forecasting model.



Figure 4: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval) up to 1 June, based on data up to and including 26 May. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

Impact of macro-distancing

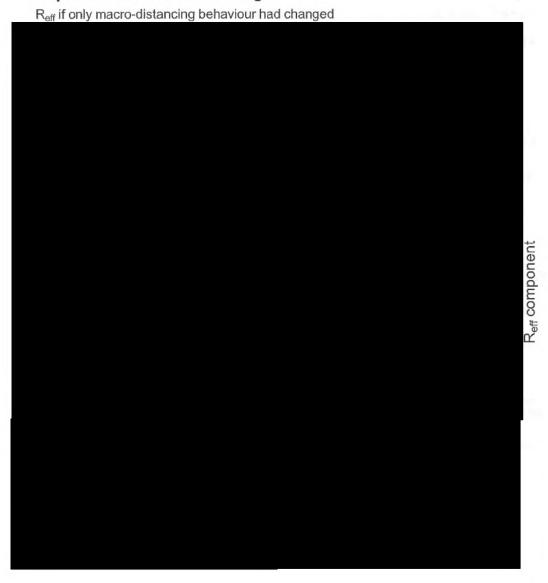


Figure 5: Estimate of average state-level trend in local transmission potential, if we assume that only 'micro-distancing' behaviour had changed and not 'macro-distancing' behaviour, for each state/territory (light purple ribbon = 90% credible interval; dark purple ribbon = 50% credible interval) up to 1 June, based on data up to and including 26 May. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

Impact of micro-distancing

Reff if only micro-distancing behaviour had changed

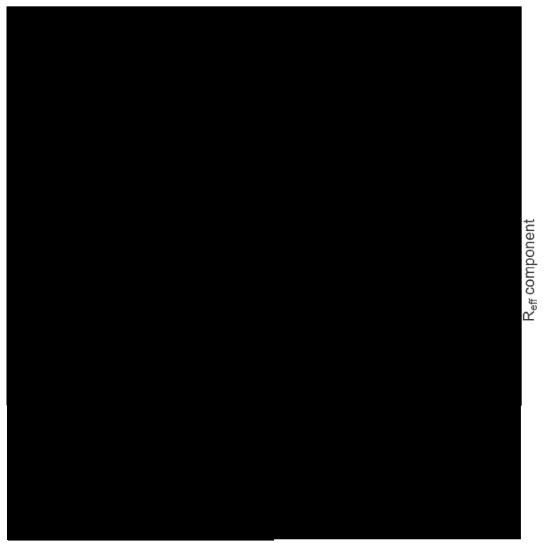


Figure 6: Estimate of local transmission potential averaged over state/territory population (component 1); *i.e.*, removing short-term variation due to clusters (component 2) (light green ribbon=90% credible interval; dark green ribbon=50% credible interval) up to 1 June, based on data up to and including 26 May. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. This includes the combined effect of macro- and micro-distancing behaviours.

Impact of social distancing

Component of Reff due to social distancing

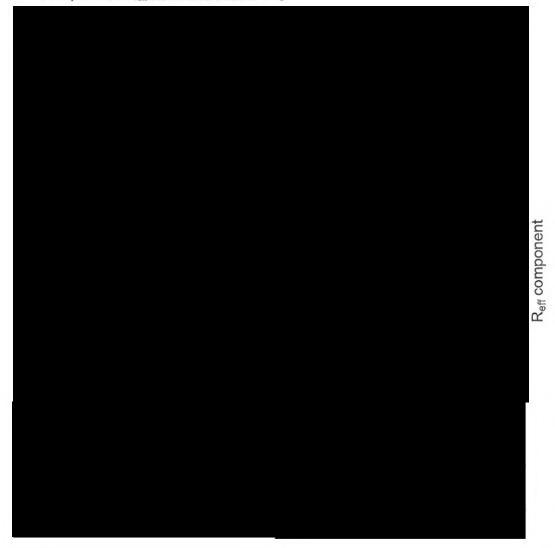


Figure 7: Deviation of transmission potential in local active cases (component 2, formerly component 3) from state-level local transmission state/territory (light pink ribbon=90% credible interval; dark pink ribbon = 50% credible interval) up to 1 June, based on data up to and including 26 May. Solid grey vertical lines indicate key dates of implementation of various social distancing policies.

Short-term variation in local to local transmission rates

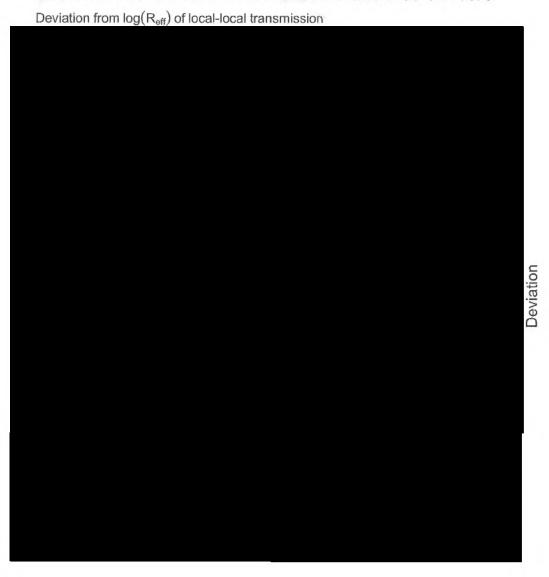
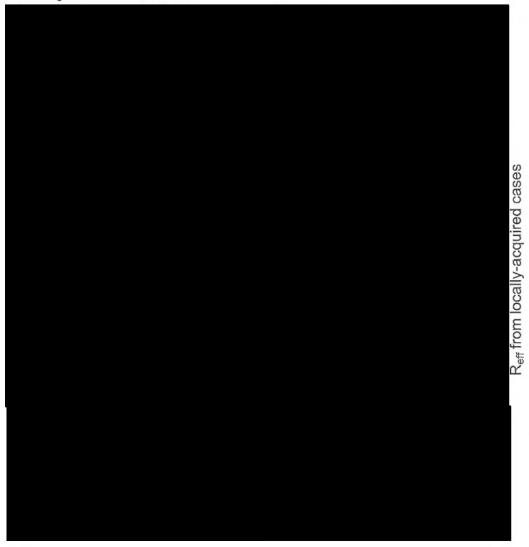
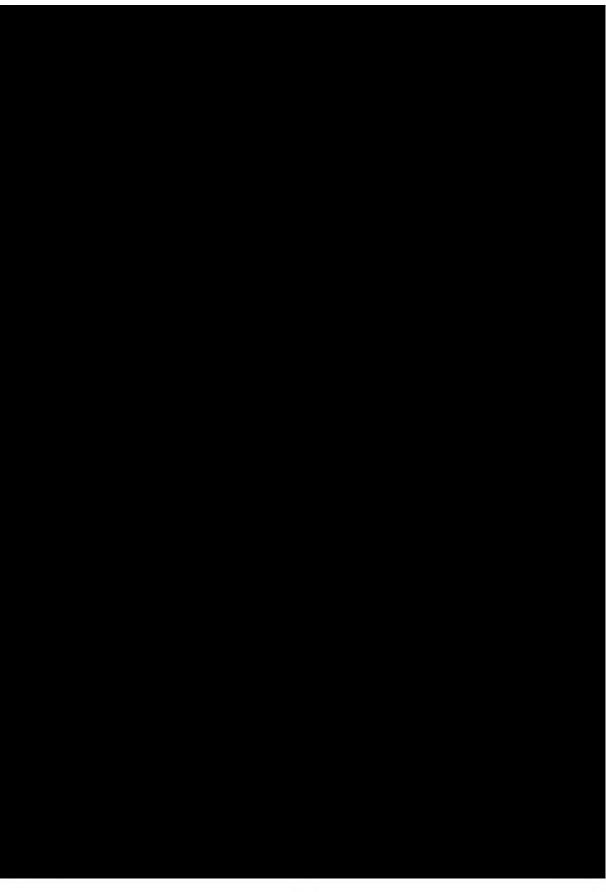


Figure 8: Estimate of average local transmission potential of active cases for each state/territory (light green ribbon=90% credible interval; dark green ribbon=50% credible interval) up to 1 June, based on case data up to and including 26 May. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Local to local transmission potential









Forecasts of the daily number of new confirmed cases nationally

We used our estimates of local transmission potential (Figure 8) and observed cases to generate forecasts of the daily number of new confirmed cases nationally (Figure 9).

Figure 9: Time series of new daily confirmed local cases of COVID-19 estimated from the forecasting model up to 1 June and projected forward up to 14 July (light blue shading = 95% confidence intervals, dark blue shading = 50% confidence intervals), assuming that local transmission potential remains at its current estimated level. The observed daily counts of locally acquired cases are also plotted (grey bars).



Forecasts of the daily number of new confirmed cases for each state/territory

Figure 10: Time series of new daily confirmed local cases of COVID-19 estimated from the forecasting model up to 1 June and projected forward up to 14 July (light blue shading = 95% confidence intervals, dark blue shading = 50% confidence intervals), assuming that local transmission potential remains at its current estimated level. The observed daily counts of locally acquired cases are also plotted (grey bars).



Assessment of changes in social distancing behaviours through the analysis of trends in population mobility data streams

A number of data streams provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

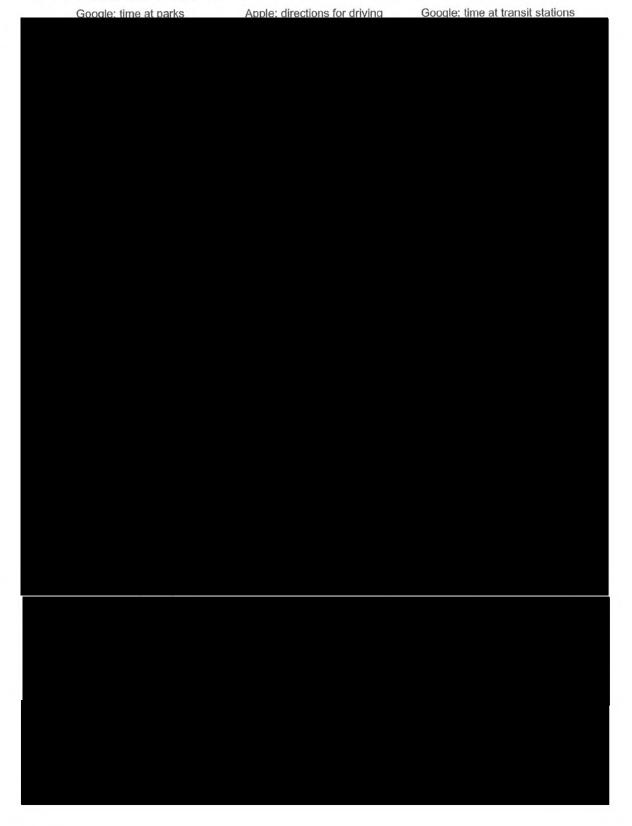
Interpretation

The model detects a decline in the social distancing variable over time (i.e., increasing mixing) since the date of peak adherence to these measures, ≈ 2 April (see Figure 11). Specifically, by

The largest reductions in the impacts of social distancing are evident in mobility data streams for lower transmission risk activities, including activities encouraged by public health authorities e.g., exercising. There is a clear reduction in data streams representing higher-risk activities, such as time at workplaces. However, these mobility data, which measure do not indicate whether the increase in lower transmission risk activities is mitigated by other behaviours that are not measured by these metrics — such as reducing contacts and adherence to the $4m^2$ rule rule.

Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S4–S10), with annotation matching that in Figure 11.

Figure 11: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 1 June. Solid vertical lines give the dates of three social distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 1 June, the most recent date for which some mobility data are available. Blue dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream.



Supplementary Appendix

For full methodology details on the mobility, R_{eff} and forecasting analyses, please refer to our most recent Technical Report (15 May 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications

References

- [1] Freya M. Shearer, Lisa Gibbs, Eva Alisic, Katitza Marinkovic Chavez, Niamh Meagher, Lauren Carpenter Phoebe Quinn, Colin MacDougall, and David J. Price. Distancing measures in the face of COVID-19 in Australia. Available from: https://www.doherty.edu.au/uploads/content_doc/social_distancing_survey_wave1_report_May142.pdf, 2020.
- [2] Kiesha Prem, Alex R. Cook, and Mark Jit. Projecting social contact matrices in 152 countries using contact surveys and demographic data. PLOS Computational Biology, 13(9):1–21, 09 2017.

Supplementary figures

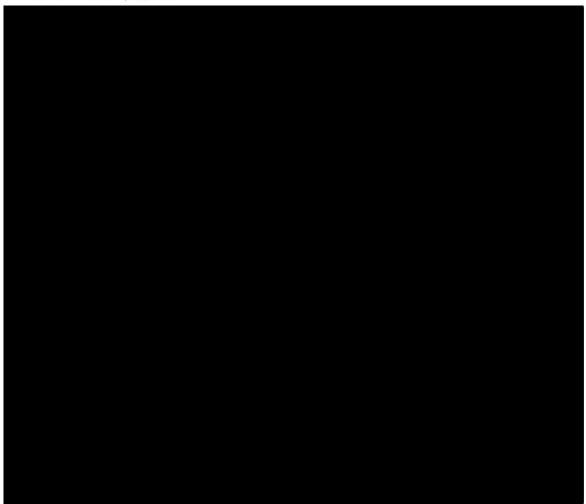
Figure S1: Time series of new daily confirmed cases of COVID-19 in Australia (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 1 June 2020. Plotted by recorded or inferred date of symptom onset.



Figure S2: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 1 June 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.



Figure S9: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of three social distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks the most recent date for which some mobility data are available. Blue dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.



Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia

Report submitted to CDNA/AHPPC 17 June 2020

Key messages

Estimates of changes in physical distancing behaviour

 We used data from nationwide behavioural surveys to estimate trends in both macrodistancing and micro-distancing behaviour over time.

Estimates of current epidemic activity

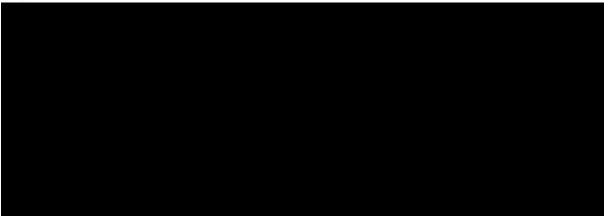
We report estimates of local transmission potential from a statistical method which allows
us to distinguish between transmission in the general population and clusters/localised
outbreaks (Figure 2).



Estimating trends in distancing behaviour

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide behavioural surveys to estimate trends in specific macrodistancing (average daily number of non-household contacts) and micro-distancing (proportion of the population always keeping 1.5m physical distance from non-household contacts) behaviours over time. We used these survey data to infer state-level trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.



Population mobility analysis

changes in micro-distancing behaviour.

A number of data streams provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

The largest reductions in the impacts of physical distancing are evident in mobility data streams for lower transmission risk activities, such as time at parks. There is also a clear reduction in data streams representing higher-risk activities, such as time at workplaces. However, these mobility data do not indicate whether the increase in higher transmission risk activities is mitigated by other behaviours that are not measured by these metrics — such as reducing contacts and adherence to the $4m^2$ rule. In other words, while changes in these mobility data streams are useful for detecting changes in macro-distancing behaviour, they do not capture

Figure 1: Estimated trends in macro-distancing behaviour, i.e., reduction in the daily rate of non-household contacts, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from two surveys conducted by the national modelling group in early April and early May, and two BETA surveys conducted in late May and early June (indicated by the black lines and grey rectangles), and an assumed pre-COVID-19 daily rate of 10.7 non-household contacts taken from previous studies. The width of the grey boxes corresponds to the duration of each survey wave (around 4 days) and the green ticks indicate the dates that public holidays coincided with survey waves (when people tend to stay home, biasing down the number of non-household contacts reported on those days). Note that the apparent increase in contacts in the second survey in Tas and WA is a statistical artefact due to the small sample sizes (100 in WA, 21 in Tas) which happen to contain two respondents reporting 100+ contacts.

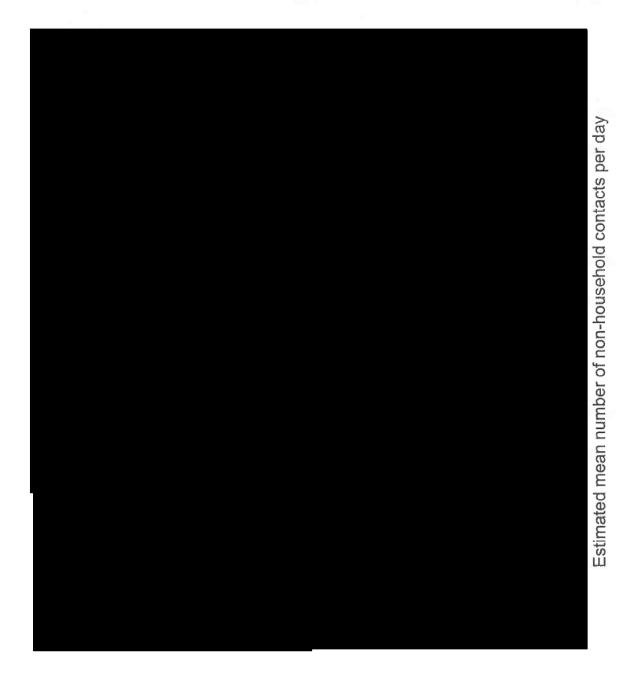


Figure 2: Estimated trends in micro-distancing behaviour, *i.e.* reduction in transmission probability per non-household contact, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from 11 nationwide surveys conducted by BETA from late March to early June (indicated by the black lines and grey boxes). The width of the grey boxes corresponds to the duration of each survey wave (around 4 days).

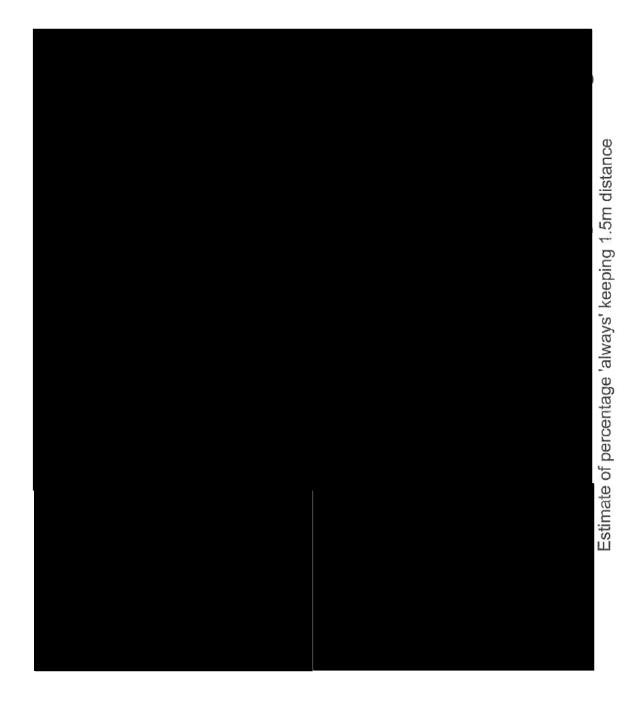
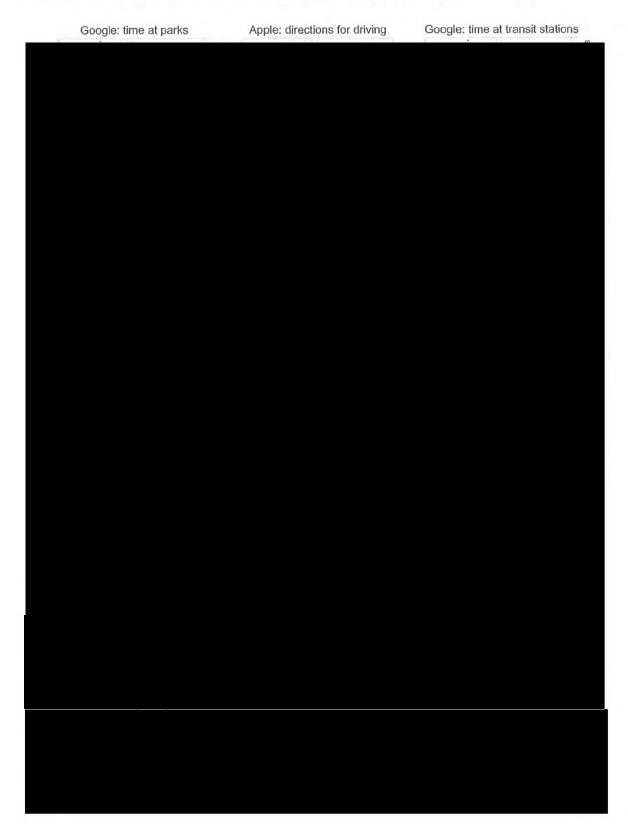


Figure 3: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 14 June. Solid vertical lines give the dates of three social distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 14 June, the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream. Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S13).



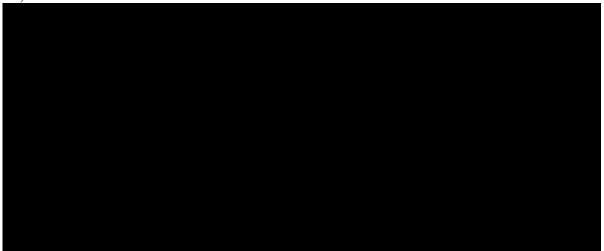
Estimating local transmission potential

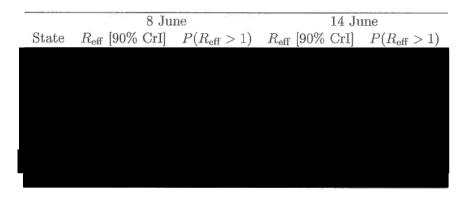
We separately model local to local transmission (Figure 6) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} driven by interventions (specifically changes in macro- and micro-distancing behaviour, surveillance measures, and quarantine of overseas acquired cases);
- 2. short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics of transmission, such as clusters of cases and short periods of low transmission.

Component 1 reflects the average local transmission potential at state level (Figure S5), and Component 2 captures transmission within the sub-populations that have the most active cases at a given point in time (Figure 4). Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases in high-transmission environments — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure 7).

Note that Component 1 for local to local transmission now incorporates the impact of improvements in surveillance on transmission rates. Using data on the number of days from symptom onset to testing for cases, we estimate the proportion of cases that are tested (and therefore advised to isolate) by each day post-infection. We quantify how these times-to-detection have changed over time, and therefore how earlier isolation of cases due to improvements in contact tracing and clinical screening has reduced statewide $R_{\rm eff}$ for local to local transmission (Figure 5).





Interpretation

Where there is epidemic activity, the estimates of local transmission potential may be interpreted as the effective reproduction number, R_{eff} . In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Figure 4: Depiction of how R_{eff} analysis components 1 and 2 feed into the forecasting model. TTD = time from symptom onset to detection.



Figure 5: Estimated trend in time from symptom onset to detection for locally-acquired cases (black ribbon = median estimate; yellow ribbons = 90% credible intervals; black dots = time-to-detection of each case). Note that we will continue to review how this trend is estimated, given changes in testing strategies, particularly noting the increasing use of serological assays for case ascertainment.



Figure 6: Estimate of average local transmission potential of active cases for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval) up to 14 June, based on case data up to and including 8 June (due to a delay from symptom onset to reporting, the trend in estimates after 14 June is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1). NOTE: The magnitude of the increase in $R_{\rm eff}$ for Vic should be interpreted with caution due to missing data on the date of symptom onset for 20 cases reported between 12 and 14 June (inclusive).

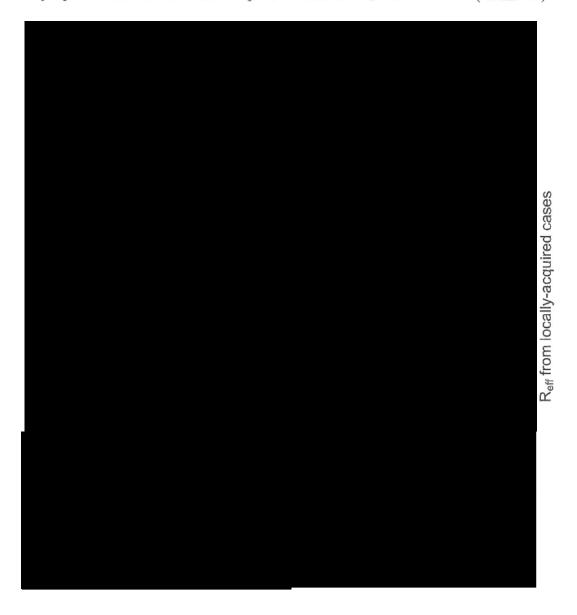
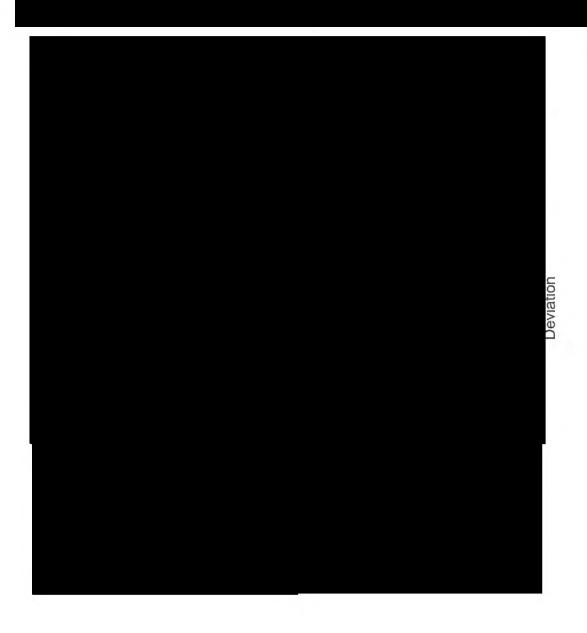


Figure 7: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission state/territory (light pink ribbon=90% credible interval; dark pink ribbon=50% credible interval) up to 14 June, based on data up to and including 8 June (due to a delay from symptom onset to reporting, the trend in estimates after 14 June reflects the average range of deviations for that state, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies.



Ensemble forecast of the daily number of new confirmed cases nationally

We report Australia-wide and

state-level forecasts of the daily number of new confirmed cases cases up to 21 July—synthesised from three independent models (including our existing forecasting model, previously presented to CDNA/AHPPC).

Ensemble forecasts are more accurate than any individual forecast alone — biases and variances in each model that result from different modelling choices balance against each other to improve predictions. Hence, ensemble forecasts tend to produce improved estimates of both the central values, as well as improved estimates of the plausible yet unlikely forecasts (uncertainty). Here, the ensemble has been generated by equally weighting the forecasts from each model for the first week (the time-series model has zero weighting beyond the first week). In future weeks, we will continue to improve the ensemble performance by updating the weights for each model based on their past-performance.

A brief description of each method incorporated in the ensemble is given below:

- SEEIIR Forecast: Our existing forecasting model previously presented to CDNA and AHPPC a stochastic susceptible-exposed-infectious-recovered (SEEIIR) compartmental model that incorporates changes in local transmission potential via the estimated timevarying effective reproduction number (as shown in Figure 6). Details can be found in our technical report at: https://www.doherty.edu.au/about/reports-publications.
- Probabilistic Forecast: A stochastic epidemic model that accounts for the number of imported-, symptomatic- and asymptomatic-cases over time. This model estimates the effective reproduction number corresponding to local and imported cases, and incorporates mobility data to infer the effect of macro-distancing behaviour. This model captures variation in the number and timing of new infections via probability distributions. The parameters that govern these distributions are inferred from the case and mobility data (e.g., mean number of imported cases).
- Time-Series Forecast: A classic time-series model that does not account for disease transmission dynamics, but rather uses recent daily case counts to forecast case counts into the future. Parameters of this 'autoregressive' model are estimated using global data accessible via the Johns Hopkins COVID-19 repository. Case counts from a specific number of days prior to the forecasting date (the present). Case counts from a specific time window prior to the forecasting date (the present) are used for model calibration. The number of days within this time window is chosen to optimise projections for Australia data.

The SEEIIR and Probabilistic Forecasts explicitly incorporate dynamics of disease transmission and the impact of public health measures on transmission over time (in SEEIIR, via $R_{\rm eff}$). The Time-Series Forecast does not explicitly incorporate either of these factors. The Time-Series Forecast has been shown to accurately forecast new daily case numbers approximately one week into the future, whereas the two disease-specific models are anticipated to provide more accurate forecasts several weeks into the future. Hence, the Time-Series Forecast only contributes to the ensemble for one week into the future. All forecasts assume that current public health measures will remain in place and that public adherence to these measures will be consistent into the future.

Figure 8: National time series of new daily local cases of COVID-19 estimated from the forecasting ensemble model up to 14 June and projected forward up to 21 July (blue shading corresponds to 50–90% confidence intervals), assuming that local transmission potential remains at its current estimated level. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars).



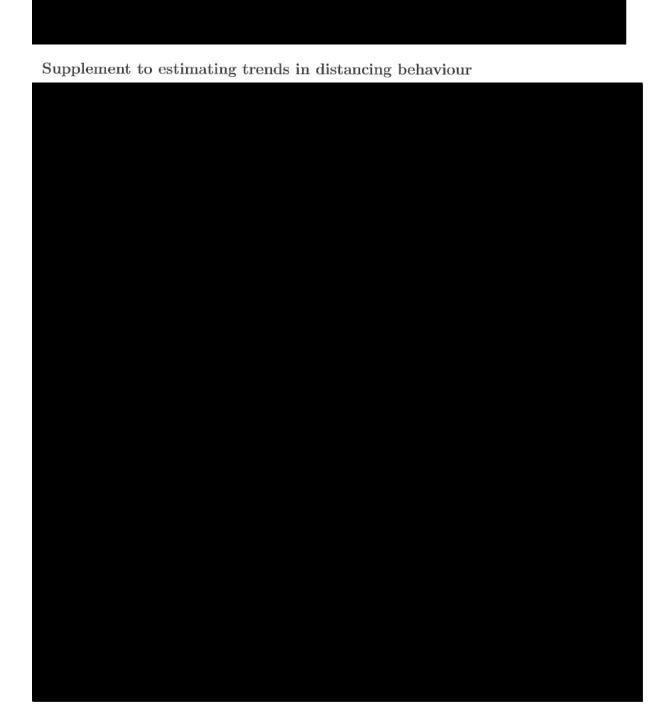
Figure 10: Time series of new daily local cases of COVID-19 estimated from the forecasting ensemble model. Left panels show the 50–90% confidence intervals of the forecast (coloured as per Figure 8). Right panels display 8 randomly selected trajectories from each model within the ensemble. Note that in all states, a considerable fraction of trajectories remain at or close to zero. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars).



Supplementary Appendix

For full methodological details on the mobility, $R_{\rm eff}$ and forecasting analyses, please refer to our most recent Technical Report (15 May 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications





References

[1] Freya M. Shearer, Lisa Gibbs, Eva Alisic, Katitza Marinkovic Chavez, Niamh Meagher, Lauren Carpenter Phoebe Quinn, Colin MacDougall, and David J. Price. Distancing measures in the face of COVID-19 in Australia. Available from: https://www.doherty.edu.au/uploads/content_doc/social_distancing_survey_wave1_report_May142.pdf, 2020.

Supplementary figures

Figure S1: Time series of new daily confirmed cases of COVID-19 in Australia (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 15 June 2020. Plotted by recorded or inferred date of symptom onset.



Figure S2: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 15 June 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.



Figure S3: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour or time-to-detection, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval) up to 14 June, based on data up to and including 8 June. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

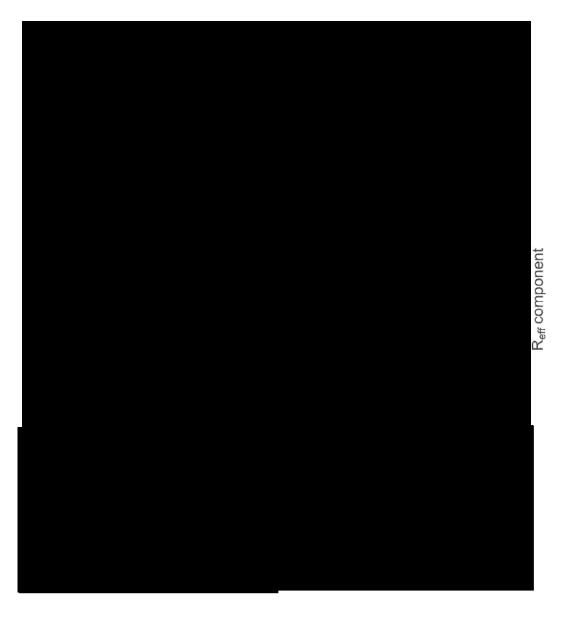


Figure S4: Estimate of average state-level trend in local transmission potential, if we assume that only 'micro-distancing' behaviour had changed and not 'macro-distancing' behaviour or time-to-detection, for each state/territory (light purple ribbon = 90% credible interval; dark purple ribbon = 50% credible interval) up to 14 June, based on data up to and including 8 June. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

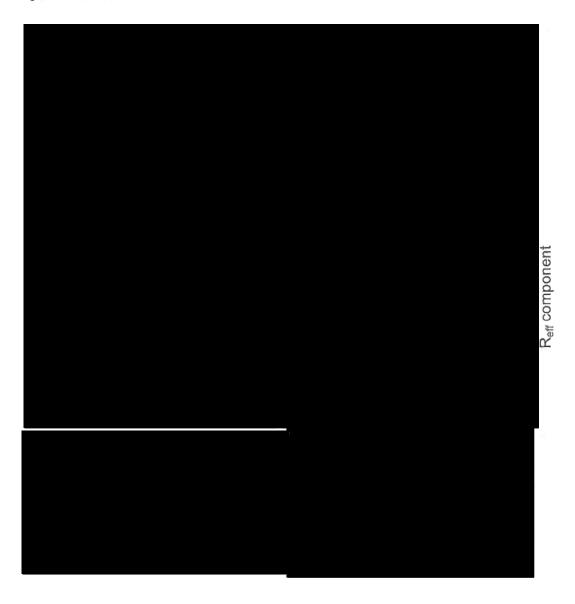


Figure S5: Estimate of local transmission potential averaged over state/territory population (component 1); i.e., removing short-term variation due to clusters (component 2) (light green ribbon=90% credible interval; dark green ribbon=50% credible interval) up to 14 June, based on data up to and including 8 June. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. This includes the combined effect of macro- and micro-distancing behaviours.

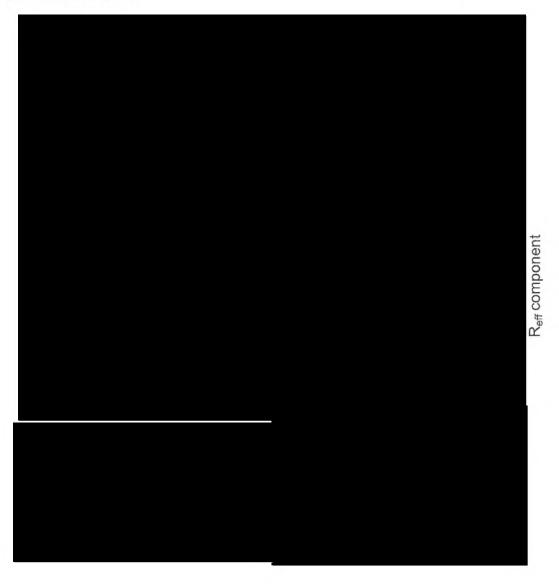
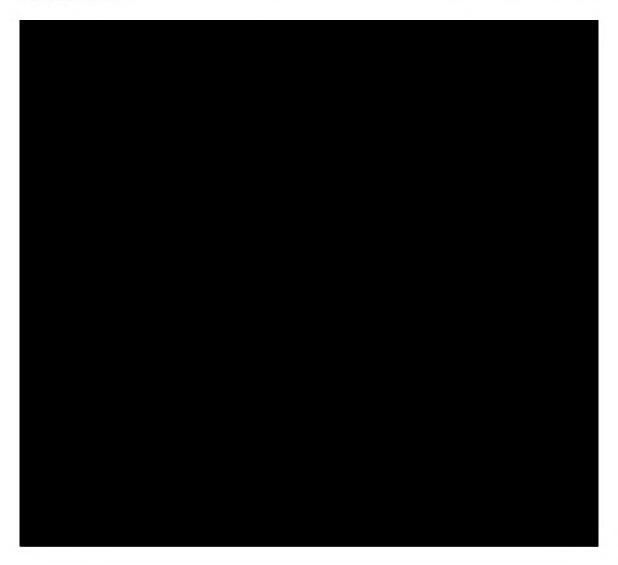


Figure S12: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of three social distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.





Novel Coronavirus (COVID-19) Daily epidemiology update as at 1200h, 18 June 2020

1. AUSTRALIAN SUMMARY (as at 1200h 18 June 2020)

- Vic reported 18 newly confirmed cases: 6 were overseas acquired detected in returned travellers in hotel quarantine, 1 case was linked to a known cluster (Croydon Family Practice outbreak), and 11 have been detected through routine community testing and are under investigation.
 - Of the cases under investigation, 1 attended a protest but was not considered infectious at the time

Over the past week:

 The total number of cases reported over the last week was 110, up from the 42 cases reported in the week prior. Of newly confirmed cases in the past week 74% were reported from Vic (81 cases) Table 1. Summary of COVID-19 cases#

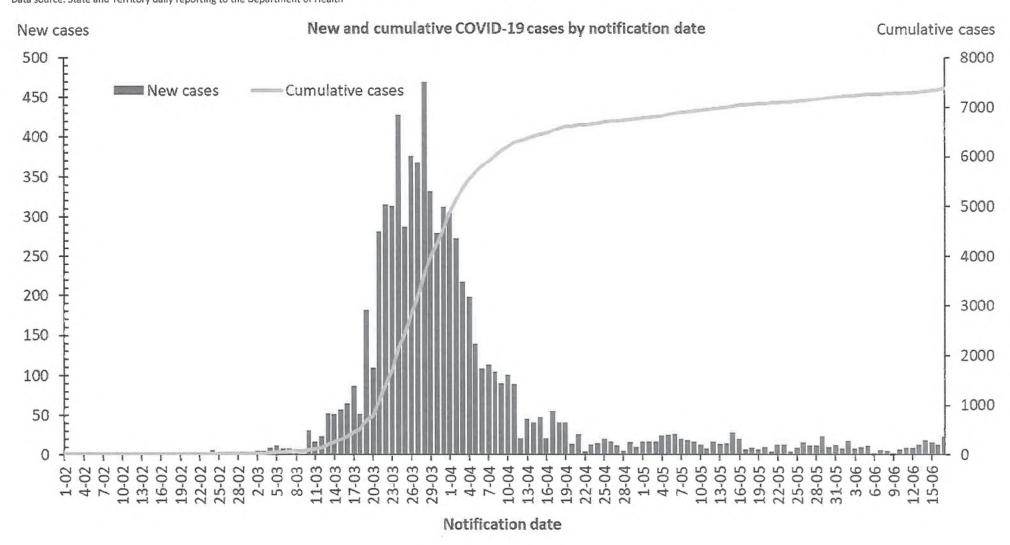
COVID-19 cases	Vic
Source of acquisition (cumulative to date)	
Overseas acquired	916
Locally acquired - contact of confirmed case and/or in a known cluster	642
Locally acquired - contact not identified	192
Locally acquired - contact not identified interstate travel	0
Under investigation	30
Total (confirmed and probable)	1,780
Recovered	1,678
Deaths	19
COVID-19 status (current)	
Active cases	81
Hospitalised (total)	4
Hospitalised - ICU (of those hospitalised)	2
Hospitalised - ICU ventilated (of those admitted to ICU)	2
Comparison over time of cumulative case count	
Newly confirmed cases in the last 24 hours	18
% change in the last 24 hours	1.0%
Newly confirmed cases in the last 72 hours	48
% change in the last 72 hours	2.7%
New increase in cases over the past week (7 days)	81
COVID-19 testing (cumulative to date)	
Total tests (both positive and negative)	621,226
Change in the last 24 hours	12,400
%change in the last 24 hours	2.0%
Percent testing positivity	0.3%
Total tests per 100,000 population	9,370
Due to the dynamic nature of surveillance data, our daily reports f	rom state and territories are subject to retrospective revision. Data under investigation will be allocated to

[#]Due to the dynamic nature of surveillance data, our daily reports from state and territories are subject to retrospective revision. Data under investigation will be allocated to another category once known, this therefore will result in negative values

[^]Due to discrepancies in the way active cases are currently being reported per jurisdiction, we are unable to report on the total number of active cases in Australia.

Distribution

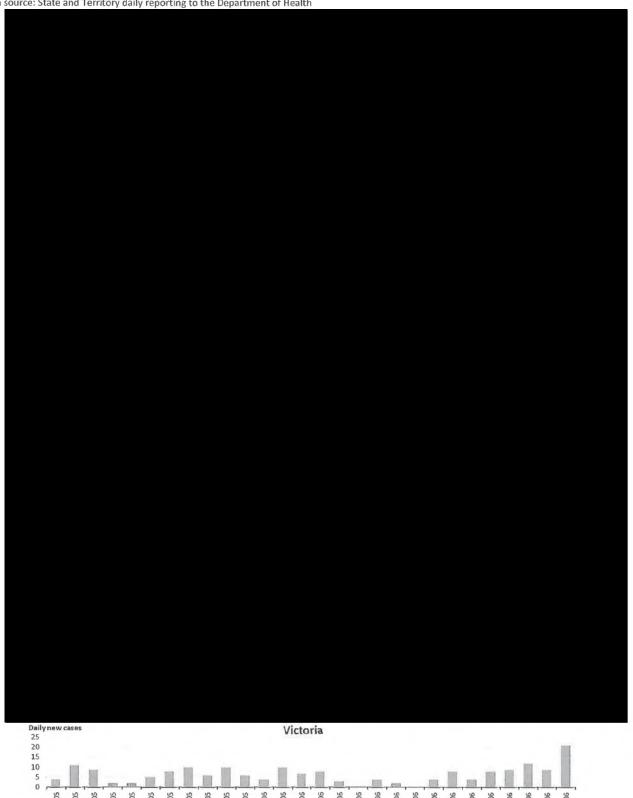
Figure 1. Number of new and cumulative confirmed cases, by date of notification, Australia Data source: State and Territory daily reporting to the Department of Health



Recently reported cases

Figure 2. Cases in the last 4 weeks by jurisdiction

Data source: State and Territory daily reporting to the Department of Health



Clusters and Outbreaks

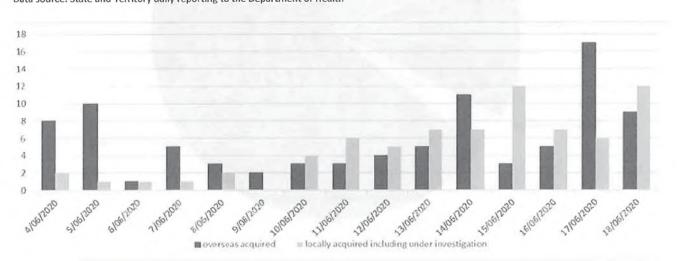
Clusters and outbreaks currently open and under investigation include:

- Vic: Coburg extended family outbreak
 - o To date, a total of 12 cases are associated with the outbreak; from 4 households
 - Testing of family members has been undertaken and extensive contact tracing is underway.
 - o St Dominic's Primary School in Broadmeadows.
 - o Pakenham Springs Primary School.
- Vic: South Eastern Suburbs outbreak (previously named Monash Health)
 - Cases have included a patient at the facility, healthcare workers, and household contacts.
 - To date, a total of 7 cases are associated with this outbreak, including 1 hospitalised case.
- Vic: An outbreak has been linked to the Cedars Medical Clinic in Coburg and the Croydon Family Practice on 9 June 2020, and at the Lilydale Medical Clinic on 11 June 2020.
 - On 12 June 2020 was identified as an asymptomatic case. has been linked as a close contact of a prior confirmed case.
 - Through subsequent contact tracing, two household contacts were identified as cases on 13 June 2020.
 - One additional case linked to the Croydon Family Practice has been reported over the past 24 hours bringing the total number of cases associated with this outbreak to 5.
- Vic: Rydges outbreak among staff at quarantine hotel facility and household contacts, reported on 29 May 2020:
 - To date, 16 cases have been associated with this outbreak, including one case who
 was notified by 11 June 2020.
 - o Investigations into all potential sources of transmission are ongoing.

Source of acquisition

Over the past fortnight the proportion of locally acquired to overseas acquired cases has fluctuated and varies by jurisdiction. (see figure 3). Over this period cases in returned travellers in hotel quarantine has been reported in 4 jurisdictions vic, the number of cases detected may be reflective of different testing timelines by jurisdictions and the country of origin of the returned traveller cohorts.

Figure 3. Source of COVID-19 acquisition reported daily by jurisdictions
Data source: State and Territory daily reporting to the Department of Health



Of the 102 confirmed deaths reported by jurisdictions:			
 19 were Vic cases (including 1 health care worker); 			



Figure 8. COVID-19 confirmed cases notified among Aboriginal and Torres Strait Islander persons by source of acquisition

Data source: National Notifiable Diseases Surveillance System

Aboriginal and Torres Strait Islander persons (% of all confirmed cases)

Overseas acquired

Locally acquired - contact of confirmed case and/or in a known cluster

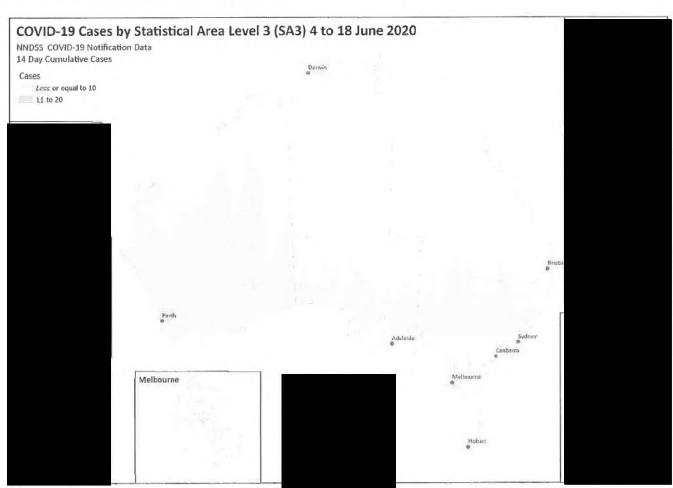
Locally acquired - contact not identified

Locally acquired - contact not identified



Figure 9. Australian COVID-19 cases by Statistical Area Level 3 from 4 – 18 June 2020*

Data source: National Notifiable Diseases Surveillance System



^{*}These maps requires caution especially when drawing inferences about areas of current transmission. The allocation of a case to an SA3 area is based on **their postcode of Australian residence** and does not necessarily represent the area where they acquired their infection, or were tested or treated. Cases that are overseas residents are not included in this mapping.

Testing Data

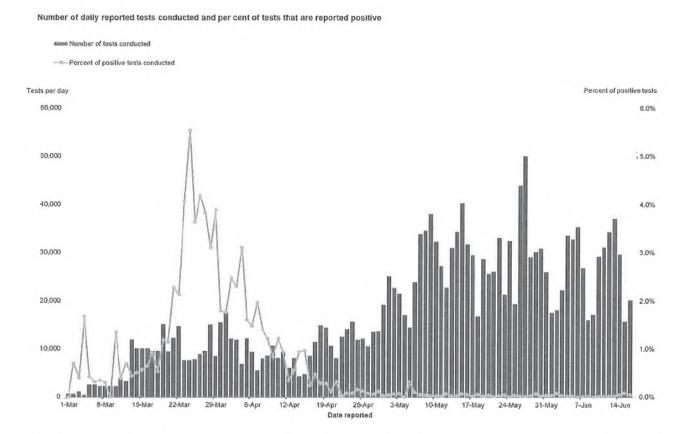
As at 18 June 2020, there have been over 1,927,000 tests conducted across Australia. The test positivity rate has fallen nationally over the past month; however, this has varied by jurisdiction due to differences in testing criteria and local epidemiology (Figure 10).

There average number of tests conducted each day for the last week was approximately 31,000 tests with the cumulative percentage positive remaining at approximately 0.4%.

All jurisdictions now report the number of tests conducted and not the number of people tested. Overall testing rates remain high in all jurisdictions.

Figure 10. Number of daily reported tests conducted and per cent of tests that are reported positive, Australia

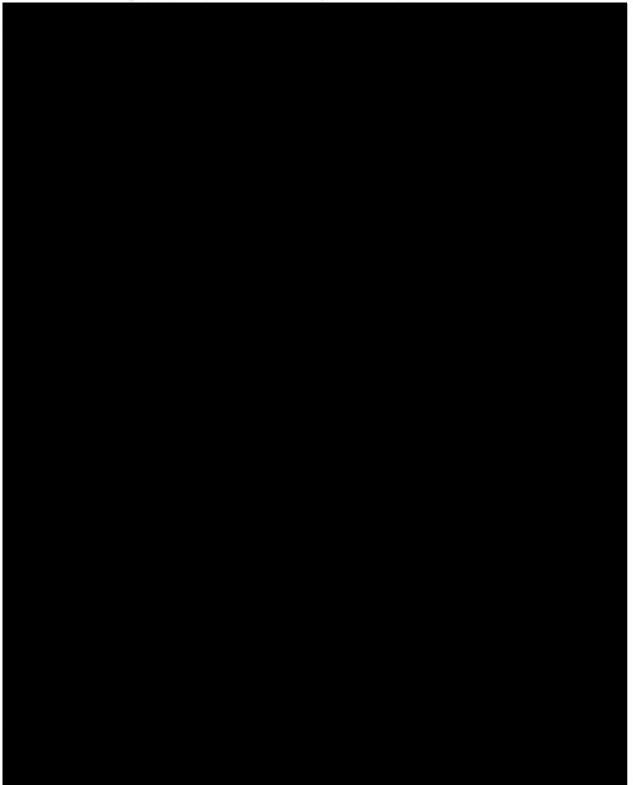
Data source: State and Territory daily reporting to the Department of Health



Notes: Date prior to 24 March 2020 has been partially estimated to give a national picture, as data from South Australia was not supplied until 24 March 2020.

Correction and update: Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia

Report submitted to CDNA/AHPPC 21 June 2020



Estimates of changes in physical distancing behaviour

 We used data from nationwide behavioural surveys to estimate trends in both macrodistancing and micro-distancing behaviour over time.



Estimates of current epidemic activity

• We report estimates of local transmission potential from a statistical method which allows us to distinguish between transmission in the general population and clusters/localised outbreaks (Figure 2).



Estimating trends in distancing behaviour

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide behavioural surveys to estimate trends in specific macrodistancing (average daily number of non-household contacts) and micro-distancing (proportion of the population always keeping 1.5m physical distance from non-household contacts) behaviours over time. We used these survey data to infer state-level trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.



Population mobility analysis

A number of data streams provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

The largest reductions in the impacts of physical distancing are evident in mobility data streams for lower transmission risk activities, such as time at parks. There is also a clear reduction in data streams representing higher-risk activities, such as time at workplaces. However, these mobility data do not indicate whether the increase in higher transmission risk activities is mitigated by other behaviours that are not measured by these metrics — such as reducing contacts and adherence to the 4m² rule. In other words, while changes in these mobility data streams are useful for detecting changes in macro-distancing behaviour, they do not capture changes in micro-distancing behaviour.

Figure 1: Estimated trends in macro-distancing behaviour, i.e., reduction in the daily rate of non-household contacts, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from two surveys conducted by the national modelling group in early April and early May, and two BETA surveys conducted in late May and early June (indicated by the black lines and grey rectangles), and an assumed pre-COVID-19 daily rate of 10.7 non-household contacts taken from previous studies. The width of the grey boxes corresponds to the duration of each survey wave (around 4 days) and the green ticks indicate the dates that public holidays coincided with survey waves (when people tend to stay home, biasing down the number of non-household contacts reported on those days). Note that the apparent increase in contacts in the second survey in Tas and WA is a statistical artefact due to the small sample sizes (100 in WA, 21 in Tas) which happen to contain two respondents reporting 100+ contacts.

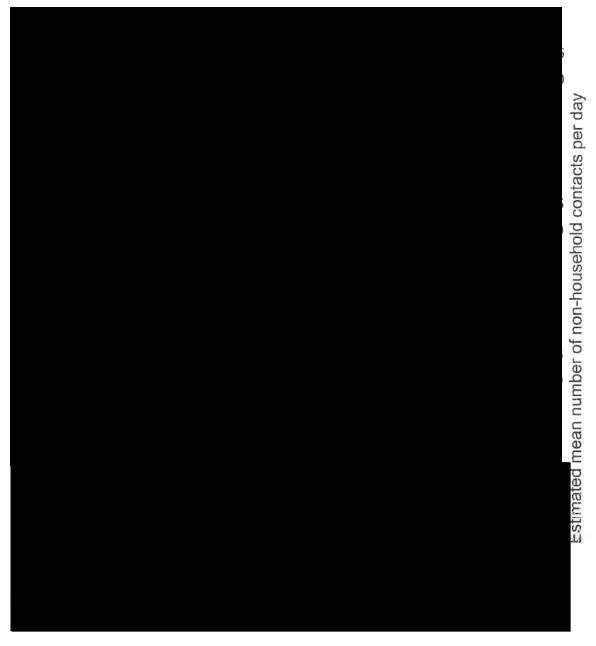


Figure 2: Estimated trends in micro-distancing behaviour, *i.e.* reduction in transmission probability per non-household contact, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from 11 nationwide surveys conducted by BETA from late March to early June (indicated by the black lines and grey boxes). The width of the grey boxes corresponds to the duration of each survey wave (around 4 days).

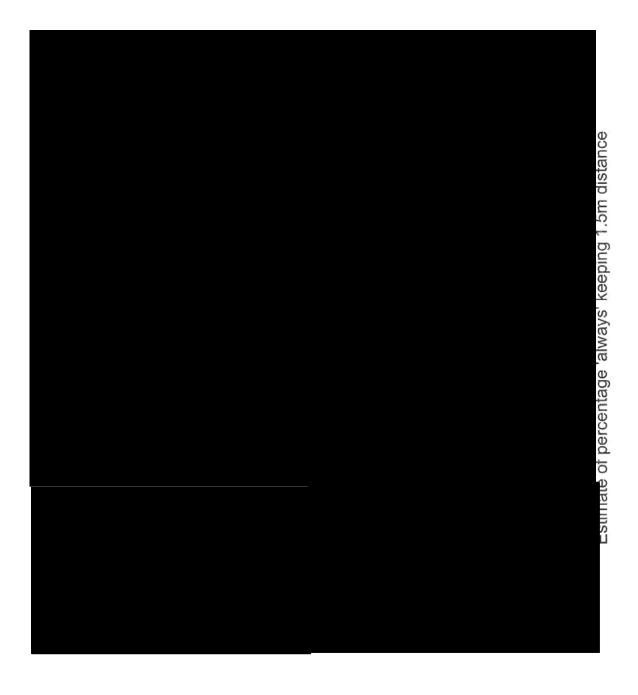


Figure 3: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 14 June. Solid vertical lines give the dates of three social distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 14 June, the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream. Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S13).



Estimating local transmission potential

We separately model local to local transmission (Figure 7) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} driven by interventions (specifically changes in macro- and micro-distancing behaviour, surveillance measures, and quarantine of overseas acquired cases);
- 2. short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics of transmission, such as clusters of cases and short periods of low transmission.

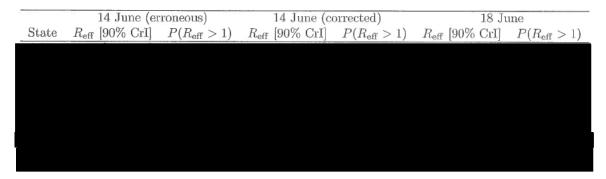
Component 1 reflects the average local transmission potential at state level (Figure S5), and Component 2 captures transmission within the sub-populations that have the most active cases at a given point in time (Figure 5). Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases in high-transmission environments — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure 9).

Note that Component 1 for local to local transmission now incorporates the impact of improvements in surveillance on transmission rates. Using data on the number of days from symptom onset to testing for cases, we estimate the proportion of cases that are tested (and therefore advised to isolate) by each day post-infection. We quantify how these times-to-detection have changed over time, and therefore how earlier isolation of cases due to improvements in contact tracing and clinical screening has reduced statewide $R_{\rm eff}$ for local to local transmission (Figure 6).



These discrepancies were not resolvable at the time of preparation of this report, but warrant further investigation.

Table 1: Estimates of average local transmission potential of active cases for each state/territory as of 14 June and 18 June. Estimates for 14 June use case data up to and including 8 June (due to a delay from symptom onset to reporting, the trend in estimates after 8 June is inferred from mobility data). Estimates for 18 June use case data up to and including 12 June.



Interpretation

Where there is epidemic activity, the estimates of local transmission potential may be interpreted as the effective reproduction number, R_{eff} . In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Figure 4: Changes in estimates of local transmission potential in Victoria as of 14 June (erroneous and corrected) and 18 June. Left column displays estimates of average local transmission potential of active cases (light green ribbon=90% credible interval; dark green ribbon=50% credible interval). Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Right column displays deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission potential (light pink ribbon=90% credible interval; dark pink ribbon=50% credible interval). Note the differences in y-axis scales for plots in the right hand column (pink).



Figure 5: Depiction of how $R_{\rm eff}$ analysis Components 1 and 2 feed into the forecasting model. TTD = time from symptom onset to detection.



Figure 6: Estimated trend in time from symptom onset to detection for locally-acquired cases (black ribbon = median estimate; yellow ribbons = 90% credible intervals; black dots = time-to-detection of each case). Note that we will continue to review how this trend is estimated, given changes in testing strategies, particularly noting the increasing use of serological assays for case ascertainment.

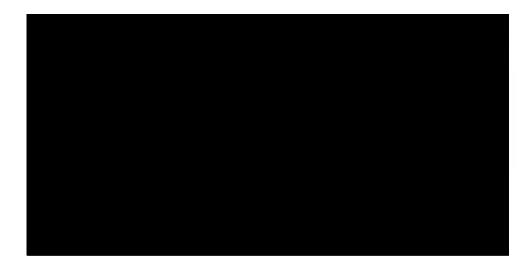


Figure 7: Corrected plot for 17 June report: Estimate of average local transmission potential of active cases for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval) up to 14 June, based on case data up to and including 8 June (due to a delay from symptom onset to reporting, the trend in estimates after 14 June is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1). NOTE: The magnitude of the increase in $R_{\rm eff}$ for Vic should be interpreted with caution due to missing data on the date of symptom onset for 20 cases reported between 12 and 14 June (inclusive).

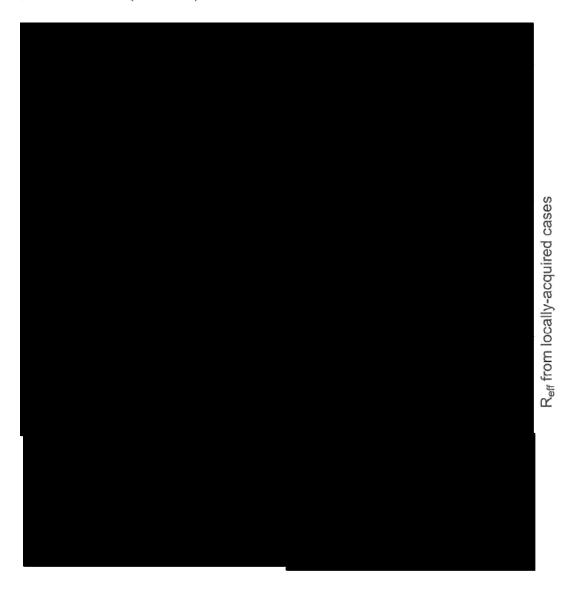


Figure 8: New plot for 21 June report using data up to 18 June: Estimate of average local transmission potential of active cases for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval), based on case data up to and including 12 June (due to a delay from symptom onset to reporting, the trend in estimates after 12 June is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

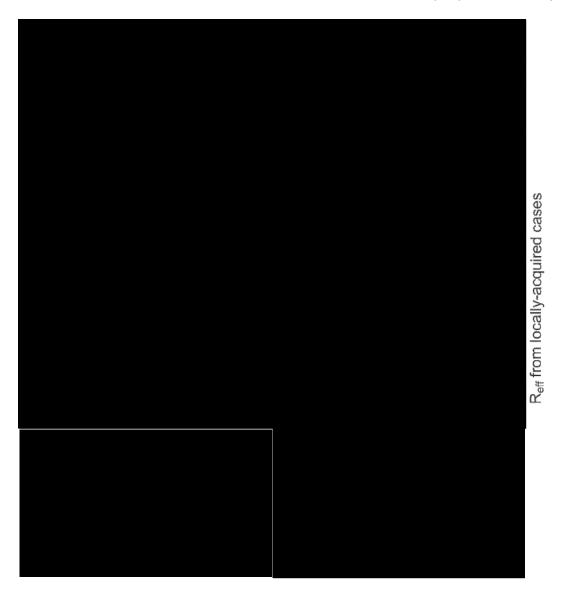


Figure 9: Corrected plot for 17 June report: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission state/territory (light pink ribbon=90% credible interval; dark pink ribbon = 50% credible interval) up to 14 June, based on data up to and including 8 June (due to a delay from symptom onset to reporting, the trend in estimates after 14 June reflects the average range of deviations for that state, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies. NOTE: The magnitude of the recent the deviation above zero in Vic should be interpreted with caution due to missing data on the date of symptom onset for 20 cases reported between 12 and 14 June.

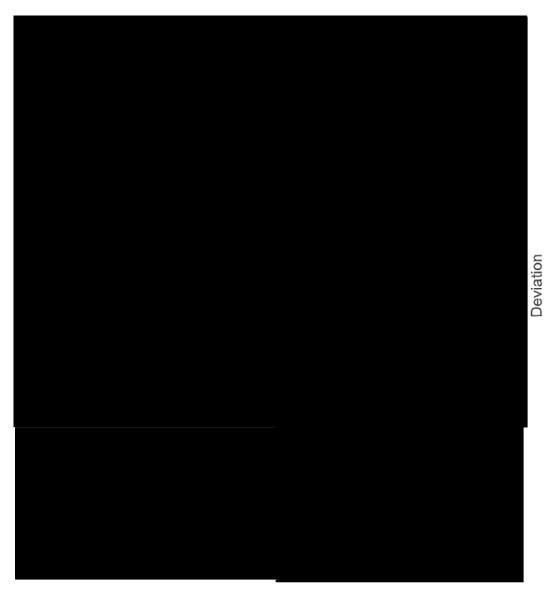


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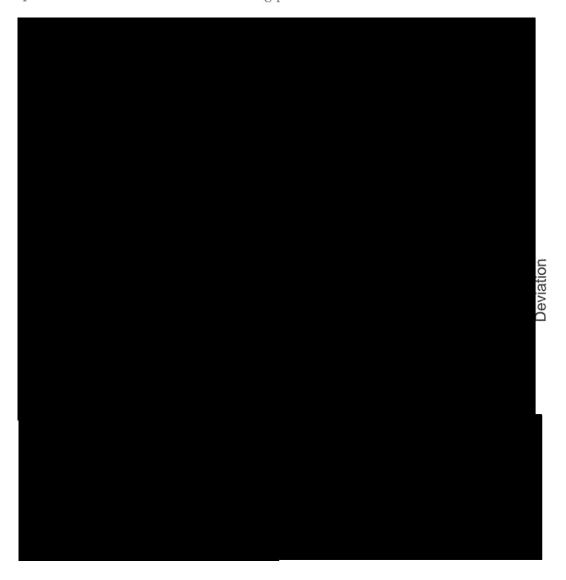




Figure 11: New plot for 21 June report using data up to 18 June: Estimate of average local transmission potential of active cases for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval), based on case data up to and including 12 June (due to a delay from symptom onset to reporting, the trend in estimates after 12 June is inferred from mobility data. Estimates were made up to 18 June and projected forward to 31 July (indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

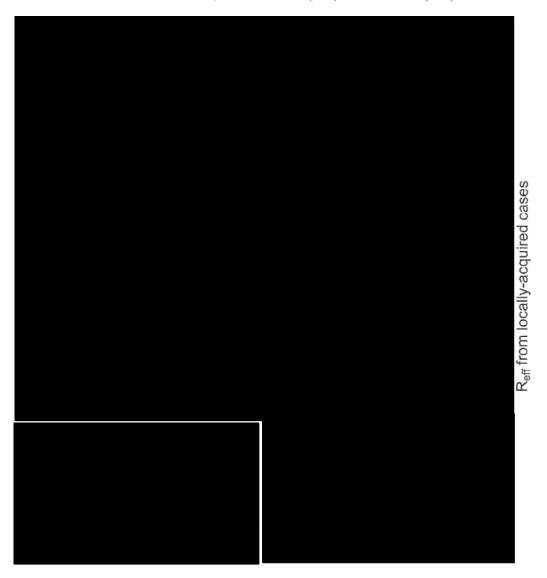
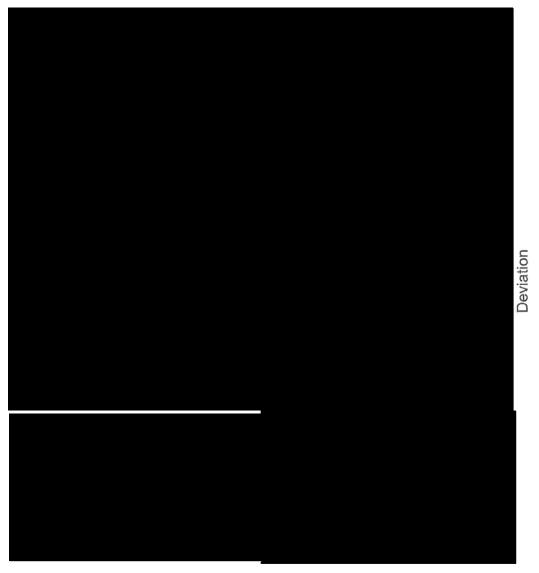


Figure 12: New plot for 21 June report using data up to 18 June: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission state/territory (light pink ribbon=90% credible interval; dark pink ribbon = 50% credible interval), based on data up to and including 12 June (due to a delay from symptom onset to reporting, the trend in estimates after 12 June reflects the average range of deviations for that state). Estimates were made up to 18 June and projected forward to 31 July (indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various social distancing policies.



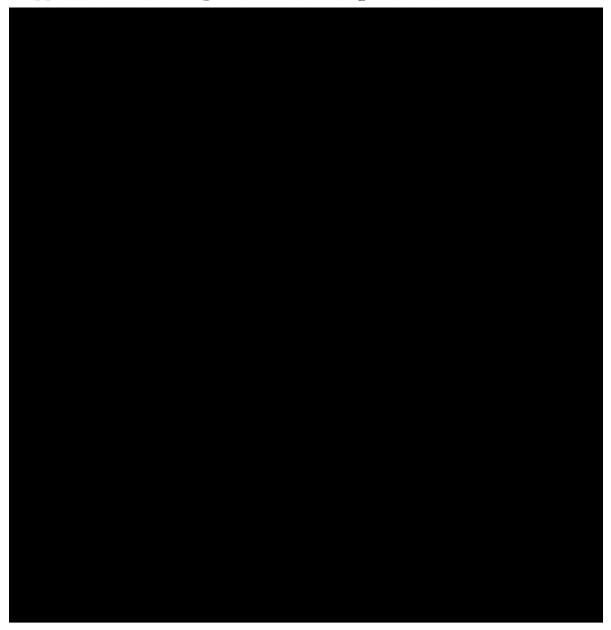
Supplementary Appendix

For full methodological details on the mobility, $R_{\rm eff}$ and forecasting analyses, please refer to our most recent Technical Report (15 May 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications



Supplement to estimating trends in distancing behaviour





Supplementary figures

Figure S1: Time series of new daily confirmed cases of COVID-19 in Australia (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 15 June 2020. Plotted by recorded or inferred date of symptom onset.



Figure S2: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 15 June 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.

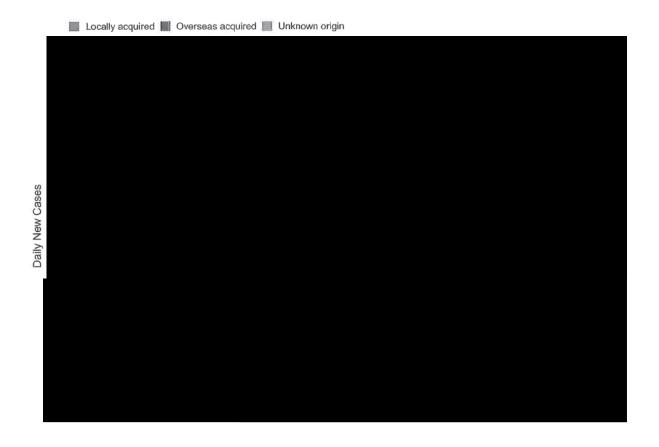


Figure S3: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour or time-to-detection, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval) up to 14 June, based on data up to and including 8 June. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

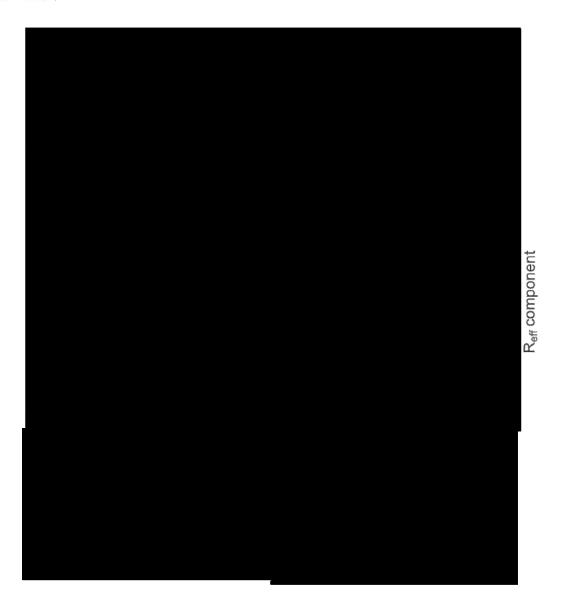


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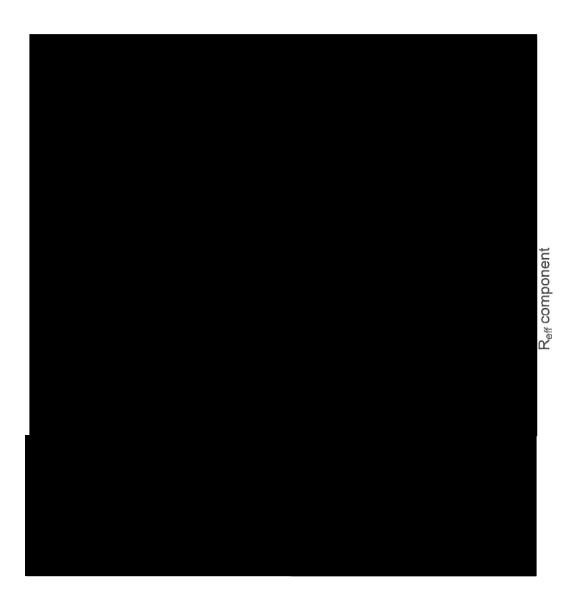


Figure S5: Estimate of local transmission potential averaged over state/territory population (component 1); *i.e.*, removing short-term variation due to clusters (component 2) (light green ribbon=90% credible interval; dark green ribbon=50% credible interval) up to 14 June, based on data up to and including 8 June. Solid grey vertical lines indicate key dates of implementation of various social distancing policies. This includes the combined effect of macro- and micro-distancing behaviours.

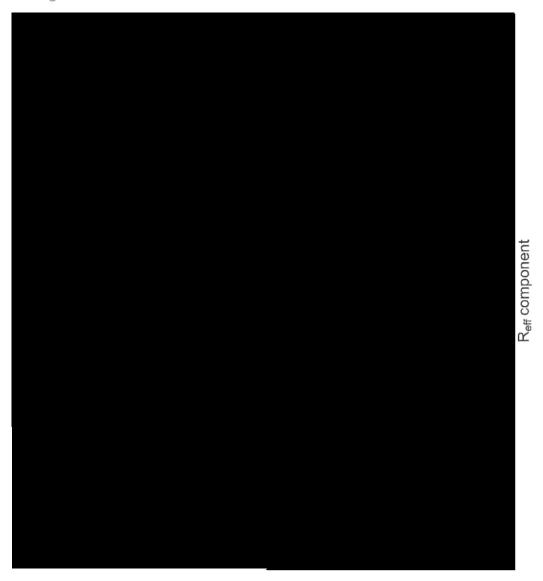
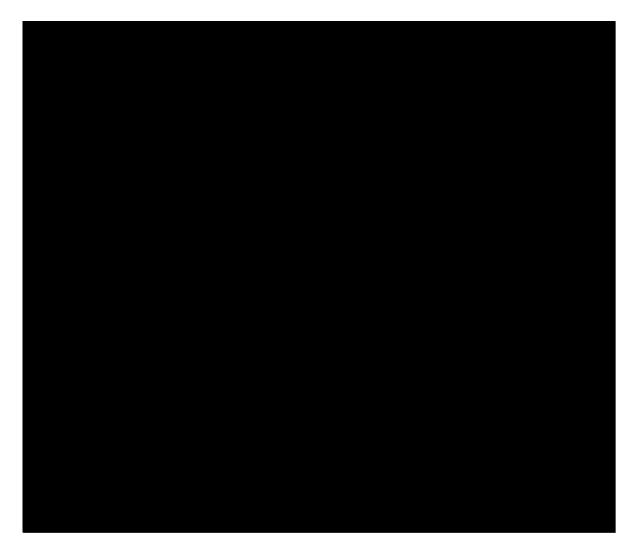


Figure S12: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of three social distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.

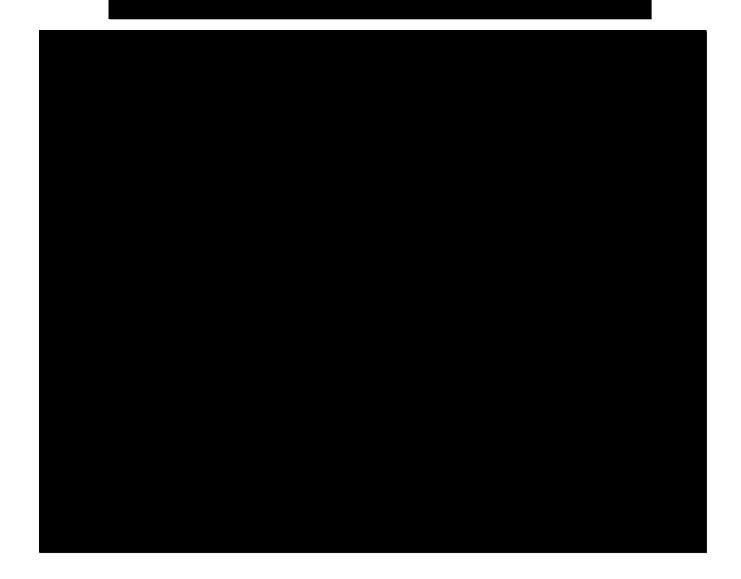




Jurisdictional Updates

Victoria:

- Adj Prof Brett Sutton provided an update on the situation in Victoria.
- Victoria has restricted residents of 10 suburbs to stay at home, except for four reasons (work, exercise, shop for essential, caring or medical reasons)
- Other parts of Victoria have also had some restrictions re-imposed.
- 73 newly confirmed cases: three were overseas acquired and detected in returned travellers in hotel quarantine, nine were locally acquired and contacts of a confirmed case or a known cluster and 61 remain under investigation.
- Judicial inquiry into the hotel quarantine, as the genomics has proven that the outbreak across the north western suburbs (about 70 cases) was seeded out of infection control breaches from hotel quarantine.
- The fresh food distribution centre in Laverton now has six cases. The first case was 22 June, and the subsequent five cases are not considered close contacts of the first. This suggests quite a wide spread of disease. All involved are looking to mitigate what risks they can,



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Jurisdictional Update

Victoria

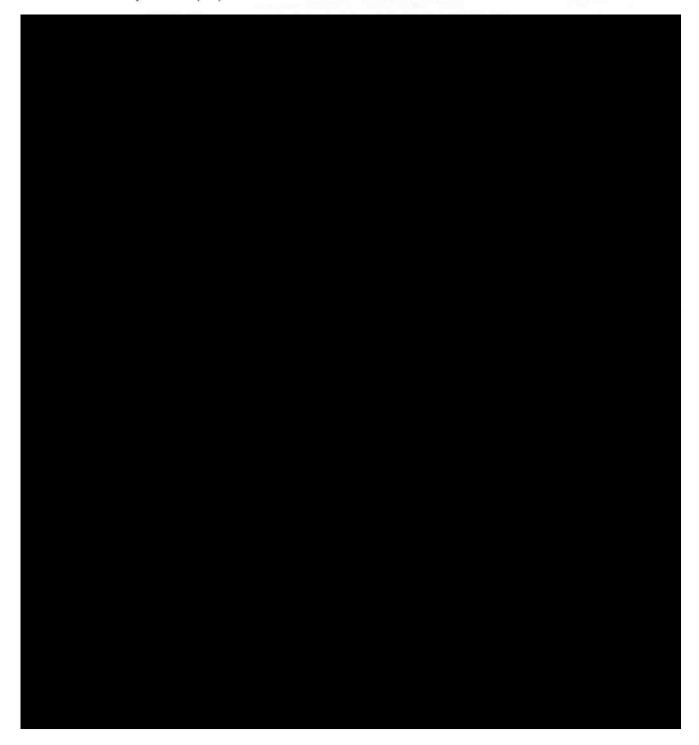
- o 77 new cases
- 13 linked to outbreaks with 37 detected through routine testing and 27 still under investigation
- o 20 patients hospitalised, with four in intensive care
- o 26,000 people tested on 1 July 2020
- o 415 active cases, with 332 without a known source
- Spot checks will be performed on entry and exit roads of suburbs being restricted to ensure they are only travelling for accepted reasons

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Agenda Item 1 - Welcome

Professor Paul Kelly welcomed members to the meeting. Prof Kelly advised that:

- · the major issue for AHPPC was still the situation in Melbourne,
- the good news is that the number of cases coming out of Melbourne, while high, has stabilised,
- all states and territories have some restrictions in place relating to the hotspot
- there have been a lot of discussions overnight about what support we can provide to Victoria,
- over 8000 cases in Australia now
- 0
- including a health-focused review of quarantine arrangements for returned travellers which is as tight and safe as possible, while also being cognisant of the judicial inquiry in Victoria.



Agenda Item 6 – Other business

Jurisdictional Update

Victoria:

- o 66 new cases
- o 28 cases from an unknown source
- o 17 cases connected to contained outbreaks
- o 1 cases connected to hotel quarantine
- o 20 cases from routine testing
- o 28 cases from an unknown source
- o 27 people in hospital with 7 in intensive care
- Noted the disproportionate number of household transmissions and that behaviours in private settings are driving the outbreak
- Thanked all of the teams who have come to assist from other states and territories.
- Noted that the exchange of process and innovation between teams has been useful and should be further explored later when more time is available.



Update on situation in Victoria

The Chair welcomed members and thanked them for responding to so quickly to the call for a meeting. The aim of the meeting was to hear from colleagues in Vic about their needs and what can be done to assist.

The Chair noted that there has been an increase in cases, despite lots of testing, and the significant escalation in the response.

The Chair further noted that all stand ready to help Victoria.

Members noted that there were 108 new cases identified, none of which are people in hotel quarantine. Most are in north and west postcodes, with two additional postcodes being added as hotspots: 3031 and 3051. (Nine and five cases respectively.)

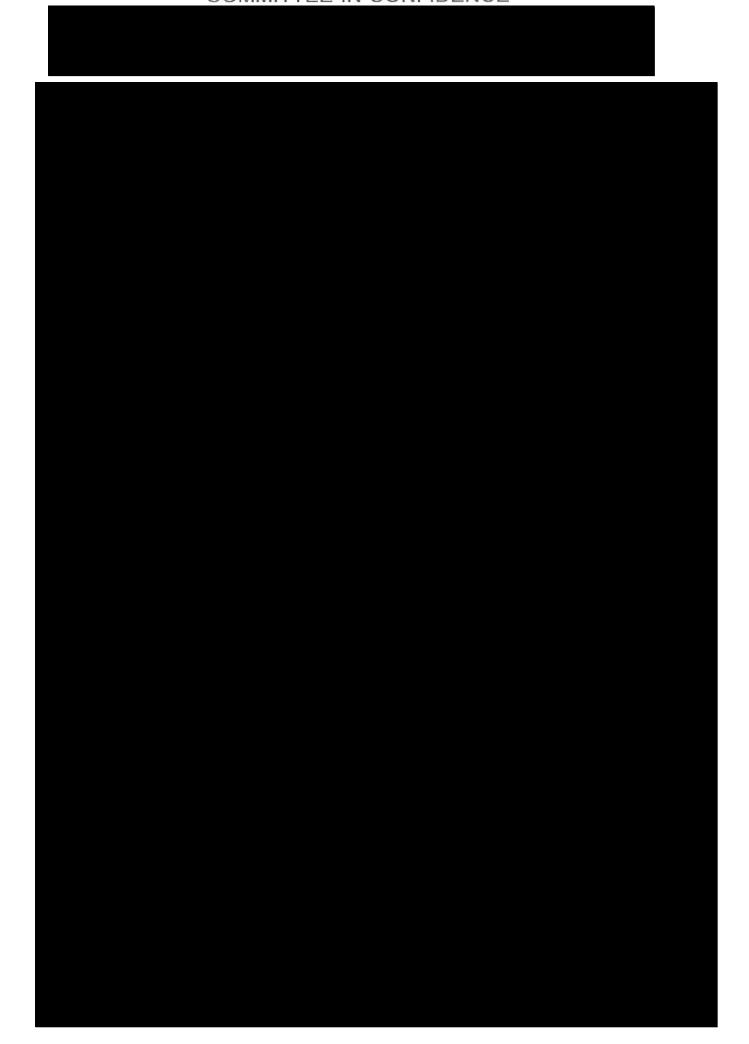
Members also noted at least 27 cases have been identified in public high-rise towers, with extensive movement between and within the towers shown by CCTV, and so susceptible to rapid spread. Therefore, those towers have been locked down;

In addition, there is a cluster in the Northern hospital emergency department (ED), and Department of Health and Human Services Victoria (DHHS) is working to identify if it is further spread within the hospital, or just in the ED.

DHHS noted that the assistance from NSW health in contact tracing has been invaluable, as was assistance being provided by other jurisdictions. Identified need to pivot to testing symptomatic people as asymptomatic testing is becoming unsuitable very quickly. NSW has been able to undertake contact tracing remotely as the Victorian system has be changed to cloud-based.

Members discussed options which may assist in the future, for example:





Update on situation in Victoria

The Chair welcomed members and asked Dr Sonya Bennett to provide an update on the situation in Victoria.

Dr Bennett advised that there had been Another 70 cases since last night, and still unclear how many with links. There has been a lot of focus on the public health response to the housing commission high-rises.

Ms Alison McMillan will work in a command and control capacity between all the relevant players around infection control, based on her knowledge of the health system in Melbourne. Dr Bennett advised that this offer would be accepted. The Royal Melbourne

hospital will provide infection control support to the high-rise community.

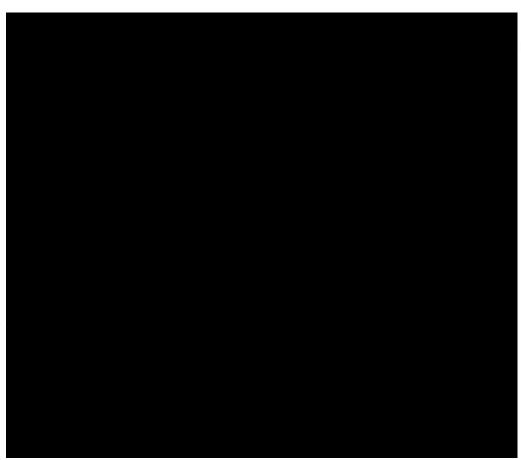
Members also noted that the importance of a national approach to infection control, and the utility of a coordination mechanism. The Commonwealth will provide this coordination.

Members noted that knowledge about whether there is transmission outside the hotspot suburbs will become clearer in coming days. Also, that regional Victoria appears to still be clear of transmission.

Members also noted that it may be timely to re-visit the AHPPC statement on testing including the role of asymptomatic testing and the difference between asymptomatic and presymptomatic testing, and to develop some communications around it

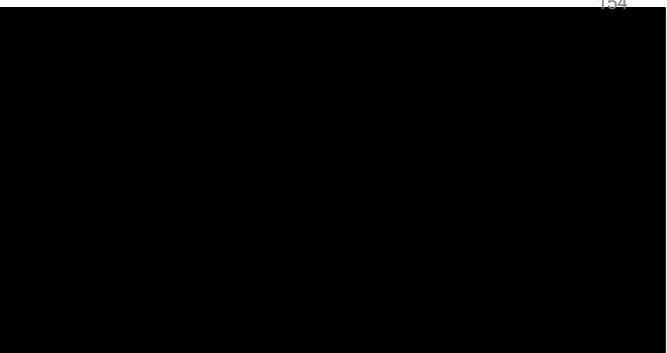
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Members noted that no new public health directions had been issued in Victoria since the last meeting		
rose meeting		



Members noted that some Victorians from hotspots may still be travelling for work reasons. CHOs agreed to communicate the jurisdictional requirements for those travelling from hotspots for approved reasons.

Members reaffirmed support for Victoria.



Agenda Item 5 - Other Business

a) Victoria epi & situational update

Prof Paul Kelly noted that:

- The situation in Victoria could be referred to as a second wave within Victoria, as this is a very different outbreak to the first wave in March/April (mainly returning overseas travellers).
- The cases diagnosed in the past 24 hours exceeded any previous day since the beginning of the pandemic in Victoria but, that this is a matter for the Victorian CHO.
- The NSW and Victorian Governments have announced that the border between New South Wales and Victoria will be closed from 0001hrs Wednesday 8 July 2020.



It was noted that Ms Alison McMillan is leading public liaison with emergency response and public health for whatever is developed nationally. It was noted that Ms McMillan would be able to assist with infection prevention and control as well, but would need assistance from or through the NIR.

Members further discussed how they can support Victoria and agreed to consider developing a roster of senior executive support over the next month to assist, as needed during the outbreak.

Members discussed the situation noting the following points:

- Dr Lucas de Toca is putting together a list of GP testing in Melbourne and surrounds and
- providing daily data on this to Victoria.

- Airline crew have been reported by the media as being sent to assist in hotel quarantine –
 exact assistance has not been confirmed.
- The messaging on the use of masks was confirmed as being in line with the national principles, including the advice provided to GPs and health care workers in hospital settings.

Agenda Item 5- Community use of masks or face shields

Dr Lyn Gilbert provided an overview of the ICEG advice to the question - Who should be wearing a mask in the community, in Australia, now that there is COVID-19 occurring in Melbourne?

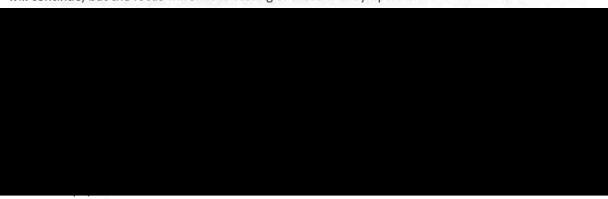
Dr Gilbert advised the advice is consistent with previous AHPPC advice on the use of masks as the recommendation to not wear masks was based on low rates of community transmission. Given, the situation has significantly changed in Victoria, it is reasonable to encourage the use of masks in areas of high community transmission.

Agenda Item 6 - Victorian Update

Prof Brett Sutton advised members that there are 191 new cases today (27 were reclassified from yesterday – the net increase is 154) within Victoria, making a total of 2824 cases to date.

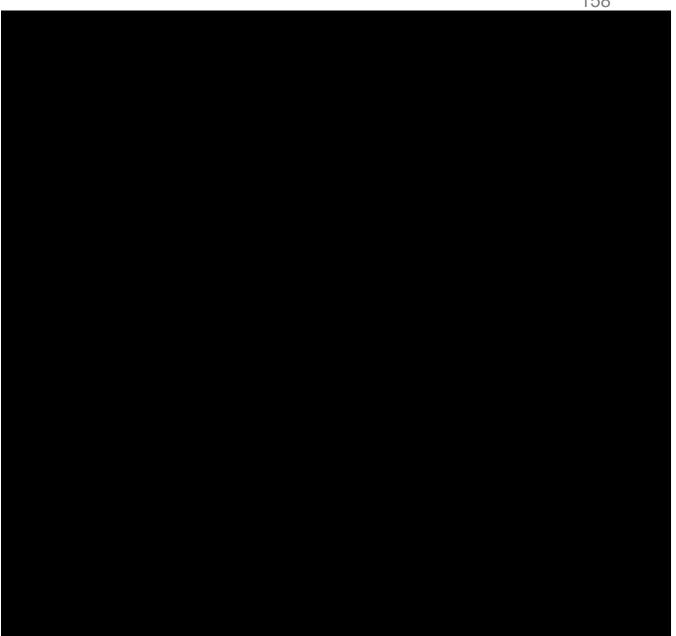
It was noted that there were 4 regional cases in Wodonga, Golden Plains, Latrobe and East Gippsland. It is not known where these were acquired but suspect that the seeding has occurred from Melbourne.

Door to door testing is occurring where the probability of infection is high. Asymptomatic testing will continue, but the focus will shift to testing of those with symptoms.



Widespread testing is also being undertaken of staff and residents in residential care facilities to check for any undetected cases.

Prof Sutton noted that in clinical settings, Victoria are likely to recommend that health care workers wear masks all the time. There may be a transition to homemade masks if there is a move to wearing masks routinely.



Agenda Item 3 – Update on Victoria's Situation

Adj Prof Brett Sutton advised Victoria has 134 new cases today, an increase of 118 once reclassifications were taken into account. 11 of the new cases are linked to known cases and the remainder are still under investigation. There were 29 000 tests conducted yesterday within Victoria.

Within the public housing towers, there are 5 towers with approximately 10 - 15 cases and 1 tower	
with 60 plus cases	



Agenda Item 6 - Modelling Update

Professor James McCaw spoke to this paper, highlighting the following points:

- Levels of both macro and micro-distancing have continued to wane since previous estimates, however, there is evidence of stabilising behaviour in some population mobility data streams. This includes decreased levels of mobility in Victorian Local Government Areas over the past week, particularly in hotspots.
- As of 1 July, average state-wide transmission potential is estimated to be above 1 in all states/territories, except Victoria, where it is 0.92.
- If local transmission potential remains at its current estimated level, it is anticipated that the daily local case counts will remain very low or zero into August for all states/territories except Victoria.
- Forecasting scenarios of the June outbreak in Victoria suggest that the most likely effect is where control is achieved with slowly declining epidemic activity over the next month.

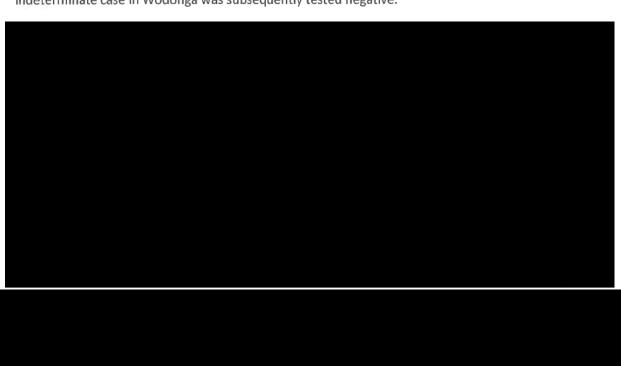


Victorian undate		

Professor Brett Sutton reported that Victoria has recorded 165 new infections overnight and 9 cases were reclassified overnight. 30 of the new cases are linked to known outbreaks and 135 are still under investigation. The total cases for Victoria is 3098.

The 2 public housing towers with aged residents currently remaining free of infection.

All of Victoria's current rural cases have been traced back to Melbourne or known outbreaks, one indeterminate case in Wodonga was subsequently tested negative.





Agenda Item 2 - Epidemiology Update

Ms Kate Pennington presented an update of the latest epidemiology to members. Members noted:

- Total of 9,059 cases
- 182 new cases
- Victoria reported 165 new cases
- 14% of cases are being hospitalised
- Since mid-June there has been a week-on-week doubling of cases driven by Victoria
- 14 indigenous cases identified since June 2020 in the Greater Melbourne area
- There has been a drop in the median age driven by an increase of cases in the younger population.

Members noted this update.
Professor Howden advised that enhanced testing strategies, for example, the current testing blitz in Victoria have impacts on testing turnaround times.



Update on Victoria's Situation

Professor Brett Sutton reported that Victoria has reported 288 new cases overnight making a total of 1,172 active cases. 32 of these cases have an unknown source. 37,588 tests were performed yesterday.

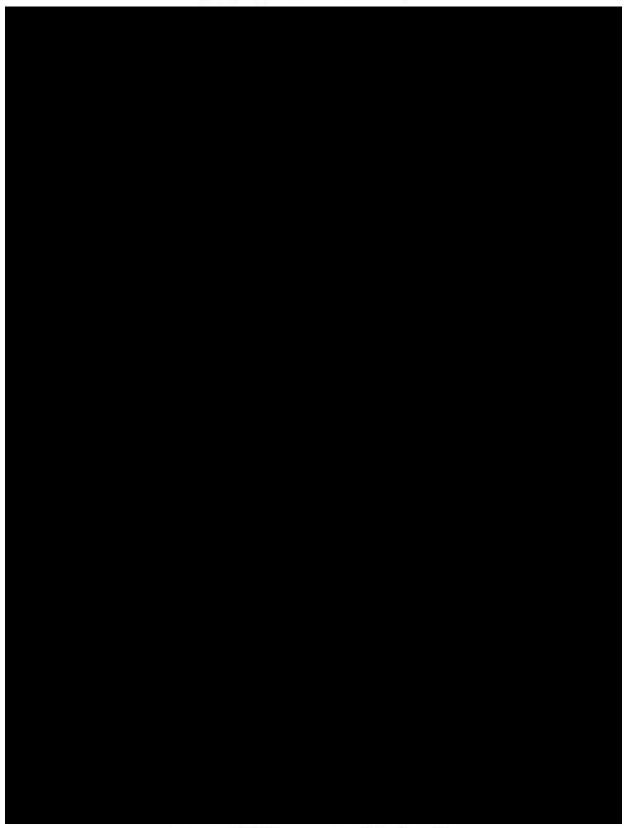
There are 8 new cases in regional areas in Greater Geelong and Greater Bendigo where some have been linked to the outbreak in Melbourne while other cases remain with an unknown source.

Professor Sutton thanked jurisdictions for the assistance with contact tracing across the board.



Agenda Item 1 - Welcome

The Chair, Professor Paul Kelly, opened the meeting, welcomed members, and thanked them for taking the time to attend today. He noted that the meeting would concentrate on the Victorian situation and how that may be playing out in other jurisdictions. He also noted that we would be discussing the surging of the public health workforce.





Agenda Item 3 - Update on Victorian Situation

A/Prof Sutton advised that there were 273 new cases identified overnight, with 34 being reclassified leading to a net increase of 239 cases. There are now 1484 active cases, with 57 people in hospital 16 of whom are in intensive care. 30,000 tests were undertaken on Saturday.

More cases have been identified in Carlton public housing and many of the public housing cases are connected by language and culture. There are a number of new clusters causing concern, including a supermarket, two abattoirs, several hospitals and aged care homes.



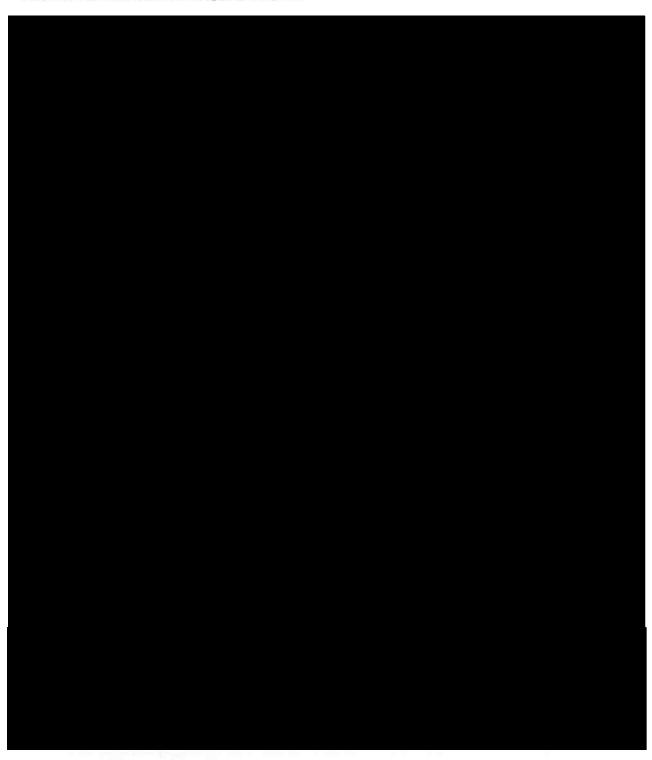
In relation to rural and regional settings, there is one new case in Shepparton and all relevant information would be shared.



a) Victorian update Adjunct Professor Brett Sutton advised that the 22,943 tests undertaken yesterday identified 177 new cases in Victoria overnight, a net increase of 168 after reclassifications. Currently there are 1612 active cases, 72 of whom are in hospital and 17 of those are in intensive care. The key outbreaks of note include an abattoir in Essendon, a building site in Footscray and several aged care homes. One aged care home has a number of cases including staff and residents. The other aged care homes are characterised by single staff member cases.
Victoria has introduced a policy change requiring staff in aged care homes to wear a mask at all times with support from the National Medical Stockpile.
In the regional areas of Victoria, there are about a dozen single cases, largely essential workers linked back to metropolitan Melbourne.



A/Prof Sutton advised that guidance has been provided to the Victorian aged care sector that only essential visitors should attend aged care homes.



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Final Comments	

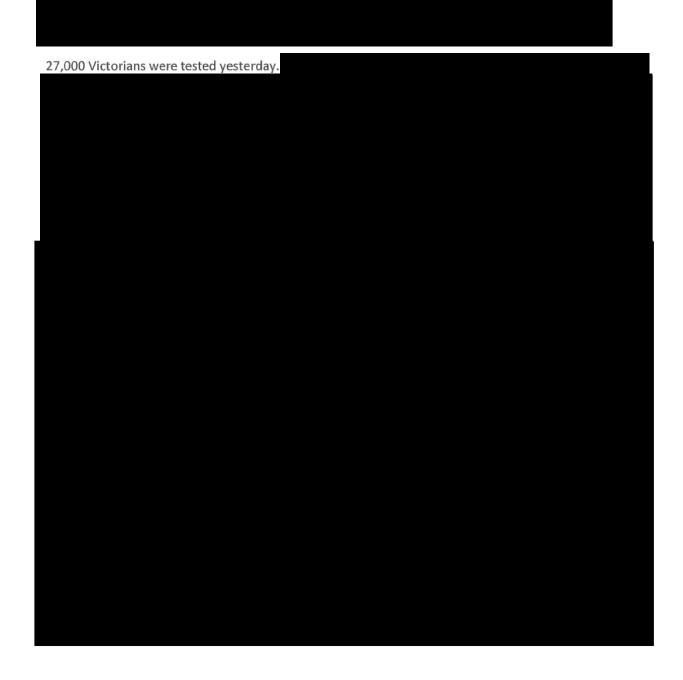
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	Victorian situation report	
	Adjunct Professor Brett Sutton advised that there have been 270 new cases identified overnight, 28 of which are connected to known outbreaks, and 242 are under investiga. There are 1803 active cases in Victoria at the moment and the number of people in hos has increased.	
	Regional Victoria now has cases in over 20 postcodes with positive cases.	
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Agenda Item 2 - Latest Epidemiology Update

Victoria

Adjunct Professor Brett Sutton advised that there had been a slight stabilisation in new cases numbers, although still high. There were an additional 238 cases overnight, although 14 from the previous day have been reclassified, leading to a net increase of 224. There were 3 more deaths yesterday, so a total of 27 COVID-19 deaths within Victoria. Only 1 person left in hotel quarantine. Department of Health and Human Services (DHHS) is focusing on outbreaks in aged care and private hospital settings.

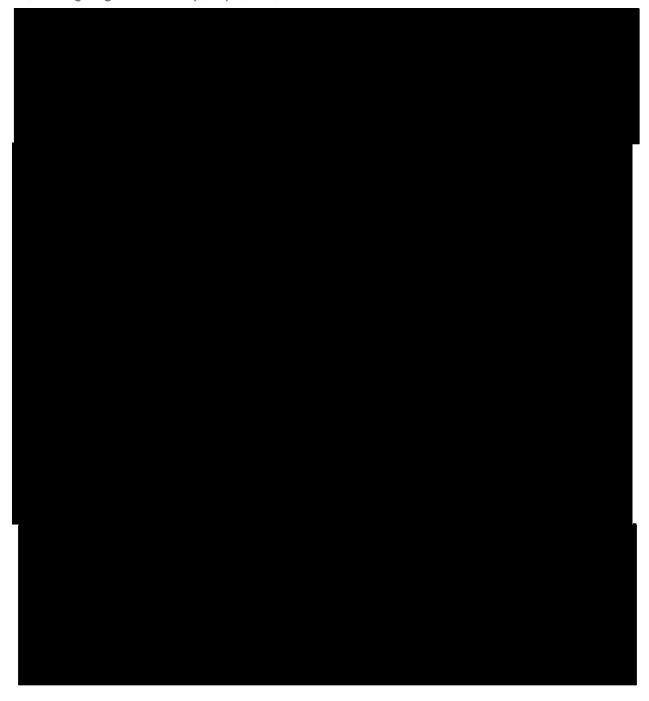




Agenda Item 2 - Latest Epidemiology Update <u>Victoria</u>

Adjunct Professor Brett Sutton advised 317 more cases were identified overnight with two additional deaths. Victoria currently has 109 people in hospital which is 4 more than yesterday and 29 in intensive care, an increase of 2. 180 outbreaks in all, an increase of 13 since yesterday.

There are 27 outbreaks in aged care facilities. There are additional outbreaks in workplaces, including a legal firm and carpentry business.







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Agenda	Item	3 –	Latest	Epidemio	ogy	Update
Victoria						

Adjunct Professor Brett Sutton advised 428 more cases were identified overnight with three additional deaths. Victoria currently has 122 people in hospital with 31 in intensive care. 67 cases have been linked to known outbreaks with the remaining cases under investigation. Six more health workers have been infected (394 to date) and there are outbreaks in five new nursing homes. 24,409 tests were conducted yesterday.

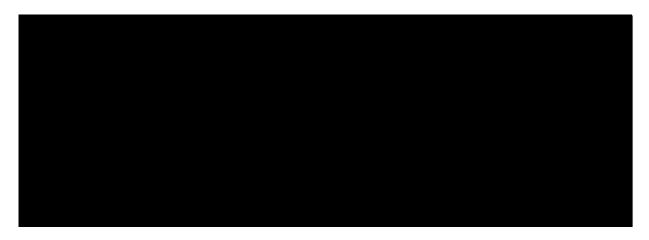


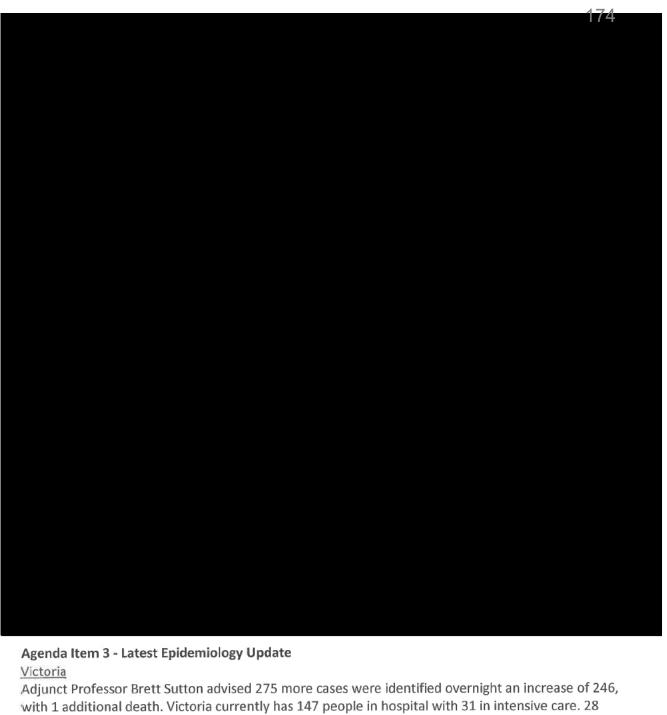
Agenda Item 3 - Latest Epidemiology Update

Victoria

Adj Prof Brett Sutton advised 363 new cases were identified overnight with 3 additional deaths. Victoria currently has 130 people in hospital with 28 in intensive care.

Adj Prof Sutton advised the wearing of face masks or face cover will be mandatory in Victoria's Greater Melbourne or Mitchell Shire from 11:59pm on Wednesday night.





Adjunct Professor Brett Sutton advised 275 more cases were identified overnight an increase of 246, with 1 additional death. Victoria currently has 147 people in hospital with 31 in intensive care. 28 cases have been linked to known outbreaks with the remaining cases under investigation. 26,588 tests were conducted yesterday.

Following the announcement that people in metropolitan Melbourne and the Mitchell Shire will be required to wear masks or face coverings when leaving their homes from midnight on Wednesday, masks are selling out where available, with reports of purchases of including the materials to make masks and sewing machines.

COMMITTEE-IN-CONFIDENCE

Agenda Item 5 - Latest Epidemiology Update

Victoria

A/Prof Brett Sutton advised that there were 374 new cases identified overnight, but when taking reclassifications into account, there were an additional 347 cases. 3 more deaths were recorded overnight as well

Mandatory mask wearing in Victoria commences tomorrow.

COMMITTEE-IN-CONFIDENCE

Agenda Item 1 - Welcome

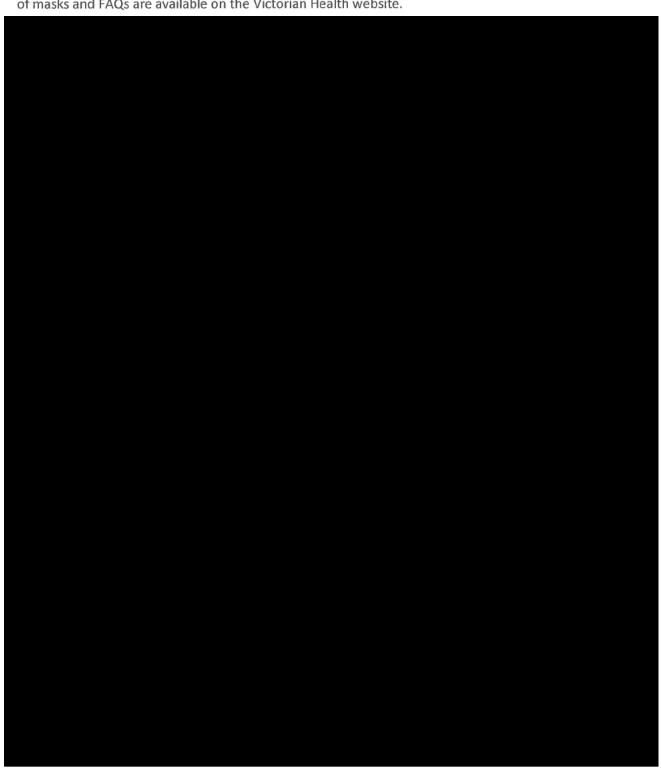
The Chair, Professor Paul Kelly opened the meeting and acknowledged the Traditional Owners, and paid his respects to Elders past, present and emerging.

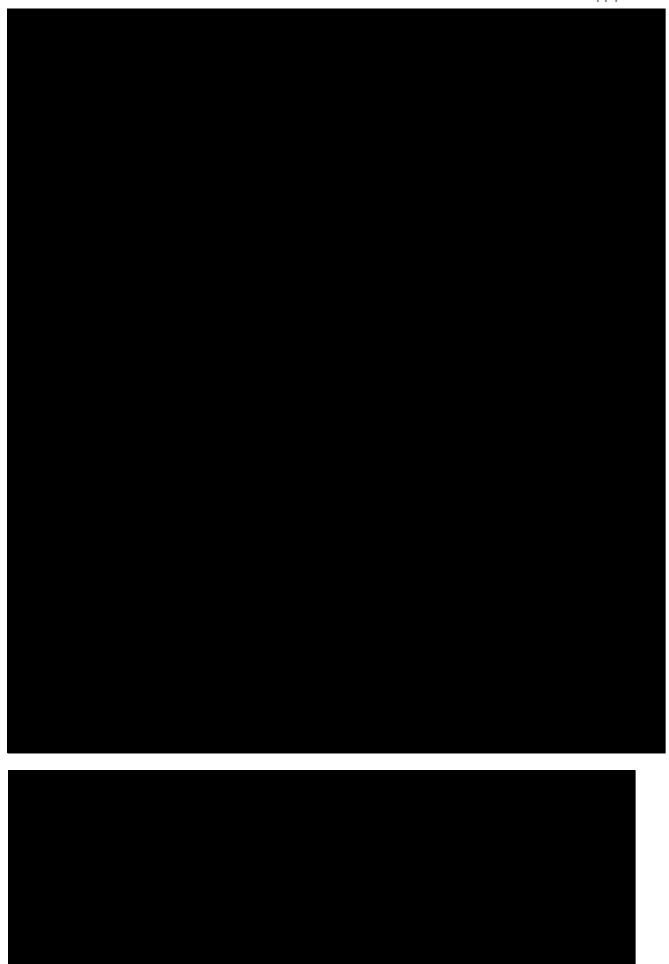
Agenda Item 2 - Latest Epidemiology Update

Victoria

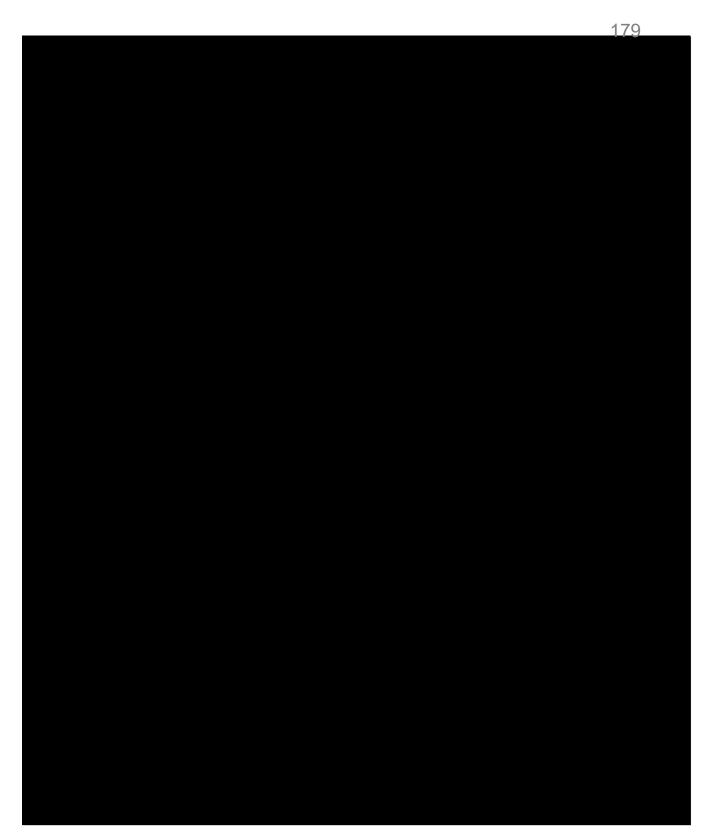
Prof Allen Cheng advised that there were 484 new cases overnight, 97 cases linked with known and contained outbreaks and 387 under investigation. Single cases in a number of residential aged care and 84 in non-mandatory hotel quarantine.

Face masks will be made mandatory from midnight tonight and information on the appropriate use of masks and FAQs are available on the Victorian Health website.





COMMITTEE IN CONFIDENCE	



Agenda Item 6 – Latest Epidemiology update

Victoria

Victoria recorded 403 new cases overnight, but a net increase of 386 once reclassifications were taken into account. There were 5 deaths, including a 59 year old man and 3 people linked to aged care. There are currently 201 Victorians in hospital, 40 of whom are in intensive care, and 21 of those are ventilated. Over 27,000 tests were undertaken.

There are 50 new cases in healthcare workers, most from the aged care sector.

There have been 41 new outbreaks, and there are 200 active outbreaks. Members noted that 6 detention facilities are in lockdown.

COMMITTEE-IN-CONFIDENCE			

COMMITTEE-IN-CONFIDENCE

Agenda Item 1 - Welcome

Dr Nick Coatsworth, the Chair of today's meeting, opened the meeting and acknowledged the Traditional Owners, and paid his respects to Elders past, present and emerging.

Agenda Item 2 – Latest Epidemiology Update

Victoria

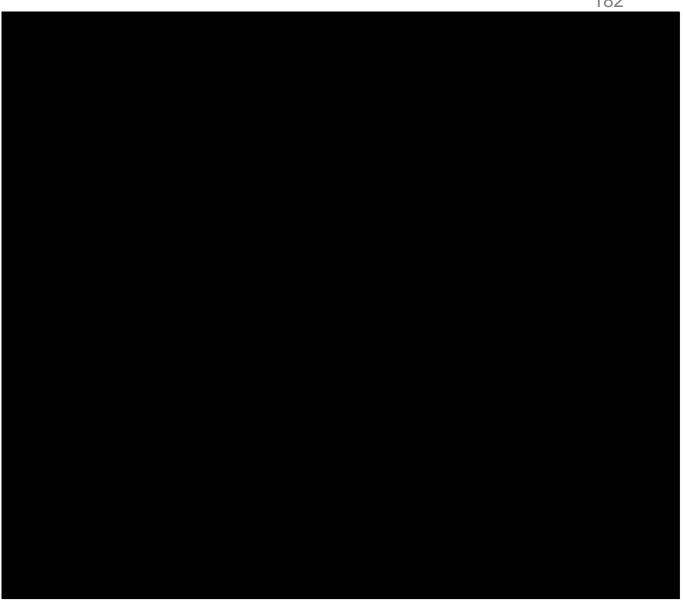
Professor Allen Cheng advised that Victoria identified 300 new cases overnight. 206 Victorians are in hospital, 41 of whom are in intensive care. There were 6 deaths overnight, each connected to an aged care setting.

There are 148 current outbreaks more meatworks, 5 new aged care facilities, a couple of education settings.	
There has also been an outbreak in a disability respite home, and one in a hospital	
Victoria will extend level 3 social restrictions to some regional areas in line with Melbourne.	

Agenda Item 3 - Update from the Commonwealth on Aged Care in Victoria

Mr Nick Hartland advised that the Commonwealth in conjunction with Victoria, has set up an aged care response centre in Victoria to be better positioned to respond. This centre will be publically announced when it is operational. There continue to be more cases notified in aged care facilities. Residents from St Basil's are being moved to a hospital with the assistance of DHHS.





Agenda Item 4 - Latest epidemiology update

Victoria

Prof Brett Sutton advised that Victoria recorded 532 new cases overnight, 6 deaths in people aged between 50 and 90. There are currently 4500 plus active cases, 245 of whom are in hospital and 44 in intensive care. An additional 30 health care workers also tested positive yesterday, bringing the total of infected health care workers to 749. Over 17,500 people were tested yesterday.

Prof Nicola Spurrier advised that South Australia is going to send through some senior nurses to help out in aged care.



Aged Care

Dr Nick Hartland provided an update on aged care outbreaks in Victoria. Members noted that at least 7 facilities have over 50 cases associated with them, with a mix of staff and residents. Many more facilities have single or low staff cases only, and are being closely monitored.





Agenda Item 2 - Latest Epidemiology Update

Aged Care

Dr Nick Hartland advised members the Victorian Aged Care Crisis Centre is now operational with a number of people from the Australian Defence Force (ADF), Emergency Management Australia (EMA), Commonwealth Department of Health (Health) and the Victorian Department of Health and Human Services (DHHS) working on the difficult emerging situation in a number of aged care facilities. There are around 13 facilities of concern.



Victoria

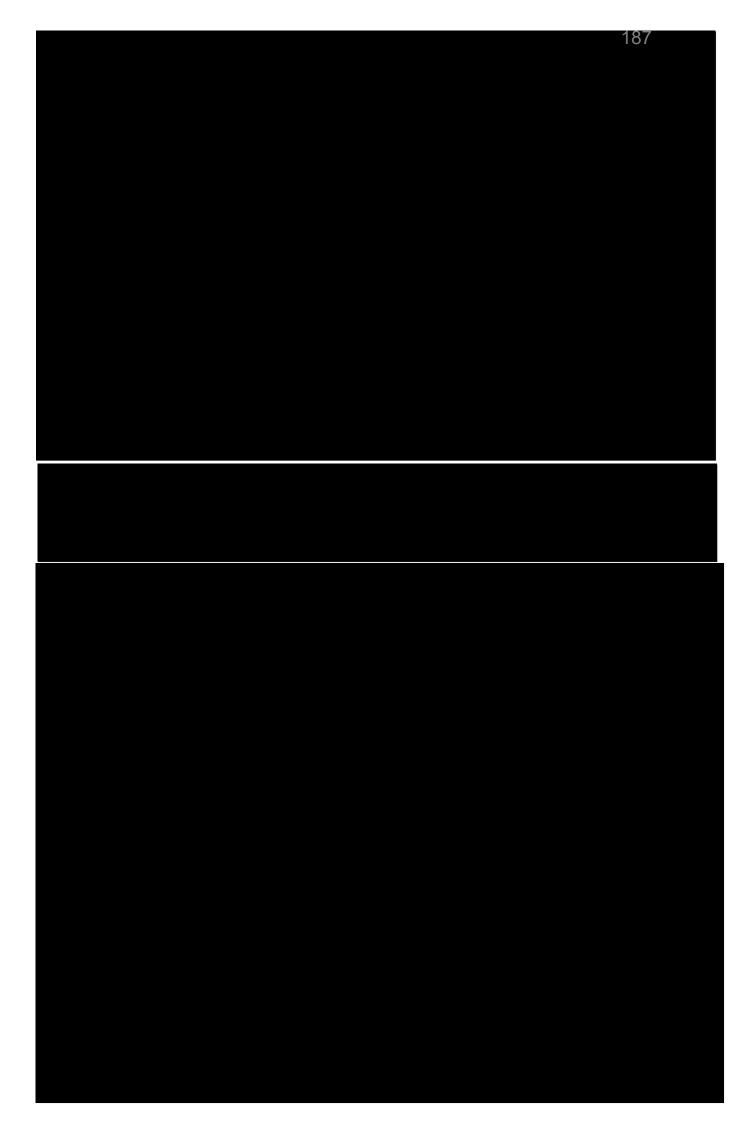
Prof Brett Sutton advised that Victoria recorded 384 new cases overnight, an actual increase of 363 once reclassifications were taken into account. This is about 150 less than yesterday's count. 6 people died in the past 24 hours ranging in age from 70s to 90s. 4 of those were linked to aged care.

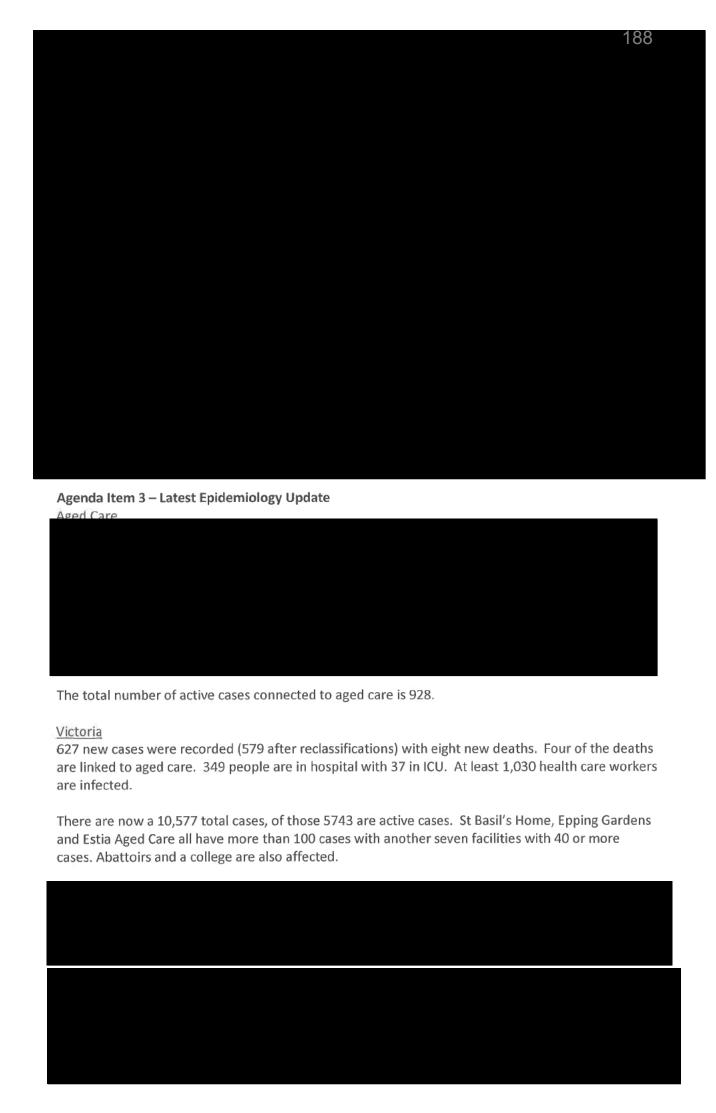
There are 4775 active cases across Victoria, 769 of those are in aged care.

Elective surgery other than for Category 1 and urgent Category 2 patients will be suspended in Victoria from today. This is to ensure staff are freed up to provide care and support to aged care residents.

	185
Victoria A/Prof Sutton confirmed that the Aged Care Response Centre is the dedicated coordination mechanism for the response to the situation in aged care. He also advised that updated guidathe use of PPE will be announced later today.	nce for

	186
Aged Care In the absence of Dr Nick Hartland, the Chair provided an update on the aged care outbreaks in Victoria. Of the 766 aged care facilities in Victoria, 71 residential facilities are currently affected well as a number of in-home services.	
Prof Len Notaras advised members an AUSMAT team will fly arrive in Victoria tomorrow and Pr Nicola Spurrier advised 5 senior nurses from South Australia will also arrive in Victoria tomorrow	
Victoria Prof Brett Sutton advised that Victoria recorded 295 new cases overnight. 40 were reclassified anet increase of 255. There were 9 deaths in the previous 24 hours. Currently, 307 people are in hospital, 49 of whom are in intensive care and 21 of those are on ventilators. 804 active aged cases.	





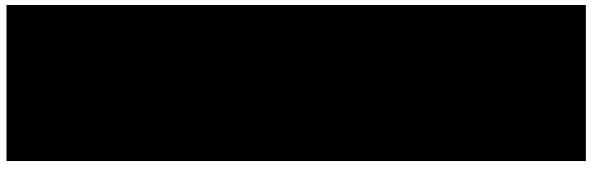
Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia

Report submitted to CDNA/AHPPC 1 July 2020

Key messages

Estimates of changes in physical distancing behaviour

• We use data from nationwide surveys and mobility data from technology companies to estimate trends in macro-distancing and micro-distancing behaviour over time.



Estimates of current epidemic activity

We report estimates of local transmission potential from a statistical method which allows
us to distinguish between transmission in the general population and clusters/localised
outbreaks (Figure 5).



Ensemble forecasts of the daily number of new local cases



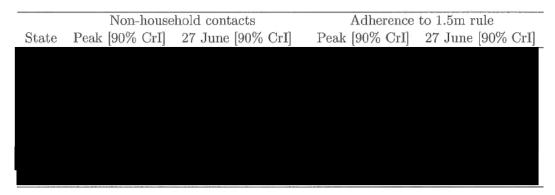
Estimating trends in distancing behaviour

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide surveys to estimate trends in specific macro-distancing (average daily number of non-household contacts) and micro-distancing (proportion of the population always keeping 1.5m physical distance from non-household contacts) behaviours over time. We used these survey data to infer state-level trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.



Table 1: Left columns: estimates of the average daily number of non-household contacts (macro-distancing) at peak adherence on around 12 April and as of 27 June for each state/territory. Right columns: estimates of self-reported adherence to the 1.5m rule (micro-distancing) at peak adherence on around 10 April and as of 27 June for each state/territory.



These state-level macro- and micro-distancing trends were then used in the model of R_{eff} to inform the reduction in non-household transmission rates (Figures S4 and S5).

Population mobility analysis

A number of data streams provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

The model detects a decline in the physical distancing variable over time (i.e., increasing mixing) since the date of peak adherence to these measures, ≈ 2 April (see Figure 3). Specifically, by 27 June, the impact of physical distancing on time at parks is expected to have reduced by a verage across states (ranging from the effect on requests for driving directions by and the effect on time at transit stations by

The largest reductions in the impacts of physical distancing are evident in mobility data streams for lower transmission risk activities, such as time at parks. There is also a clear reduction in data streams representing higher-risk activities, such as time at workplaces. However, these mobility data do not indicate whether the increase in higher transmission risk activities is mitigated by other behaviours that are not measured by these metrics — such as reducing contacts and adherence to the 4m² rule. In other words, while changes in these mobility data streams are useful for detecting changes in macro-distancing behaviour, they do not capture changes in micro-distancing behaviour.

Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S13)

Figure 1: Estimated trends in macro-distancing behaviour, *i.e.*, reduction in the daily rate of non-household contacts, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from two surveys conducted by the national modelling group in early April and early May, and four BETA surveys conducted in late May and June (indicated by the black lines and grey rectangles), and an assumed pre-COVID-19 daily rate of 10.7 non-household contacts taken from previous studies. The width of the grey boxes corresponds to the duration of each survey wave (around 4 days) and the green ticks indicate the dates that public holidays coincided with survey waves (when people tend to stay home, biasing down the number of non-household contacts reported on those days). Note that the apparent increase in contacts in the second survey in the second is a statistical artefact due to the small sample sizes which happen to contain two respondents reporting 100+ contacts. In general, estimates depicted by the grey rectangles are very sensitive to individuals with high numbers of contacts.

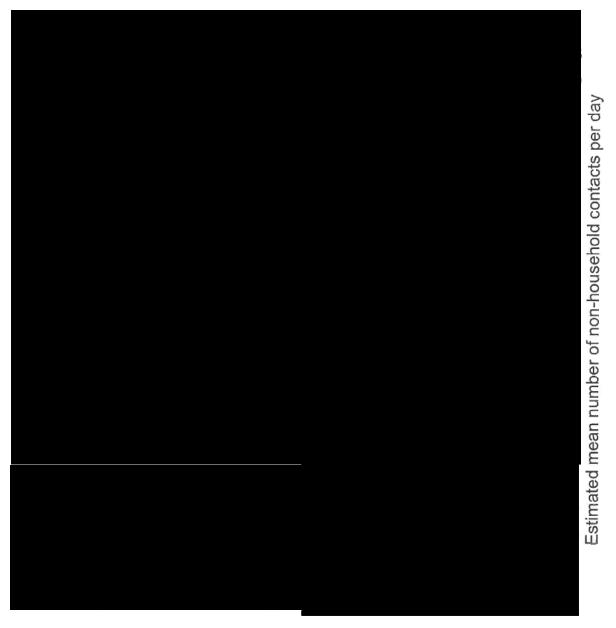


Figure 2: Estimated trends in micro-distancing behaviour, *i.e.* reduction in transmission probability per non-household contact, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from 13 nationwide surveys conducted by BETA from late March to late June (indicated by the black lines and grey boxes). The width of the grey boxes corresponds to the duration of each survey wave (around 4 days).

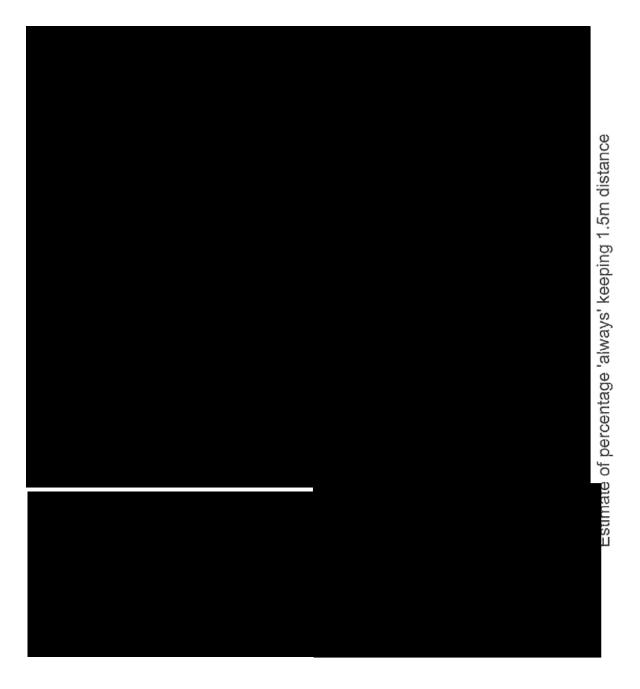
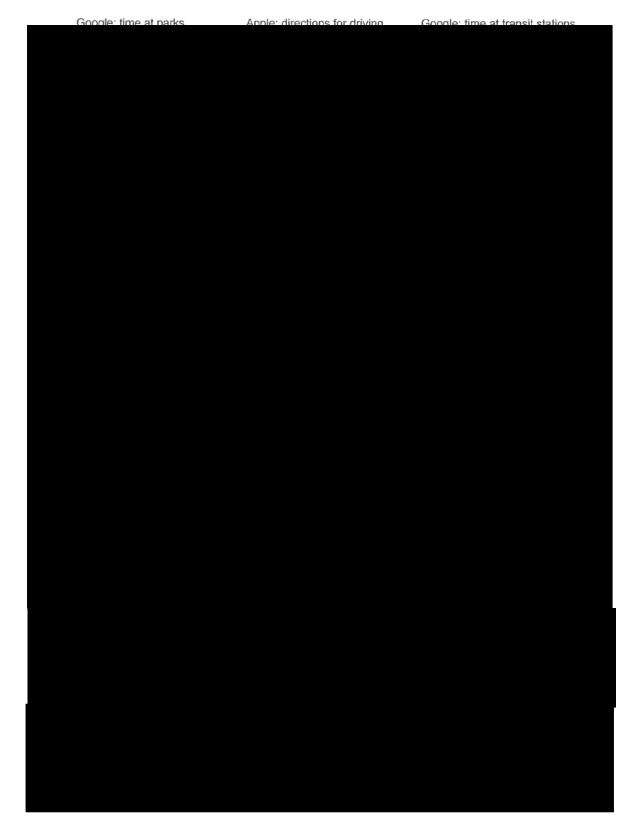


Figure 3: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 27 June. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 27 June, the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream. Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S13).



LGA-level population mobility analysis for Victoria

Overview

Facebook provide access to several aggregated and anonymised data sets on mobility for humanitarian use via their Data for Good program (https://dataforgood.fb.com). To preserve privacy, data are aggregated to the level of map tiles (which range in size from 0.6 km² to 4 km²) or administrative regions (corresponding to Local Government Areas), and data are not provided for any tiles or regions containing a small numbers of users (10 to 300, depending on the data set). Here we use a movement range data set which records the proportion of Facebook users who "stay put" over the course of a day (24 hour period) aggregated by LGA.

Results

We report the proportion of users who "stayed put" each day between Saturday 29 February 2020 and Sunday 28 June 2020 (the latest date at which data are available) for each LGA in Victoria (Figure 4).

The proportion of people "staying put" increased dramatically over March, reaching a peak around Easter, and levelled off over April. From the beginning of May, this proportion steadily decreased into June. Over the previous week commencing Saturday 20 June, the proportion of people staying put in the outbreak "hotspot" LGAs on weekdays increased compared to the preceding three weeks, a trend not otherwise observed in other Victorian LGAs.

Figure 4: Proportion of Facebook users who "stayed put" each day between Saturday 29 February 2020 and Sunday 28 June 2020 (the latest date at which data are available). Each line represents a single Victorian LGA, with "hotspot" LGAs highlighted. Non-hotspot LGAs are shown as faint grey lines. Hotspot LGAs in northern and western Melbourne (Brimbank, Hume, Moreland, Darebin and Maribyrnong) are coloured red. Hotspot LGAs in south-eastern Melbourne (Casey and Cardinia) are coloured orange. Grey vertical bars indicate weekend and Victorian public holidays. Red and green vertical lines indicate the timing of government announcements increasing or decreasing (respectively) restrictions on movement and gatherings. Note that no data is currently available for Saturday 20 June. Extended straight lines in the (non-hotspot) LGAs indicate missing data due to LGAs with smaller not meeting the required user threshold for some time points.



Estimating local transmission potential

We separately model local to local transmission (Figure 8) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} driven by population-wide interventions (specifically changes in macro- and micro-distancing behaviour, surveillance measures, and quarantine of overseas arrivals);
- 2. short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics of transmission, such as clusters of cases and short periods of low transmission.

Component 1 reflects the average local transmission potential at state level (Figure 6), and Component 2 captures transmission within the sub-populations that have the most active cases at a given point in time (Figure 5). Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases in high-transmission environments — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure 7).

Note that Component 1 for local to local transmission now incorporates the impact of improvements in surveillance on transmission rates. Using data on the number of days from symptom onset to testing for cases, we estimate the proportion of cases that are tested (and therefore advised to isolate) by each day post-infection. We quantify how these times-to-detection have changed over time, and therefore how earlier isolation of cases due to improvements in contact tracing and clinical screening has reduced statewide $R_{\rm eff}$ for local to local transmission (Figure S3).

Interpretation

Where there is epidemic activity, local transmission potential of active cases (Component 1&2) is to be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, Component 1&2 represents the expected amount of onward transmission from any given member of the population if they were to become infectious. In contrast, Component 1 represents the average of this over the state population, indicating the potential for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Note that Component 1&2 can be higher or lower than the estimate of Component 1. In the increasing phase of a localised outbreak, it will be higher than Component 1. In the decreasing phase of a localised outbreak, Component 1&2 will be lower than Component 1 due to public health interventions, local depletion of susceptibles and/or other transmission factors that decrease the number of offspring from active cases associated with the cluster compared to that from other cases in the community.



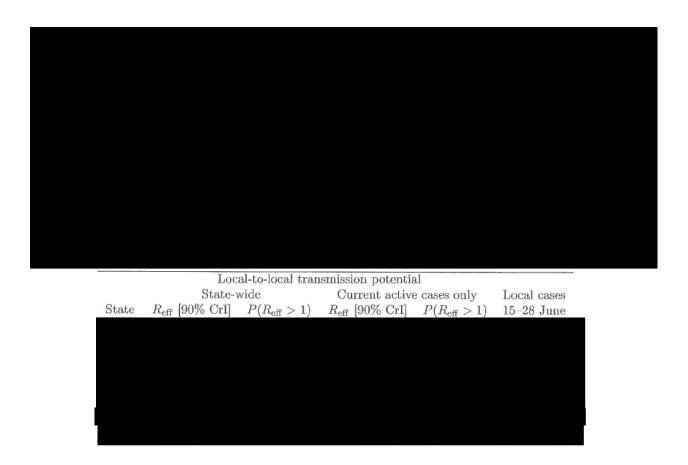


Figure 5: Depiction of the relationship between $R_{\rm eff}$ analysis components. TTD = time from symptom onset to detection.



Figure 6: Estimate of local transmission potential averaged over state/territory population (Component 1); i.e., removing short-term variation due to clusters (Component 2). Light green ribbon=90% credible interval; dark green ribbon=50% credible interval. Estimates are made up to 27 June, based on cases with inferred infection dates up to and including 24 June. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. This includes the combined effect of macro- and micro-distancing behaviours and surveillance measures.

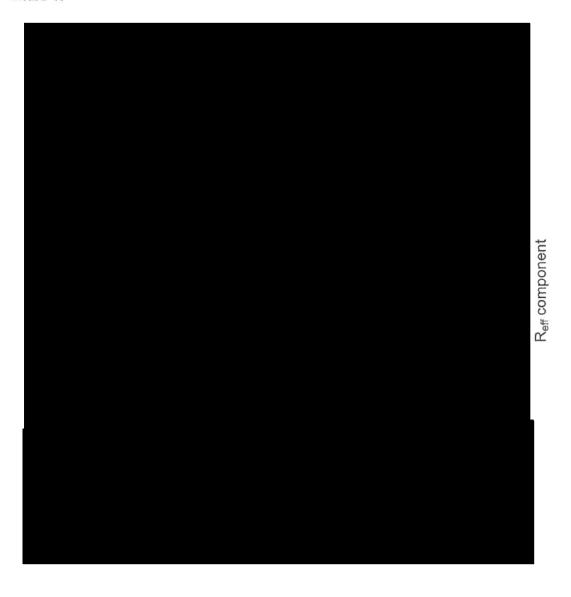


Figure 7: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission potential (Component 2) for each state/territory (light pink ribbon=90% credible interval; dark pink ribbon = 50% credible interval. Estimates are made up to 27 June based on cases with inferred infection dates up to and including 24 June (due to a delay from infection to reporting, the trend in estimates after 27 June reflects the average range of deviations for that state, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies.

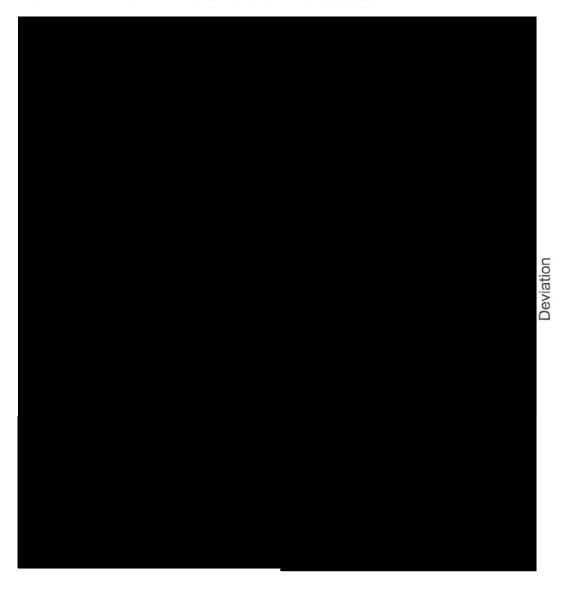
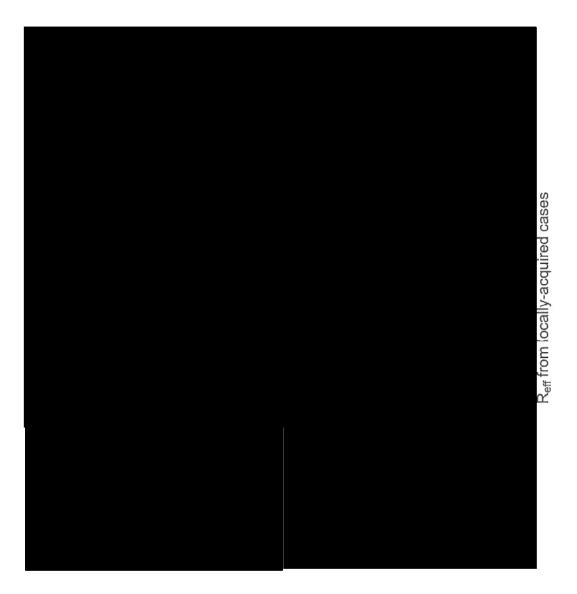


Figure 8: Estimate of average local transmission potential of active cases (Component 1&2) for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval). Estimates are made up to 27 June based on cases with inferred infection dates up to and including 24 June (due to a delay from infection to reporting, the trend in estimates after 27 June is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).



Ensemble forecast of the daily number of new confirmed cases nationally

A number of groups within the national modelling consortium have now produced independent estimates of the effective reproduction number and forecasting models. We present synthesised findings from these models, known as an 'ensemble forecast'. We report state-level forecasts of the daily number of new confirmed cases cases up to 28 July—synthesised from two independent models.

Ensemble forecasts are more accurate than any individual forecast alone — biases and variances in each model that result from different modelling choices balance against each other to improve predictions. Hence, ensemble forecasts tend to produce improved estimates of both the central values, as well as improved estimates of the plausible yet unlikely forecasts (uncertainty). Here, the ensemble has been generated by equally weighting the forecasts from each model. In future weeks, we will continue to improve the ensemble performance by updating the weights for each model based on their past-performance.

A brief description of each method incorporated in the ensemble is given below:

- SEEIIR Forecast: Our existing forecasting model previously presented to CDNA and AHPPC — a stochastic susceptible-exposed-infectious-recovered (SEEIIR) compartmental model that incorporates changes in local transmission potential via the estimated timevarying effective reproduction number (as shown in Figure 8). Details can be found in our technical report at: https://www.doherty.edu.au/about/reports-publications.
- Time-Series Forecast: A classic time-series model that does not account for disease transmission dynamics, but rather uses recent daily case counts to forecast case counts into the future. Parameters of this 'autoregressive' model are estimated using global data accessible via the Johns Hopkins COVID-19 repository. Case counts from a specific number of days prior to the forecasting date (the present). Case counts from a specific time window prior to the forecasting date (the present) are used for model calibration. The number of days within this time window is chosen to optimise projections for Australia data.

The SEEIIR Forecast explicitly incorporates dynamics of disease transmission and the impact of public health measures on transmission over time via $R_{\rm eff}$. The Time-Series Forecast does not explicitly incorporate either of these factors. The Time-Series Forecast is expected to accurately forecast new daily case numbers over a shorter time period, whereas disease-specific models are anticipated to provide more accurate forecasts several weeks into the future. Both forecasts assume that current public health measures will remain in place and that public adherence to these measures will be consistent into the future.

Results

We do not present forecasts for any jurisdictions which have not reported a local case for 28 or more days. Forecasts are therefore provided for and Vic. If local transmission potential remains at its current estimated level, we anticipate that daily local case counts will remain very low or zero into August for

Forecasts for Victoria are highly uncertain at this time. One the models (SEEIIR Forecast) in the ensemble predicts an increasing caseload into August, while the other model (Time-Series Forecast) predicts that a decrease is also plausible (Figure 10).

Forecasts of the daily number of new local cases for each state/territory

Figure 9: Left panels show time series of new daily local cases of COVID-19 estimated from the forecasting ensemble model (50–90% confidence intervals coloured in progressively lighter blue shading). The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars). Right panels display cumulative counts of locally acquired cases estimated from the forecasting ensemble model (50–90% confidence intervals coloured in progressively lighter blue shading). The observed cumulative counts of locally acquired cases are also plotted by date of symptom onset (black line and dots).

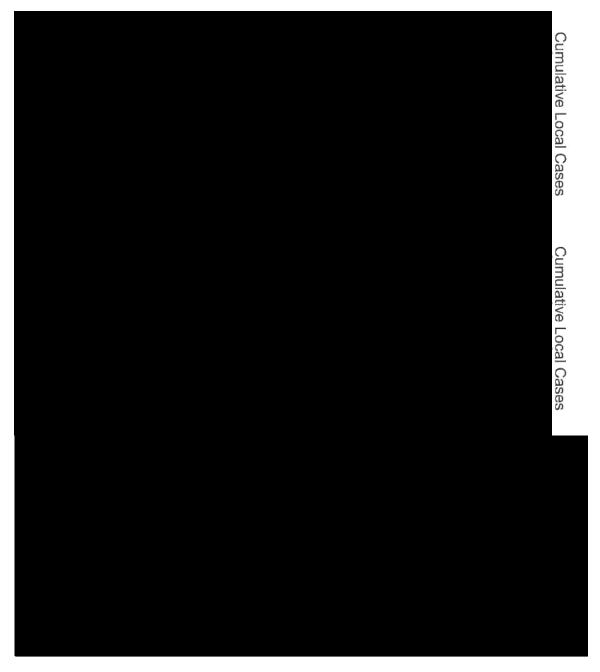


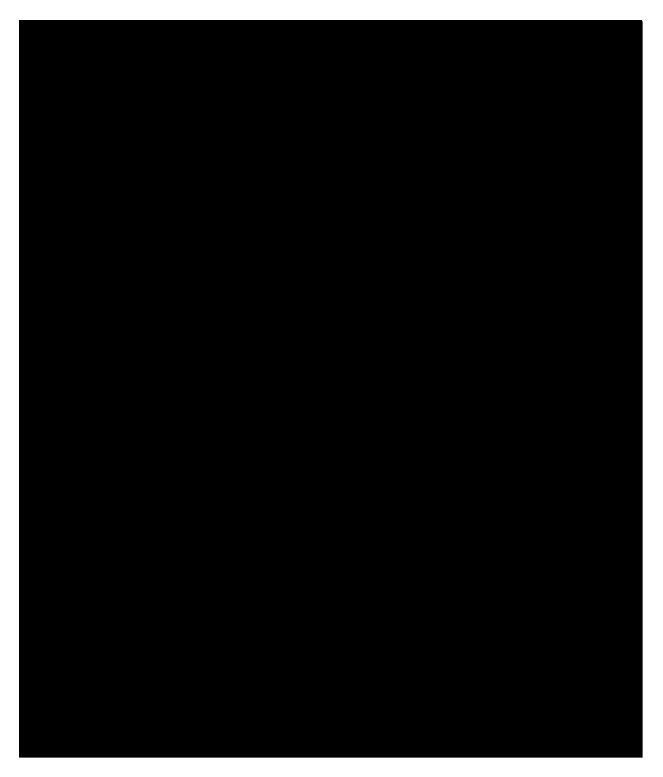
Figure 10: Time series of new daily local cases of COVID-19 estimated from the two forecasting models contributing to the ensemble. Left panel shows the 50–90% confidence intervals of the SEEIIR Forecast (coloured in progressively lighter red shading). Right panel shows the 50–90% confidence intervals of the Time-Series Forecast (coloured in progressively lighter blue shading) Note the different y-axis scale on each panel.



Supplementary Appendix

For full methodological details on the mobility, $R_{\rm eff}$ analyses, and forecasting analyses please refer to our most recent Technical Report (15 May 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications





References

[1] Freya M. Shearer, Lisa Gibbs, Eva Alisic, Katitza Marinkovic Chavez, Niamh Meagher, Lauren Carpenter Phoebe Quinn, Colin MacDougall, and David J. Price. Distancing measures in the face of COVID-19 in Australia. Available from: https://www.doherty.edu.au/uploads/content_doc/social_distancing_survey_wave1_report_May142.pdf, 2020.

Supplementary figures

Figure S1: Time series of new daily confirmed cases of COVID-19 in Australia (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 15 June 2020. Plotted by recorded or inferred date of symptom onset.



Figure S2: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 15 June 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.

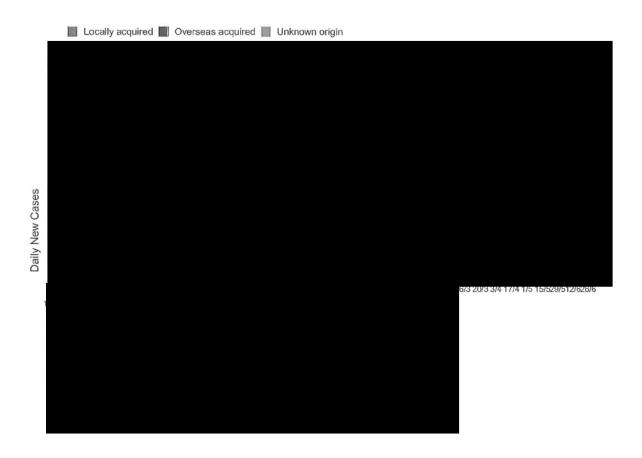


Figure S3: Estimated trend in time from symptom onset to detection for locally-acquired cases (black ribbon = median estimate; yellow ribbons = 90% credible intervals; black dots = time-to-detection of each case). Note that we will continue to review how this trend is estimated, given changes in testing strategies, particularly noting the increasing use of serological assays for case ascertainment.



Figure S4: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour or time-to-detection, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval). Estimates are made up to 27 June, based on cases with inferred infection dates up to and including 24 June. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

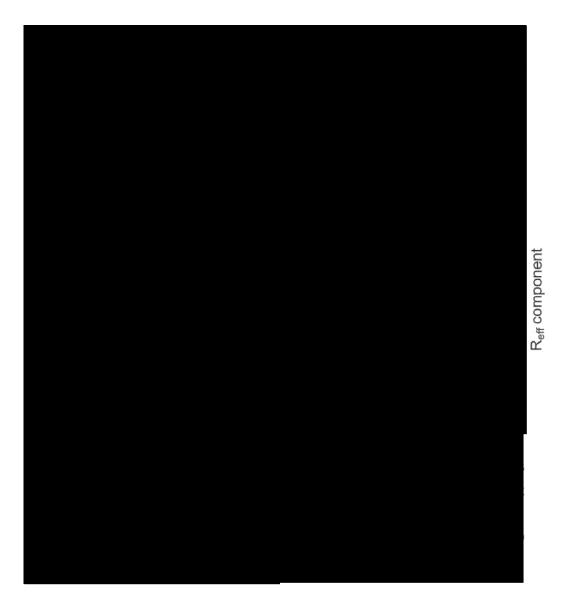


Figure S5: Estimate of average state-level trend in local transmission potential, if we assume that only 'micro-distancing' behaviour had changed and not 'macro-distancing' behaviour or time-to-detection, for each state/territory (light purple ribbon = 90% credible interval; dark purple ribbon = 50% credible interval). Estimates are made up to 27 June, based on cases with inferred infection dates up to and including 24 June. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

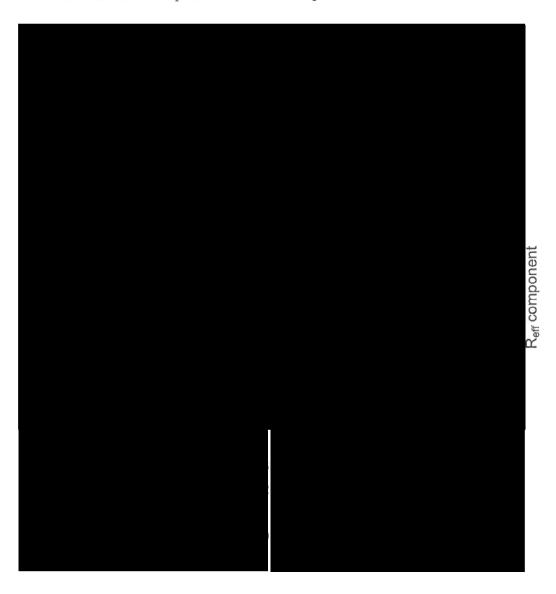


Figure S12: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.



Forecasting alternate scenarios of the June COVID-19 outbreak in Victoria Report submitted to AHPPC 4 July 2020

Key messages

Method

- A scenario analysis was performed to assess the potential impact of alternate scenarios on the Victorian outbreak.
- Estimates of the R_{eff} of local active cases for Victoria as of 30 June were projected forward from 1 July through to 28 July for three alternate scenarios:
 - Scenario 0: The forecast based on current estimates of local transmission potential
 - Scenario 1: State-wide distancing behaviour returned to levels estimated on 13 May
 - Scenario 2: State-wide distancing behaviour returned to peak levels of adherence (which is estimated to have occurred in Victoria on 13 April)
 - Scenario 3: Overall public health response at peak level of impact (Component 2 of R_{eff} from 29 March and Component 1 of R_{eff} from 13 April)
- Estimated values of R_{eff} up to 30 June and observed cases were then used as inputs into
 a mathematical model of transmission dynamics. The model was projected forward from
 1 July up to 28 July using the projected values of R_{eff} for each scenario to forecast the
 daily number of new cases in Victoria.

Results



Forecasts for each transmission scenario

Figure 1: Scenario 0: Forecast of new daily local cases of COVID-19 estimated from the SEEIIR forecasting model (50–90% confidence intervals coloured in progressively lighter blue shading), from 30 June to 28 July, based on current estimates of local transmission potential. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars).



Figure 2: Scenario 1: Forecast of new daily local cases of COVID-19 estimated from the SEEIIR forecasting model (50–90% confidence intervals coloured in progressively lighter blue shading), from 30 June to 28 July, assuming that state-wide distancing behaviour returned to levels estimated on 13 May. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars).

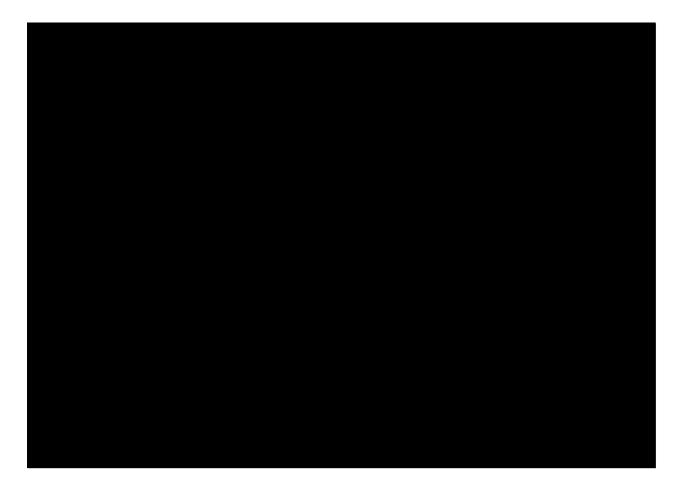


Figure 3: Scenario 2: Forecast of new daily local cases of COVID-19 estimated from the SEEIIR forecasting model (50–90% confidence intervals coloured in progressively lighter blue shading), from 30 June to 28 July, assuming state-wide distancing behaviour returned to peak levels of adherence. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars).

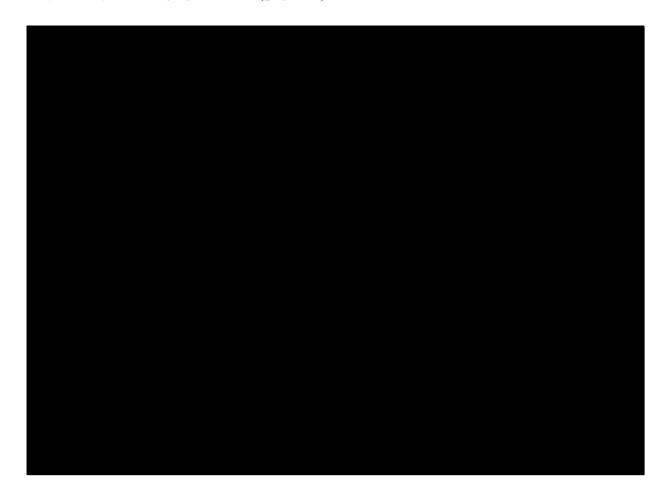


Figure 4: Scenario 3: Forecast of new daily local cases of COVID-19 estimated from the SEEIIR forecasting model (50–90% confidence intervals coloured in progressively lighter blue shading), from 30 June to 28 July, assuming that the overall public health response returned to peak levels of impact. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars).



Projected $R_{\rm eff}$ of local active cases for each transmission scenario

Figure 5: Projected average local transmission potential of active cases in Victoria for current estimated $R_{\rm eff}$ and for three future scenarios (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval). Estimates were made up to 30 June and projected forward to 13 August (indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).





Novel Coronavirus (COVID-19) Epidemiology update as at 1200h, 06 July 2020

VICTORIAN SUMMARY (as at 1200h 06 July 2020)

As at 1200h on 06 July 2020, a total of 8,586 cases of COVID-19 were reported in Australia including 7,420 recovered and 106 deaths.

 Of these a total of 2,660 cases of COVID-19 have been reported in Victoria including 1,992 recovered and 22 deaths.

Over the past 24 hours in Victoria:

- There were 127 newly confirmed cases reported: 34 were locally acquired contacts of a confirmed case or in a known cluster and 93 remain under investigation.
- 2 deaths were reported, of which one case was a male aged in their 60s and the other a male in their 90s.
- Victoria has excluded 4 cases from its cumulative total due to duplication and added 1 case that was erroneously excluded on 5 July 2020.

Currently, there are approximately 650 active cases in Victoria. A total of 186 cases remain under investigation. There are currently 31 cases in hospital, with 5 cases in ICU and 3 cases ventilated.

Based on data in the NNDSS, over the past three days (03 July - 05 July 2020) 296 cases have been reported from Vic. A substantial proportion of these cases are reported as being locally acquired (41%), noting that over half (56%) of the cases are currently under investigation (Figure 1).

Over the past seven days there have been 565 cases reported; an increase from the 248 cases reported in the week prior.

As there is an approximate 3 day lag in the investigation and categorisation of cases an analysis of NNDSS has been undertaken over the 7 day period of 26 June to 02 July 2020 (Figure 1). Over this period there were 420 cases reported in the NNDSS of which 250 (60%) were locally acquired (contacts of confirmed cases or in a known cluster), 134 (32%) were locally acquired (contact not identified), 15 (4%) were overseas acquired, 20 (5%) remain under investigation and 1 (<1%) was locally acquired (contact not identified – interstate travel)</p>

Of the cases confirmed as locally acquired, the majority have been linked to known clusters across a range of settings including quarantine hotels, family households, retail businesses, primary schools, health care practices and *public housing towers*.

There has been a total of over 952,500 tests conducted in Victoria (Figure 3), which is an increase of over 24,500 tests in the last 24 hours. The total tests per 100,000 population for Victoria is *more than 14,000* which is the highest in the country and is higher than the national rate of over 10,500 tests per 100,000 population.

• In the past 7 days, Victoria has conducted over 160,500 tests, an average of around 22,500 tests daily.

As of midnight, 01 July 2020, the Victorian government issued stay-at-home orders for 36 suburbs across 10 postcodes. On 04 July 2020, the Victorian government issued a 'hard' lockdown order for 9 public housing towers which provide accommodation for approximately 3,000 people. Residents will not be able to leave for at least 5 days and over this period all residents will be tested. Also, the Victorian government has expanded the stay-at-home directions to two additional postcodes.

Clusters and Outbreaks

The increase in locally-acquired cases in Victoria is driven by multiple epidemiologically linked outbreaks, across a range of settings including between and within households, hotels providing quarantine services, retail businesses/distribution centres, schools, childcare centres, health care practices, *public housing towers* and an aged care facility. Further details on prominent open outbreaks as at 06 July 2020 are provided below. Please note that this is not an exhaustive list of all cases with a known epidemiological link.

As of 06 July 2020 prominent open outbreaks include:

Outbreaks associated with hotel quarantine facilities (2)

- Hotel quarantine facility (Rydges) 18 cases including 17 reported in Victoria and one in Queensland as at 21 June 2020. Cases have been reported among hotel workers and household contacts.
- Hotel quarantine facility (Stamford) 42 cases reported. Cases reported include staff and close contacts of confirmed cases. Cases have been reported among hotel workers and household contacts.

Outbreaks in extended families (6)

- Extended family (Keilor Downs 2.0) 20 cases reported.
- Extended family (North Melbourne/Brimbank) now confirmed as linked
 - North Melbourne 30 cases reported across 10 households
 - o Brimbank 12 cases reported across 2 households
- Extended family (Coburg) 15 cases reported, including one new case reported 26 June 2020.
- Extended family (Patterson Lakes/Lysterfield) Family outbreak with 15 cases in total.
- Extended family (Truganina) Family outbreak with 16 cases in total.
- Extended family (Roxburgh Park) Family outbreak across at least 8 households with 28 cases linked to this outbreak.

Outbreaks in residential towers

North Melbourne and Flemington — public housing apartments have a reported total of 53 cases

Outbreaks associated with healthcare facilities (2)

GP practice – 6 cases reported as at 21 Jun 2020, including a healthcare worker and household contacts.

- Dental practice 3 cases among staff reported as at 25 June 2020.
- Northern Hospital Epping Emergency Department 2 new healthcare workers bringing the total number of cases to 5.

Retail/Distribution centres (3)

- Retail (Coles Chilled Distribution Centre) 6 cases reported as at 01 July 2020. This
 outbreak has been linked to the North Melbourne family outbreak.
- Distribution Centre (StarTrack-Tullamarine), 2 cases (staff members) reported as at 30 June 2020.
- Retail (Hugo Boss store) 3 cases reported as at 30 June 2020, including 2 new cases reported in the past 24 hours.

Schools (>7)

- Various schools and childcare centres in Vic are reporting cases among teachers and students.
- Schools (Ascot Vale Primary School) outbreak with 2 cases in total.
- Schools (Albanvale Primary School) outbreak with 14 cases in total, with 5 of the new cases in the past 24 hours including
- Schools (Al Taqwa College) outbreak with 77 cases in total.
- Schools Springside Primary School outbreak with 3 cases in total.

Residential care (2)

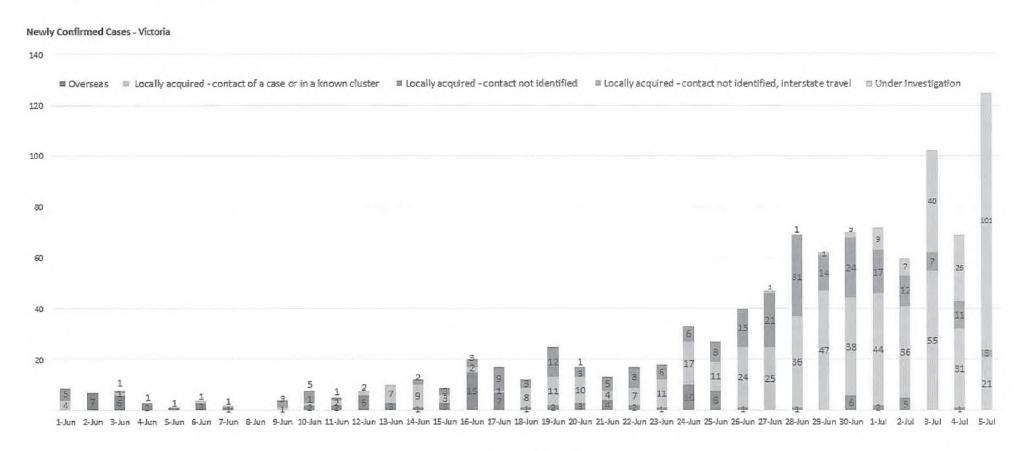
Aged care facility – 2 cases have been reported from separate ACFs.

Social Gathering (2)

- Social gathering (Wollert) 17 cases have been reported, with cases linked to school and fast food outlets.
- Social gathering (Deer Park) 12 cases have been reported.

Figure 1. Victorian daily newly confirmed cases, by acquisition

Data source: National Notifiable Diseases Surveillance System, as at 06 July 2020



Notification Recieved Date

Figure 2. Victorian weekly newly confirmed cases, by acquisition, over the past 12 weeks Data source: National Notifiable Diseases Surveillance System, as at 06 July 2020

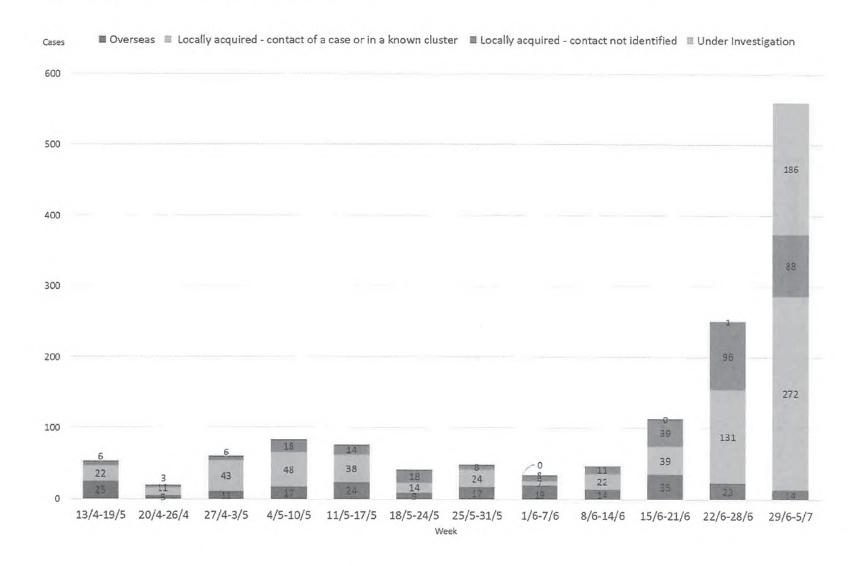


Figure 3. Daily tests for COVID-19, Victoria from 18 March – 06 July 2020 Data source: Daily jurisdictional updates to the NIR

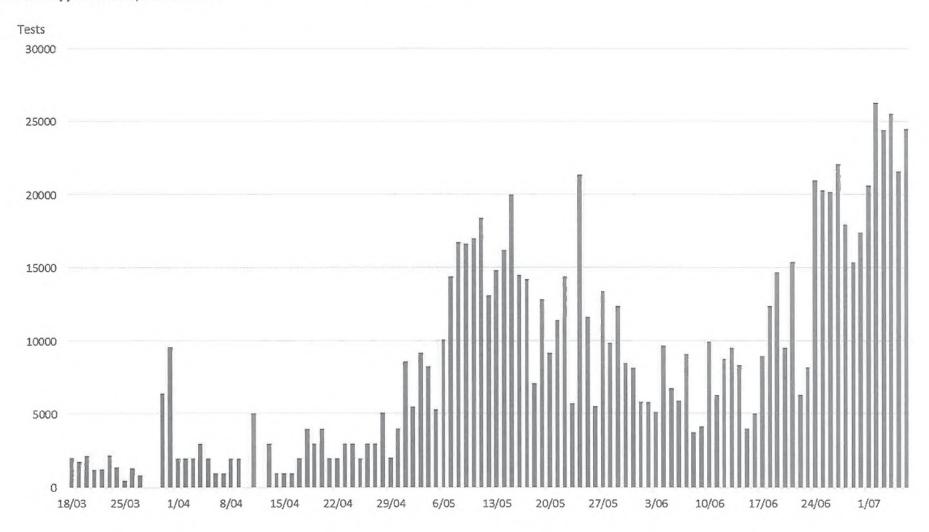
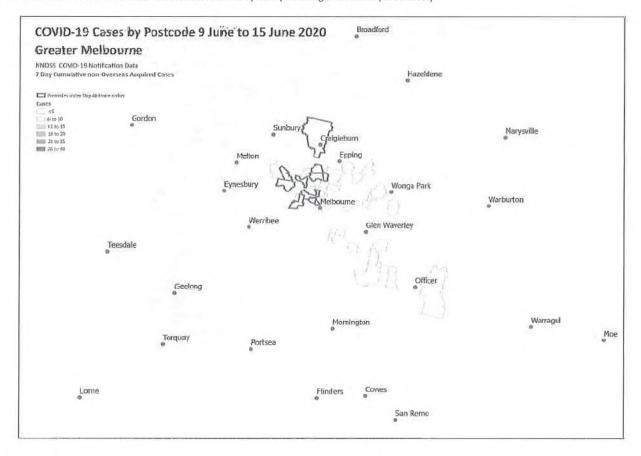
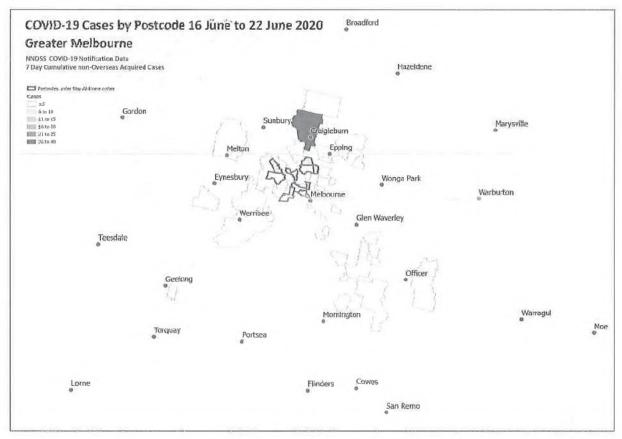
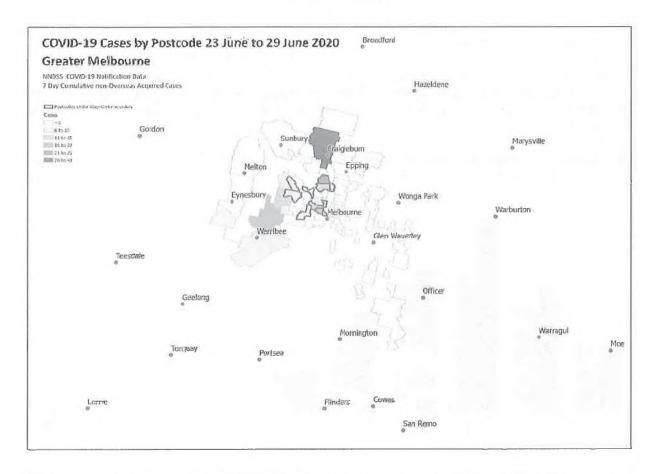


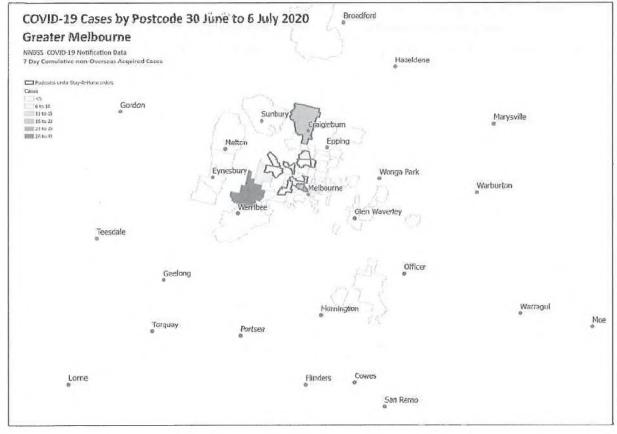
Figure 4. Greater Melbourne COVID-19 cases by postcode by week, from 09 June - 06 July 2020

Data source: National Notifiable Diseases Surveillance System (excluding overseas acquired cases)









Cases of COVID-19 reported by Victoria over the past 28 days have spanned across all age groups, as shown in Figure 5. The median age of all Victorian COVID-19 cases for this time period is 31 years (range: 0 to 91 years). Children aged less than 18 years accounted for 18% of all cases, which is a much higher proportion than has been previously observed since the epidemic first commenced in Australia. Individuals aged 70 years and older accounted for 4% of cases. Over the last week, the recent increase in cases have been predominately occurred in people aged 10 to 49 years (Figure 6).

Figure 5. Number of Victorian cases by age group and sex, from 08 June – 05 July 2020 Data source: National Notifiable Diseases Surveillance System

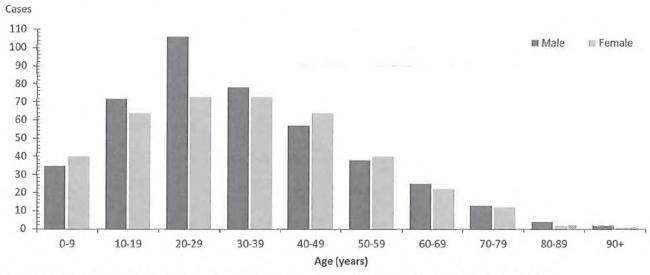
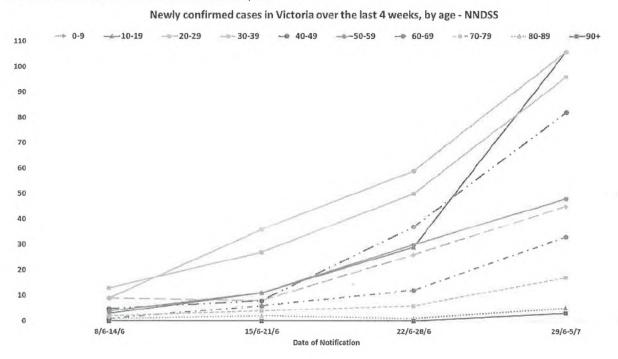


Figure 6. Number of Victorian cases by age group, from 08 June – 05 July 2020 Data source: National Notifiable Diseases Surveillance System





The Hon. Greg Hunt, MP

Minister for Health

Senator the Hon Richard Colbeck

Minister for Aged Care and Senior Australians Minister for Youth and Sport

13 July 2020

Victorian aged care workers urged to wear face masks

Aged care staff who work in residential facilities or provide home care support across Victoria's lock down zones will be required to wear surgical masks following recommendations from the Australian Health Protection Principal Committee (AHPPC).

The latest advice for aged care workers is in addition to all other infection control and staff screening measures already in place across the sector to help prevent the spread of COVID-19.

Minister for Health, Greg Hunt and Minister for Aged Care and Senior Australians, Richard Colbeck, today said personal protective equipment (PPE) such as masks, would be vital in preventing the introduction of COVID-19 to senior Australians receiving aged care as well as providing protection for carers.

An additional four million masks will be made available to aged care and home care providers in the areas with restrictions including Greater Melbourne and Mitchell Shires.

This will immediately assist around 449 residential aged care facilities and 425 home care providers, with a total of 60,427 aged care recipients in these services.

This is in addition to the one million masks made available to primary care workers announced last week.

"The Australian Government has worked very hard to ensure there is a sufficient supply of PPE, including masks, in the National Medical Stockpile (NMS) to ensure our heath care workers, and those working in aged care, can access them," Minister Hunt said.

Since late March, more than 295 million masks, more than four million gowns, more than 41 million gloves, and more than five million goggles and face shields have been received into

the NMS. Substantial amounts of PPE, including additional masks, will continue to arrive over the coming weeks and months.

Additionally, Minister Colbeck said further targeted testing will be conducted on all aged care residents and staff in facilities in the affected areas.

Other support measures include:

- Deployment of clinical first responders direct to facilities where an outbreak has been identified;
- Immediate access to emergency response teams if there is a significant outbreak; and
- Access to a surge workforce, to help providers if they're unable to fill critical skills because of infection or staff have to self-isolate.

The Aged Care Quality Safety Commission will continue to conduct site visits where concerns are raised, including in the Melbourne metropolitan area.

The Federal Government is also providing advice to services around screening people entering residential aged care facilities, particularly in hotspot areas.

Minister Colbeck said more than 1.35 million items of PPE had already been supplied to Victorian aged care services since late February 2020.

A large deployment of up to 250,000 surgical masks, 250,000 gowns, 250,000 face shields/goggles and supplies of hand sanitizer is currently underway for services in these areas.

"With the current surge in COVID-19 cases in Melbourne, there has been a particular emphasis on ensuring additional PPE has been sent to Victoria to ensure aged care workers in that state have access to such equipment," Minister Colbeck said.

PPE is the last line of defence – preventing the introduction of coronavirus into aged care services and protecting our older Australians.

"We need everyone to continue to practise good hygiene and follow limits to public gatherings including keeping 1.5 metres of distance," Minister Colbeck said.

"If you have any symptoms of COVID-19, stay at home and get tested."

Aged care providers in Melbourne and Mitchell Shire can contact AgedCareCOVIDPPE@health.gov.au to request masks for in home and residential aged care workers delivering close personal care and clinical care, and other PPE like gloves and gowns to aged care services with a potential or confirmed COVID-19 outbreak.

Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia

Report submitted to CDNA/AHPPC 15 July 2020

Key messages

Estimates of changes in physical distancing behaviour



Estimates of current epidemic activity



Forecasts of the daily number of new local cases



Estimating trends in distancing behaviour

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide surveys to estimate trends in specific macro-distancing (average daily number of non-household contacts) and micro-distancing (proportion of the population always keeping 1.5m physical distance from non-household contacts) behaviours over time. We used these survey data to infer state-level trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.

Results



Table 1: Left columns: estimates of the average daily number of non-household contacts (macro-distancing) at peak adherence on around 12 April and as of 13 July for each state/territory. Right columns: estimates of self-reported adherence to the 1.5m rule (micro-distancing) at peak adherence on around 8 April and as of 13 July for each state/territory.

	Non-household contacts		Adherence to 1.5m rule	
State	Peak [90% CrI]	13 July [90% CrI]	Peak [90% CrI]	13 July [90% CrI
Vic	2.7 [2.5,2.9]	4.3 [4.1, 4.5]	63.1% [61.4,65.0]	41.5% [36.7,46.9

These state-level macro- and micro-distancing trends were then used in the model of R_{eff} to inform the reduction in non-household transmission rates (Figures S4 and S5).

Population mobility analysis

A number of data streams provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

The model detects a decline in the physical distancing variable over time (i.e., increasing mixing) since the date of peak adherence to these measures ≈ 2 April (see Figure 3).

The largest reductions in the impacts of physical distancing are evident in mobility data streams for lower transmission risk activities, such as time at parks. There is also a clear reduction in data streams representing higher-risk activities, such as time at workplaces. However, these mobility data do not indicate whether the increase in higher transmission risk activities is mitigated by other behaviours that are not measured by these metrics — such as reducing contacts and adherence to the $4m^2$ rule. In other words, while changes in these mobility data streams are useful for detecting changes in macro-distancing behaviour, they do not capture changes in micro-distancing behaviour.

Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S12)

Figure 1: Estimated trends in macro-distancing behaviour, i.e., reduction in the daily rate of non-household contacts, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from two surveys conducted by the national modelling group in early April and early May, and six BETA surveys conducted weekly from late May to early July (indicated by the black lines and grey rectangles), and an assumed pre-COVID-19 daily rate of 10.7 non-household contacts taken from previous studies. The width of the grey boxes corresponds to the duration of each survey wave (around 4 days) and the green ticks indicate the dates that public holidays coincided with survey waves (when people tend to stay home, biasing down the number of non-household contacts reported on those days). Note that the apparent increase in contacts in the second survey in Tas and WA is a statistical artefact due to the small sample sizes (21 in Tas, 100 in WA) which happen to contain two respondents reporting 100+ contacts. In general, estimates depicted by the grey rectangles are very sensitive to individuals with high numbers of contacts.

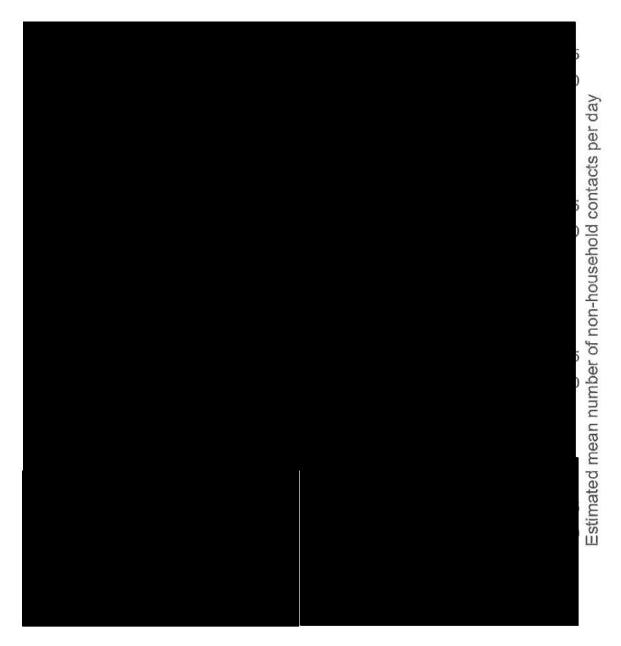


Figure 2: Estimated trends in micro-distancing behaviour, i.e. reduction in transmission probability per non-household contact, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from 15 nationwide surveys conducted weekly by BETA from late March to early July (indicated by the black lines and grey boxes). The width of the grey boxes corresponds to the duration of each survey wave (around 4 days).

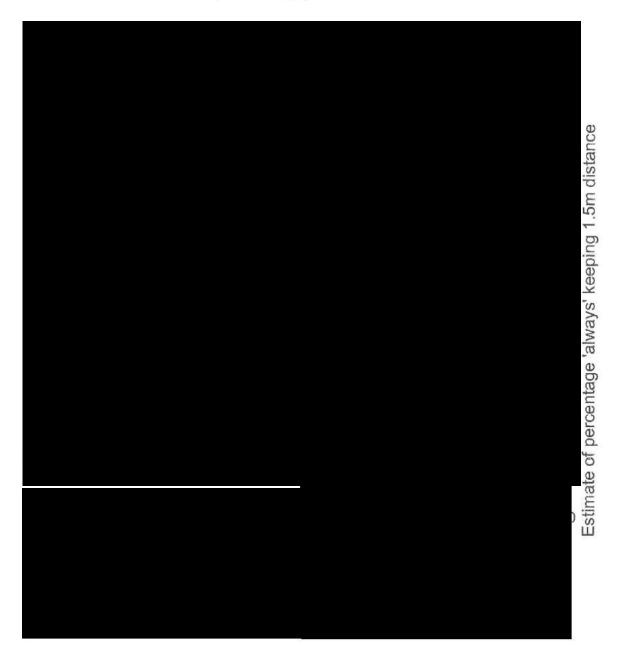


Figure 3: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 13 July. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 13 July, the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream. Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S12).



Figure 4: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.



LGA-level population mobility analysis for Victoria

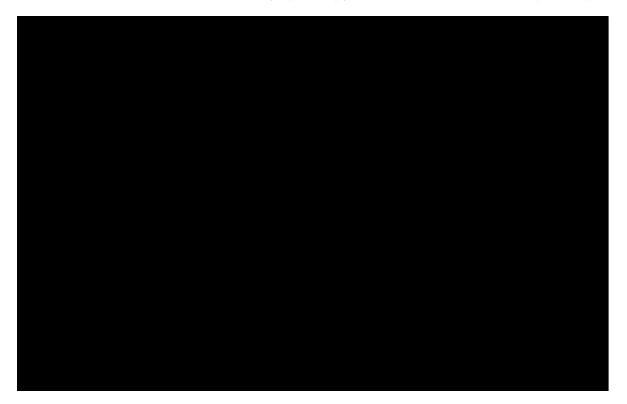
Overview

Facebook provide access to several aggregated and anonymised data sets on mobility for humanitarian use via their Data for Good program (https://dataforgood.fb.com). To preserve privacy, data are aggregated to the level of map tiles (which range in size from 0.6 km² to 4 km²) or administrative regions (corresponding to Local Government Areas), and data are not provided for any tiles or regions containing a small number of users (10 to 300, depending on the data set). Here we use a movement range data set which records the proportion of Facebook users who "stay put" over the course of a day (24 hour period) aggregated by LGA.

Results



Figure 5: Proportion of Facebook users who "stayed put" each day between Saturday 29 February 2020 and Sunday 12 July 2020 (the latest date at which data are available). Each line represents a single Victorian LGA. Blues lines are LGAs where "Stay at Home" advice is active in response to the June outbreak (thick blue line = median value). Orange lines are all other Victorian LGAs (thick orange line = median value). Grey vertical bars indicate weekend and Victorian public holidays. Red and green dotted vertical lines indicate the timing of government announcements increasing or decreasing (respectively) restrictions on movement and gatherings.



Estimating local transmission potential

We separately model local to local transmission (Figure 9) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} driven by population-wide interventions (specifically changes in macro- and micro-distancing behaviour, surveillance measures, and quarantine of overseas arrivals);
- short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics
 of transmission, such as clusters of cases and short periods of low transmission.

Component 1 reflects the average local transmission potential at state level (Figure 7), and Component 2 captures transmission within the sub-populations that have the most active cases at a given point in time (Figure 6). Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases in high-transmission environments — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure 8).

Note that Component 1 for local to local transmission incorporates the impact of improvements in surveillance on transmission rates. Using data on the number of days from symptom onset to testing for cases, we estimate the proportion of cases that are tested (and thus advised to isolate) by each day post-infection. We quantify how these times-to-detection have changed over time, and therefore how earlier isolation of cases due to improvements in contact tracing and clinical screening has reduced statewide $R_{\rm eff}$ for local to local transmission (Figure S3).

Interpretation

Where there is epidemic activity, local transmission potential of active cases (Component 1&2) is to be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, Component 1&2 represents the expected amount of onward transmission from any given member of the population if they were to become infectious. In contrast, Component 1 represents the average of this over the state population, indicating the potential for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Note that Component 1&2 can be higher or lower than the estimate of Component 1. In the increasing phase of a localised outbreak, it will be higher than Component 1. In the decreasing phase of a localised outbreak, Component 1&2 will be lower than Component 1 due to public health interventions, local depletion of susceptibles and/or other transmission factors that decrease the number of offspring from active cases associated with the cluster compared to that from other cases in the community.

Results





Table 2: Estimates of local transmission potential [90% credible intervals] resulting from Component 1 (state-wide) and Component 1&2 (current active cases only) by state/territory. The total number of observed local cases with a symptom onset date recorded (or inferred) to be recorded from 29 June–13 July inclusive (i.e., past 14 days) is also shown, indicative of the number of local active cases.

Loc	al-to-local tran	smission potentia		
State-wide				Local cases
$R_{\rm eff}$ [90% CrI]	$P(R_{\rm eff} > 1)$			29 June-13 July
	State-w	State-wide	State-wide Current active	

Figure 6: Depiction of the relationship between $R_{\rm eff}$ analysis components. TTD = time from symptom onset to detection.



Figure 7: Estimate of local transmission potential averaged over state/territory population (Component 1); *i.e.*, removing short-term variation due to clusters (Component 2). Light green ribbon=90% credible interval; dark green ribbon=50% credible interval. Estimates are made up to 12 July, based on cases with inferred infection dates up to and including 8 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. This includes the combined effect of macro- and micro-distancing behaviours and surveillance measures.

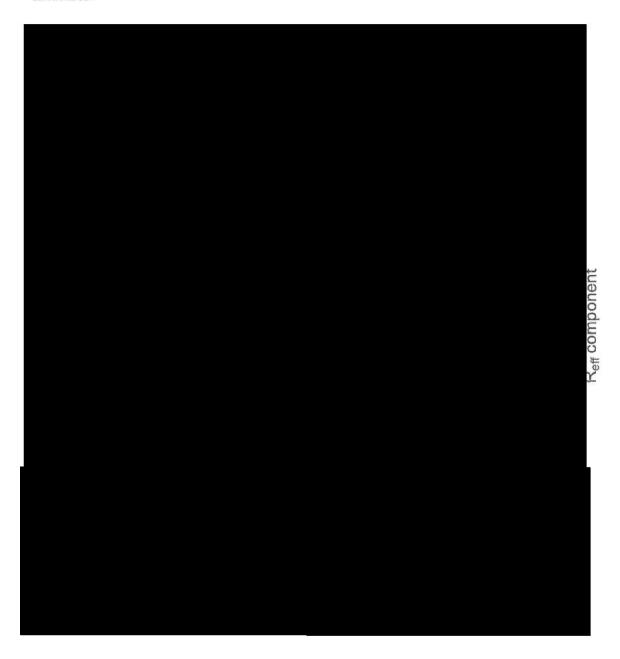


Figure 8: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission potential (Component 2) for each state/territory (light pink ribbon=90% credible interval; dark pink ribbon=50% credible interval. Estimates are made up to 12 July based on cases with inferred infection dates up to and including 8 July (due to a delay from infection to reporting, the trend in estimates after 12 July reflects the average range of deviations for that state, indicated by the grey shading). Solid grey vertical lines indicate key dates of

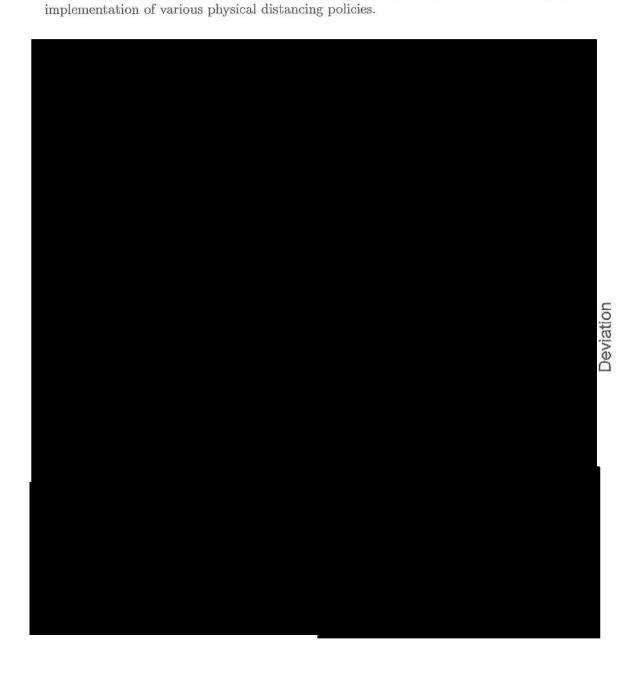
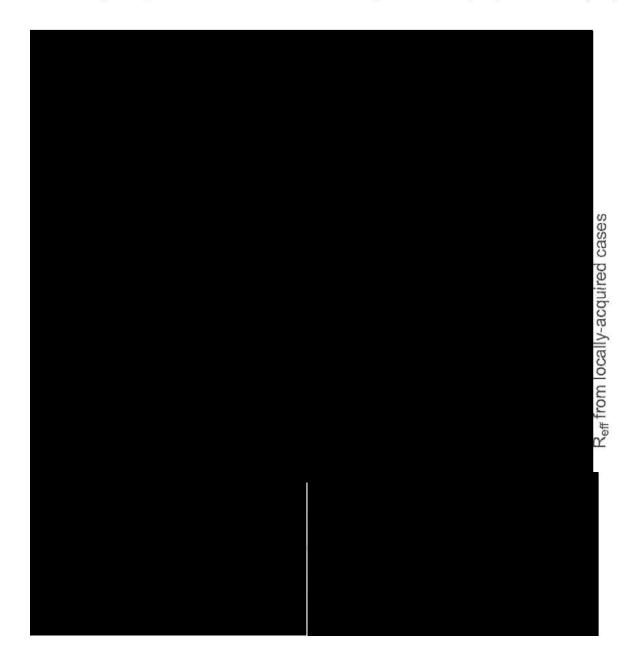


Figure 9: Estimate of average local transmission potential of active cases (Component 1&2) for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval). Estimates are made up to 12 July based on cases with inferred infection dates up to and including 8 July (due to a delay from infection to reporting, the trend in estimates after 12 July is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).



Forecasts of the daily number of new confirmed cases in each jurisdiction

We report state-level forecasts of the daily number of new confirmed cases cases up to 10 August— synthesised from three independent models (known as an 'ensemble forecast'). Ensemble forecasts are more accurate than any individual forecast alone — biases and variances in each model that result from different modelling choices balance against each other to improve predictions. Hence, ensemble forecasts tend to produce improved estimates of both the central values, as well as improved estimates of the plausible yet unlikely forecasts (uncertainty). Here, the ensemble has been generated by equally weighting the forecasts from each model. In future weeks, we will continue to improve the ensemble performance by updating the weights for each model based on their past-performance. A brief description of each method incorporated in the ensemble is given below:

- SEEIIR Forecast: Our existing forecasting model previously presented to CDNA and AHPPC a stochastic susceptible-exposed-infectious-recovered (SEEIIR) compartmental model that incorporates changes in local transmission potential via the estimated timevarying effective reproduction number (as shown in Figure 9). Details can be found in our technical report at: https://www.doherty.edu.au/about/reports-publications.
- Probabilistic Forecast: A stochastic epidemic model that accounts for the number of imported-, symptomatic- and asymptomatic-cases over time. This model estimates the effective reproduction number corresponding to local and imported cases, and incorporates mobility data to infer the effect of macro-distancing behaviour. This model captures variation in the number and timing of new infections via probability distributions. The parameters that govern these distributions are inferred from the case and mobility data (e.g., mean number of imported cases).
- Time-Series Forecast: A time-series model that does not account for disease transmission dynamics, but rather uses recent daily case counts to forecast cases into the future. Parameters of this 'autoregressive' model are estimated using global data accessible via the Johns Hopkins COVID-19 repository. Case counts from a specific time window prior to the forecasting date (the present) are used for model calibration. The number of days within this time window is chosen to optimise projections for Australia data.

The SEEIIR and Probabilistic Forecasts explicitly incorporate dynamics of disease transmission and the impact of public health measures on transmission over time via $R_{\rm eff}$. The Time-Series Forecast does not explicitly incorporate either of these factors. The Time-Series Forecast is expected to accurately forecast new daily case numbers over a shorter time period, whereas disease-specific models are anticipated to provide more accurate forecasts several weeks into the future. All forecasts assume that current public health measures will remain in place and that public adherence to these measures will be consistent into the future.

Results

Forecasts of the daily number of new local cases for each state/territory

Figure 10: Time series of new daily local cases of COVID-19 estimated from the forecasting ensemble model for each jurisdiction (50–90% confidence intervals coloured in progressively lighter blue shading) from 13 July to 10 August. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars). Recent case counts are inferred to adjust for reporting delays (black dots).

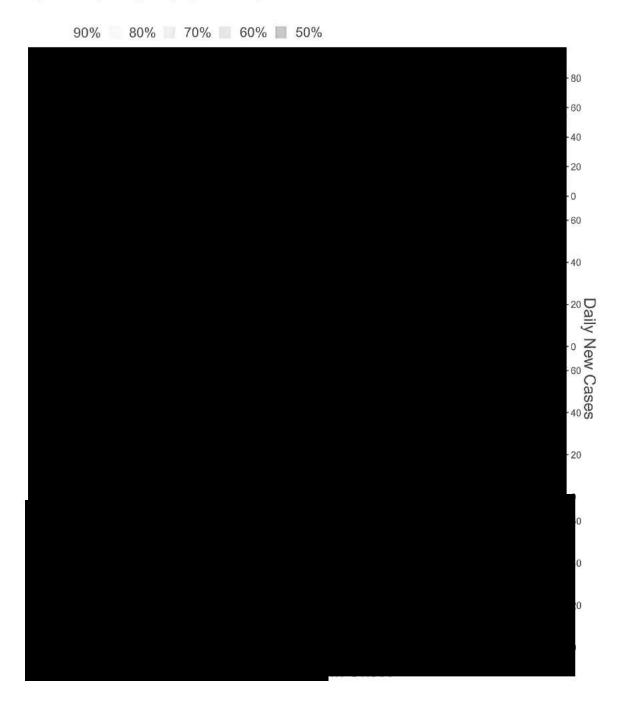
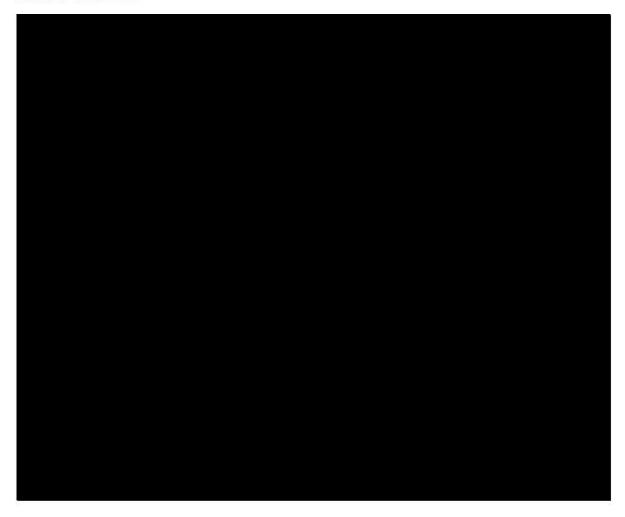


Figure 11: Time series of new daily local cases of COVID-19 estimated in Victoria from the forecasting ensemble model (50–90% confidence intervals coloured in progressively lighter blue shading) from 13 July to 10 August. Note that the y-axis is truncated at 1000 daily new cases (i.e., zoomed in on lower projected cases counts). Recent case counts are inferred to adjust for reporting delays (black dots). Note: inferring the number of cases when case numbers is small is uncertain. Furthermore, the influence of any single data point on our estimates of $R_{\rm eff}$ and forecasts is minimal.



Figure 12: Time series of new daily local cases of COVID-19 estimated in New South Wales from the forecasting ensemble model (50–90% confidence intervals coloured in progressively lighter blue shading) from 13 July to 10 August. Recent case counts are inferred to adjust for reporting delays (black dots). Note: inferring the number of cases when case numbers is small is uncertain. Furthermore, the influence of any single data point on our estimates of $R_{\rm eff}$ and forecasts is minimal.

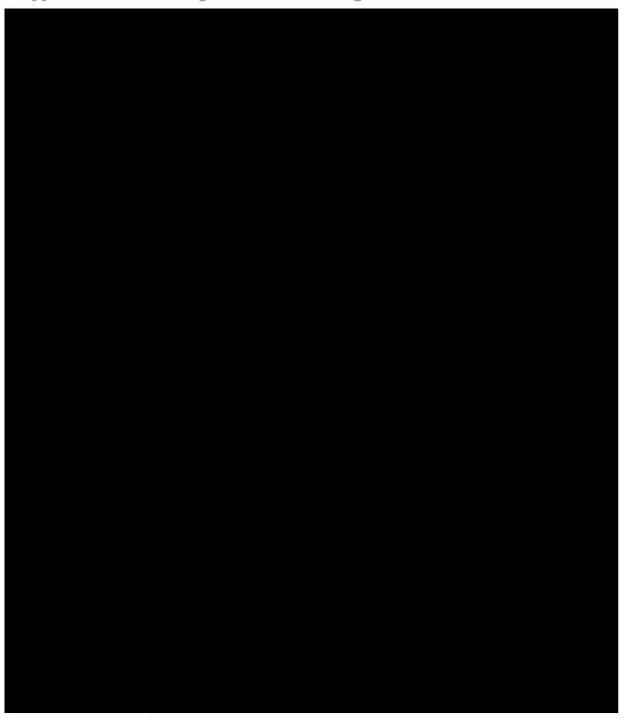


Supplementary Appendix

For methodological details on the mobility, $R_{\rm eff}$ analyses, and forecasting analyses please refer to our most recent Technical Report (15 May 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications

Supplement to estimating trends in distancing behaviour





Supplementary figures

Figure S1: Time series of new daily confirmed cases of COVID-19 in Australia (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 5 July 2020. Plotted by recorded or inferred date of symptom onset.



Figure S2: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 5 July 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.

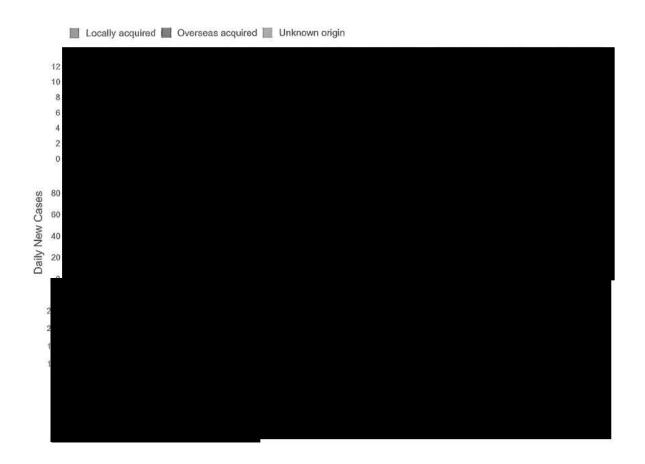


Figure S3: Estimated trend in time from symptom onset to detection for locally-acquired cases (black ribbon = median estimate; yellow ribbons = 90% credible intervals; black dots = time-to-detection of each case). Note that we will continue to review how this trend is estimated, given changes in testing strategies, particularly noting the increasing use of serological assays for case ascertainment.



Figure S4: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour or time-to-detection, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval). Estimates are made up to 12 July, based on cases with inferred infection dates up to and including 8 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

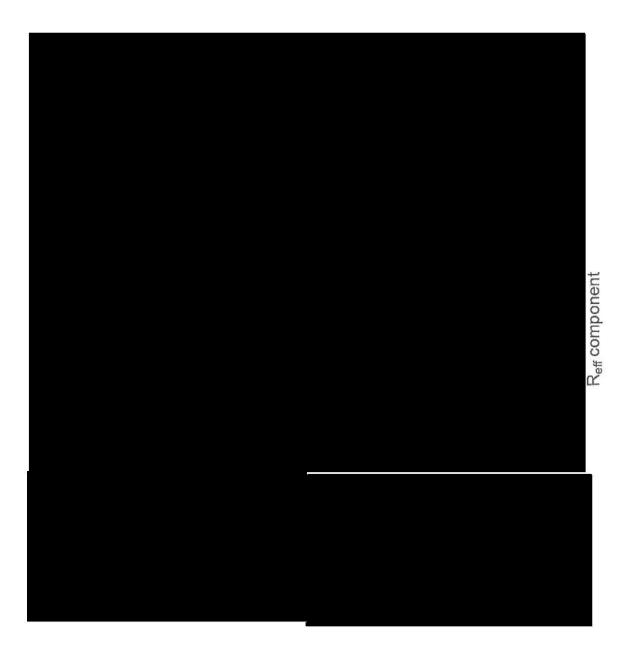
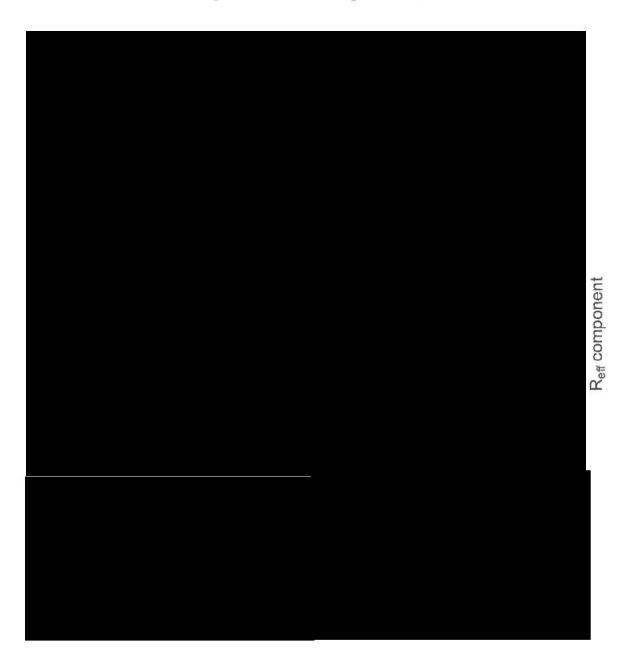


Figure S5: Estimate of average state-level trend in local transmission potential, if we assume that only 'micro-distancing' behaviour had changed and not 'macro-distancing' behaviour or time-to-detection, for each state/territory (light purple ribbon =90% credible interval; dark purple ribbon =50% credible interval). Estimates are made up to 12 July, based on cases with inferred infection dates up to and including 8 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

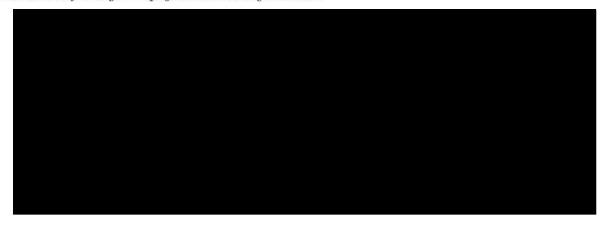


Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia

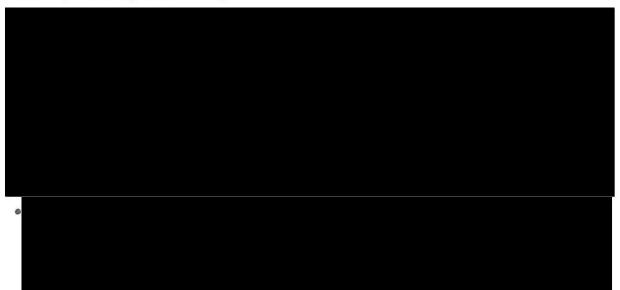
Report submitted to CDNA/AHPPC 22 July 2020

Key messages

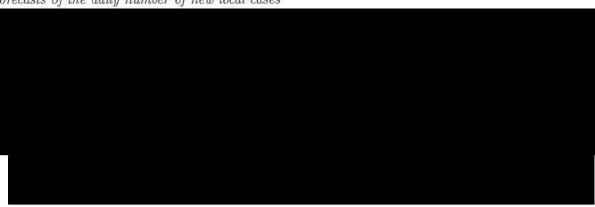
Estimates of changes in physical distancing behaviour



Estimates of current epidemic activity



Forecasts of the daily number of new local cases



LGA-level spatial analysis of active cases and importation risk

- We conducted an LGA-level analysis of the spatial distribution of active cases and relative importation risk from LGAs with active cases (source LGAs) into LGAs without active cases (non-source) in Victoria and
- Preliminary results are shown in Figures 13 and 14 below.

Estimating trends in distancing behaviour

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide surveys to estimate trends in specific macro-distancing (average daily number of non-household contacts) and micro-distancing (proportion of the population always keeping 1.5m physical distance from non-household contacts) behaviours over time. We used these survey data to infer state-level trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.



Table 1: Left columns: estimates of the average daily number of non-household contacts (macrodistancing) at peak adherence on around 12 April and as of 18 July for each state/territory. Right columns: estimates of self-reported adherence to the 1.5m rule (micro-distancing) at peak adherence on around 10 April and as of 18 July for each state/territory.

	Non-household contacts		Adherence to 1.5m rule		
State	Peak [90% CrI]	18 July [90% CrI]	Peak [90% CrI]	18 July [90% Cr]	

These state-level macro- and micro-distancing trends were then used in the model of R_{eff} to inform the reduction in non-household transmission rates (Figures S4 and S5).

Population mobility analysis

A number of data streams provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

The largest reductions in the impacts of physical distancing are evident in mobility data streams for lower transmission risk activities, such as time at parks. There is also a clear reduction in data streams representing higher-risk activities, such as time at workplaces. However, these mobility data do not indicate whether the increase in higher transmission risk activities is mitigated by other behaviours that are not measured by these metrics — such as reducing contacts and adherence to the $4m^2$ rule. In other words, while changes in these mobility data streams are useful for detecting changes in macro-distancing behaviour, they do not capture changes in micro-distancing behaviour.

Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S12)

Figure 1: Estimated trends in macro-distancing behaviour, *i.e.*, reduction in the daily rate of non-household contacts, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from two surveys conducted by the national modelling group in early April and early May, and seven BETA surveys conducted weekly from late May up to mid-July (indicated by the black lines and grey rectangles), and an assumed pre-COVID-19 daily rate of 10.7 non-household contacts taken from previous studies. The width of the grey boxes corresponds to the duration of each survey wave (around 4 days) and the green ticks indicate the dates that public holidays coincided with survey waves (when people tend to stay home, biasing down the number of non-household contacts reported on those days). Note that the apparent increase in contacts in a number of surveys in Tas and WA are statistical artefacts due to small sample sizes which happen to contain one or two respondents reporting 100+ contacts. In general, estimates depicted by the grey rectangles are very sensitive to individuals with high numbers of contacts.

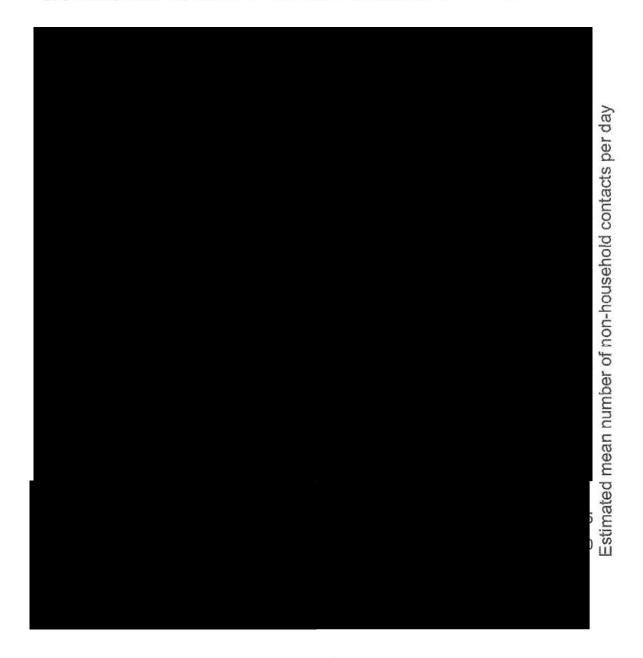


Figure 2: Estimated trends in micro-distancing behaviour, *i.e.* reduction in transmission probability per non-household contact, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from 16 nationwide surveys conducted weekly by BETA from late March up to mid-July (indicated by the black lines and grey boxes). The width of the grey boxes corresponds to the duration of each survey wave (around 4 days).

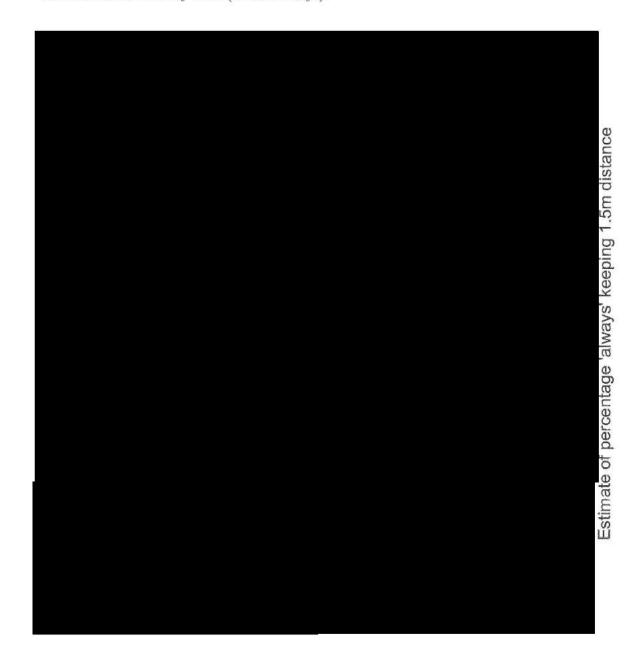


Figure 3: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 18 July. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 18 July, the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream. Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S7–S12).



Figure 4: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.



LGA-level population mobility analysis for Victoria

Overview

Facebook provide access to several aggregated and anonymised data sets on mobility for humanitarian use via their Data for Good program (https://dataforgood.fb.com). To preserve privacy, data are aggregated to the level of map tiles (which range in size from 0.6 km² to 4 km²) or administrative regions (corresponding to Local Government Areas), and data are not provided for any tiles or regions containing a small number of users (10 to 300, depending on the data set). Here we use a movement range data set which records the proportion of Facebook users who "stay put" over the course of a day (24 hour period) aggregated by LGA.

Results

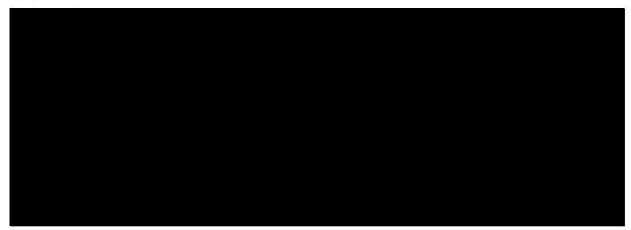


Figure 5: Proportion of Facebook users who "stayed put" each day between Saturday 29 February 2020 and Saturday 18 July 2020 (the latest date at which data are available). Each line represents a single Victorian LGA. Blues lines are LGAs where "Stay at Home" advice is active in response to the June outbreak (thick blue line = median value). Orange lines are all other Victorian LGAs (thick orange line = median value). Grey vertical bars indicate weekend and Victorian public holidays. Red and green dotted vertical lines indicate the timing of government announcements increasing or decreasing (respectively) restrictions on movement and gatherings.



Estimating local transmission potential

We separately model local to local transmission (Figure 9) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} driven by population-wide interventions (specifically changes in macro- and micro-distancing behaviour, surveillance measures, and quarantine of overseas arrivals);
- 2. short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics of transmission, such as clusters of cases and short periods of low transmission.

Component 1 reflects the average local transmission potential at state level (Figure 7), and Component 2 captures transmission within the sub-populations that have the most active cases at a given point in time (Figure 6). Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases in high-transmission environments — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure 8).

Note that Component 1 for local to local transmission incorporates the impact of improvements in surveillance on transmission rates. Using data on the number of days from symptom onset to testing for cases, we estimate the proportion of cases that are tested (and thus advised to isolate) by each day post-infection. We quantify how these times-to-detection have changed over time, and therefore how earlier isolation of cases due to improvements in contact tracing and clinical screening has reduced statewide $R_{\rm eff}$ for local to local transmission (Figure S3).

Interpretation

Where there is epidemic activity, local transmission potential of active cases (Component 1&2) is to be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, Component 1&2 represents the expected amount of onward transmission from any given member of the population if they were to become infectious. In contrast, Component 1 represents the average of this over the state population, indicating the potential for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Note that Component 1&2 can be higher or lower than the estimate of Component 1. In the increasing phase of a localised outbreak, it will be higher than Component 1. In the decreasing phase of a localised outbreak, Component 1&2 will be lower than Component 1 due to public health interventions, local depletion of susceptibles and/or other transmission factors that decrease the number of offspring from active cases associated with the cluster compared to that from other cases in the community.

Results





Table 2: Estimates of local transmission potential [90% credible intervals] resulting from Component 1 (state-wide) and Component 1&2 (current active cases only) by state/territory. The total number of observed local cases with a symptom onset date recorded (or inferred) to be from 6-20 July inclusive (i.e., past 14 days) is also shown, indicative of the number of local active cases.

	Loc	al-to-local trans	smission potential		
	State-wide		Current active cases only		Local cases
State	$R_{\rm eff}$ [90% CrI]	$P(R_{\text{eff}} > 1)$	$R_{\rm eff}$ [90% CrI]	$P(R_{\text{eff}} > 1)$	6-20 July

Figure 6: Depiction of the relationship between $R_{\rm eff}$ analysis components. TTD = time from symptom onset to detection.



Figure 7: Estimate of local transmission potential averaged over state/territory population (Component 1); *i.e.*, removing short-term variation due to clusters (Component 2). Light green ribbon=90% credible interval; dark green ribbon=50% credible interval. Estimates are made up to 18 July, based on cases with inferred infection dates up to and including 15 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. This includes the combined effect of macro- and micro-distancing behaviours and surveillance measures.

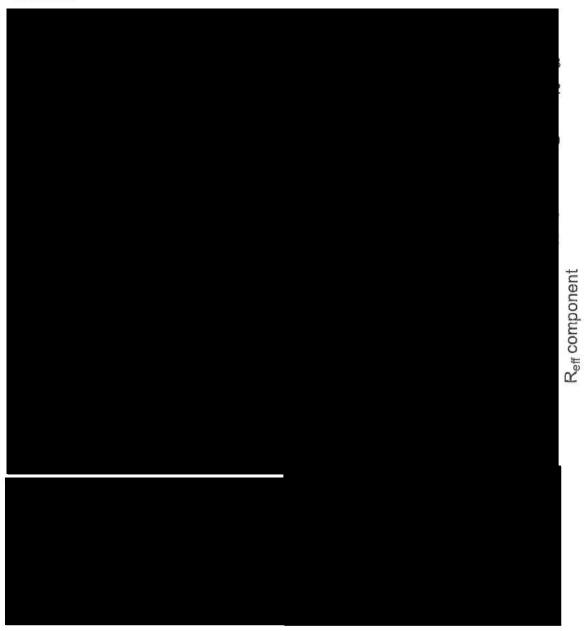


Figure 8: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission potential (Component 2) for each state/territory (light pink ribbon=90% credible interval; dark pink ribbon = 50% credible interval. Estimates are made up to 18 July based on cases with inferred infection dates up to and including 15 July (due to a delay from infection to reporting, the trend in estimates after 15 July reflects the average range of deviations for that state, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies.

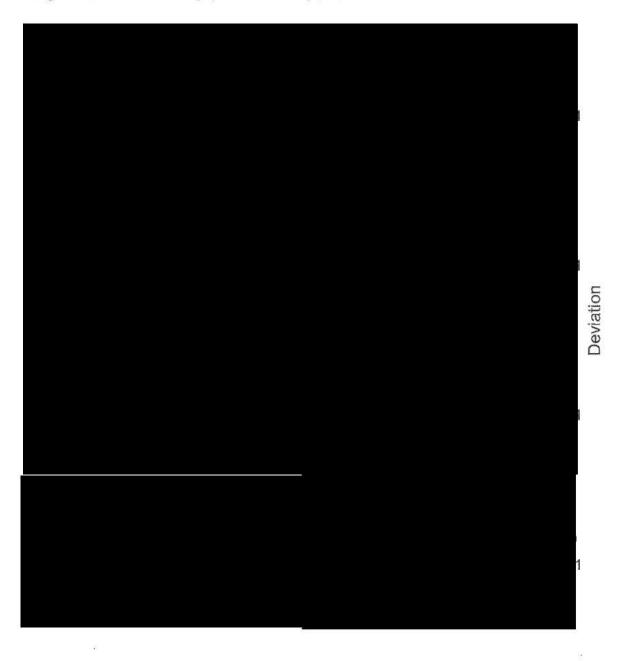
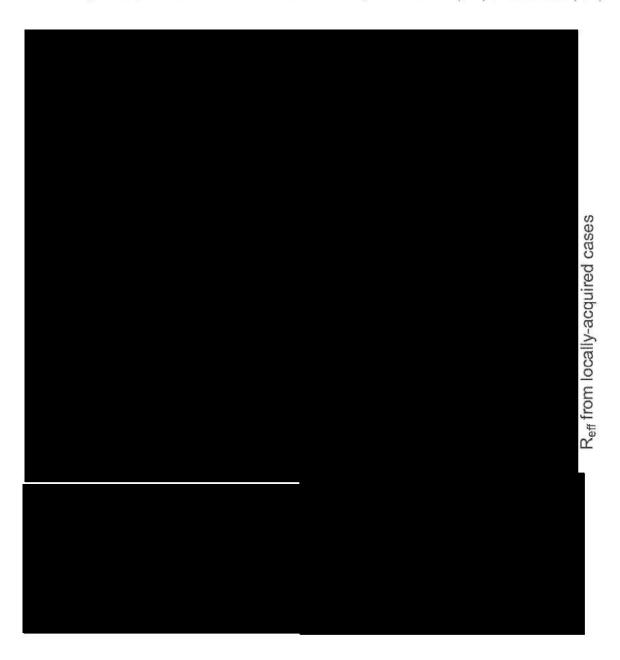


Figure 9: Estimate of average local transmission potential of active cases (Component 1&2) for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval). Estimates are made up to 18 July based on cases with inferred infection dates up to and including 15 July (due to a delay from infection to reporting, the trend in estimates after 15 July is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).



Forecasts of the daily number of new confirmed cases in each jurisdiction

We report state-level forecasts of the daily number of new confirmed cases cases up to 16 August— synthesised from three independent models (known as an 'ensemble forecast'). Ensemble forecasts are more accurate than any individual forecast alone — biases and variances in each model that result from different modelling choices balance against each other to improve predictions. Hence, ensemble forecasts tend to produce improved estimates of both the central values, as well as improved estimates of the plausible yet unlikely forecasts (uncertainty). Here, the ensemble has been generated by equally weighting the forecasts from each model. In future weeks, we will continue to improve the ensemble performance by updating the weights for each model based on their past-performance. A brief description of each method incorporated in the ensemble is given below:

- SEEIIR Forecast: Our existing forecasting model previously presented to CDNA and AHPPC — a stochastic susceptible-exposed-infectious-recovered (SEEIIR) compartmental model that incorporates changes in local transmission potential via the estimated timevarying effective reproduction number (as shown in Figure 9). Details can be found in our technical report at: https://www.doherty.edu.au/about/reports-publications.
- Probabilistic Forecast: A stochastic epidemic model that accounts for the number of imported-, symptomatic- and asymptomatic-cases over time. This model estimates the effective reproduction number corresponding to local and imported cases, and incorporates mobility data to infer the effect of macro-distancing behaviour. This model captures variation in the number and timing of new infections via probability distributions. The parameters that govern these distributions are inferred from the case and mobility data (e.g., mean number of imported cases).
- Time-Series Forecast: A time-series model that does not account for disease transmission dynamics, but rather uses recent daily case counts to forecast cases into the future. Parameters of this 'autoregressive' model are estimated using global data accessible via the Johns Hopkins COVID-19 repository. Case counts from a specific time window prior to the forecasting date (the present) are used for model calibration. The number of days within this time window is chosen to optimise projections for Australia data.

The SEEIIR and Probabilistic Forecasts explicitly incorporate dynamics of disease transmission and the impact of public health measures on transmission over time via $R_{\rm eff}$. The Time-Series Forecast does not explicitly incorporate either of these factors. The Time-Series Forecast is expected to accurately forecast new daily case numbers over a shorter time period, whereas disease-specific models are anticipated to provide more accurate forecasts several weeks into the future. All forecasts assume that current public health measures will remain in place and that public adherence to these measures will be consistent into the future.

Results

Forecasts of the daily number of new local cases for each state/territory

Figure 10: Time series of new daily local cases of COVID-19 estimated from the forecasting ensemble model for each jurisdiction (50–90% confidence intervals coloured in progressively lighter blue shading) from 20 July to 16 August. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars). Recent case counts are inferred to adjust for reporting delays (black dots).

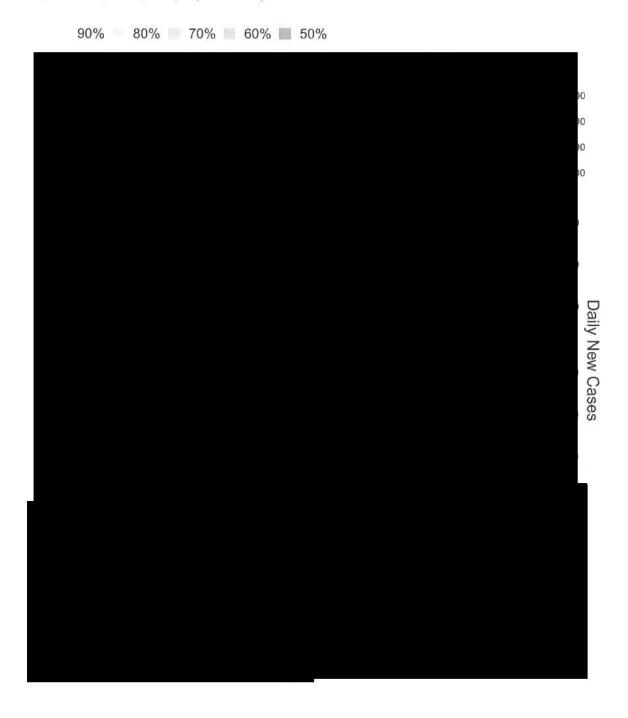


Figure 11: Time series of new daily local cases of COVID-19 estimated in Victoria from the forecasting ensemble model (50–90% confidence intervals coloured in progressively lighter blue shading) from 20 July to 16 August. Note that the y-axis is truncated at 1000 daily new cases (i.e., zoomed in on lower projected case counts). Recent case counts are inferred to adjust for reporting delays (black dots).



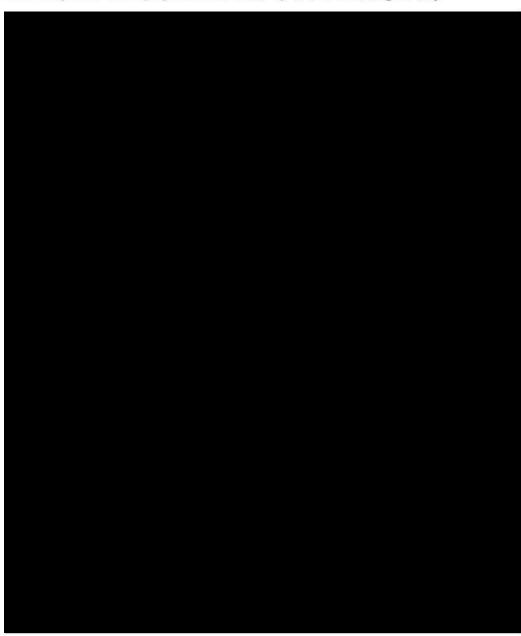
LGA-level spatial analysis of active cases and importation risk

We conducted an LGA-level analysis of the spatial distribution of active cases and relative importation risk from LGAs with active cases (source LGAs) into LGAs without active cases (non-source) in Victoria and New South Wales. Preliminary results are shown in Figures 13 and 14 below.

Overview of methods



Figure 13: Blue shading: Infectious potential of each Victorian LGA. Red shading: risk of case importation for Victorian LGAs (*i.e.*, relative number of new infections from each 'source' LGA to people resident in each 'non-source' LGA). Infectious potential and importation risk is estimated using cases with symptom onset dates up to and including 20 July.

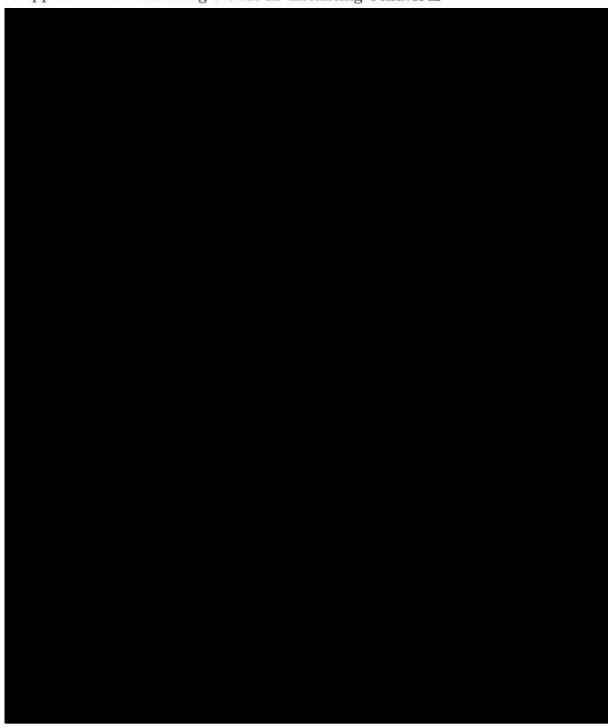


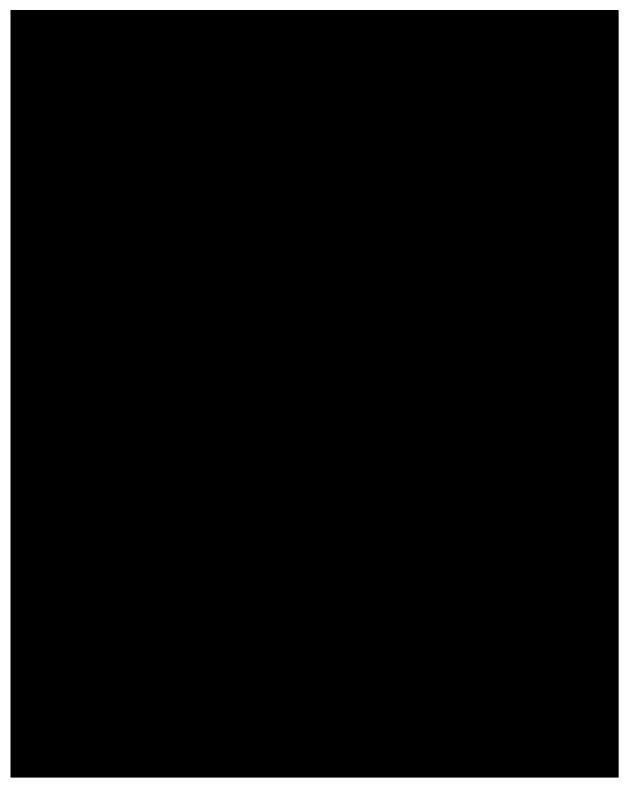
Supplementary Appendix

For methodological details on the mobility, $R_{\rm eff}$ analyses, and forecasting analyses please refer to our most recent Technical Report (15 May 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications

Supplement to estimating trends in distancing behaviour





References

[1] Freya M. Shearer, Lisa Gibbs, Eva Alisic, Katitza Marinkovic Chavez, Niamh Meagher, Lauren Carpenter Phoebe Quinn, Colin MacDougall, and David J. Price. Distancing measures

in the face of COVID-19 in Australia. Available from: https://www.doherty.edu.au/uploads/content_doc/social_distancing_survey_wave1_report_May142.pdf, 2020.

Supplementary figures

Figure S1: Time series of new daily confirmed cases of COVID-19 in Australia (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 21 July 2020. Plotted by recorded or inferred date of symptom onset.



Figure S2: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 21 July 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.

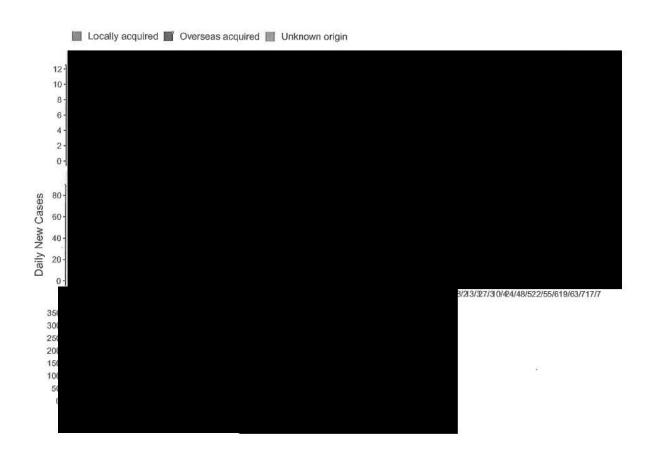


Figure S3: Estimated trend in time from symptom onset to detection for locally-acquired cases (black ribbon = median estimate; yellow ribbons = 90% credible intervals; black dots = time-to-detection of each case). Note that we will continue to review how this trend is estimated, given changes in testing strategies, particularly noting the increasing use of serological assays for case ascertainment.



Figure S4: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour or time-to-detection, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval). Estimates are made up to 18 July, based on cases with inferred infection dates up to and including 15 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

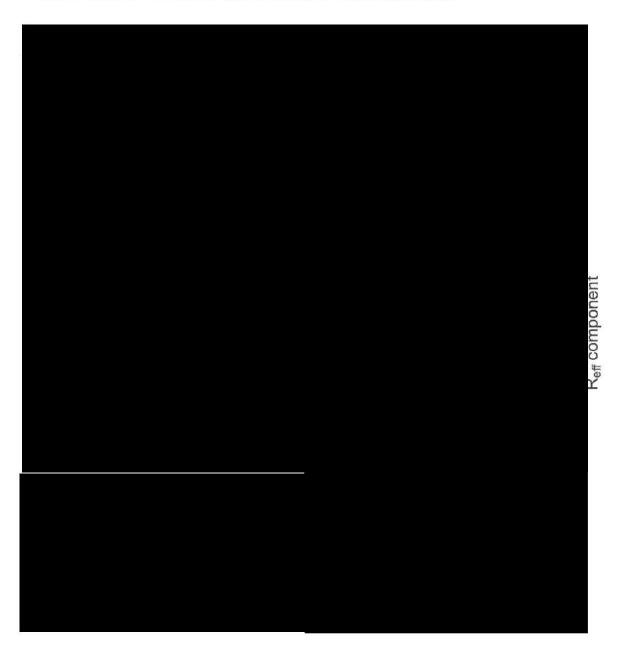
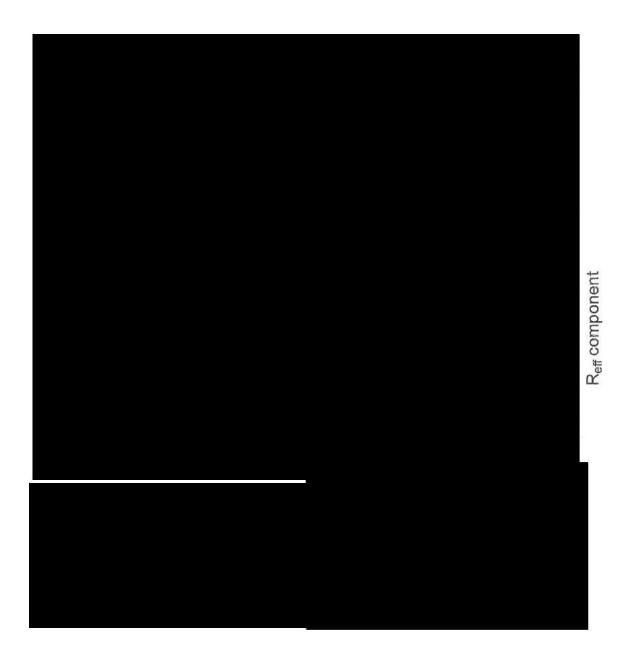


Figure S5: Estimate of average state-level trend in local transmission potential, if we assume that only 'micro-distancing' behaviour had changed and not 'macro-distancing' behaviour or time-to-detection, for each state/territory (light purple ribbon = 90% credible interval; dark purple ribbon = 50% credible interval). Estimates are made up to 18 July, based on cases with inferred infection dates up to and including 15 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.



Estimating temporal variation in transmission of COVID-19 and physical distancing behaviour in Australia $\,$

Report submitted to CDNA/AHPPC 29 July 2020

Key messages

Estimates of local transmission potential
Forecasts of the daily number of new local cases
Estimates of trends in physical distancing behaviour

Estimates of local transmission potential

We report estimates of local transmission potential from a statistical method which allows us to distinguish between transmission in the general population and clusters/localised outbreaks (Figure S1).

Results



Victoria



Table 1: Estimates of local transmission potential [90% credible intervals] resulting from Component 1 (state-wide) and Component 1&2 (current active cases only) by state/territory. The total number of observed local cases with a symptom onset date recorded (or inferred) to be from 13–27 July inclusive (i.e., past 14 days) is also shown, indicative of the number of local active cases.

Local cases 13–27 July	mission potential Current active cases only			Local-to-local trans State-wide				
	$P(R_{\rm eff} > 1)$		> 1)	$P(R_{\text{eff}})$	12 C.		$R_{ m eff}$	State

Figure 1: Estimate of local transmission potential averaged over state/territory population (Component 1); i.e., removing short-term variation due to clusters (Component 2). Light green ribbon=90% credible interval; dark green ribbon=50% credible interval. Estimates are made up to 26 July, based on cases with inferred infection dates up to and including 22 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. This includes the combined effect of macro- and micro-distancing behaviours and surveillance measures.

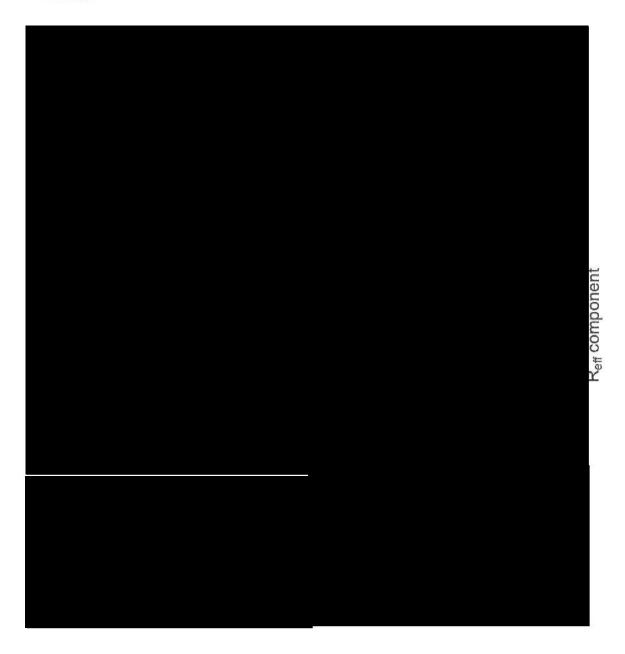
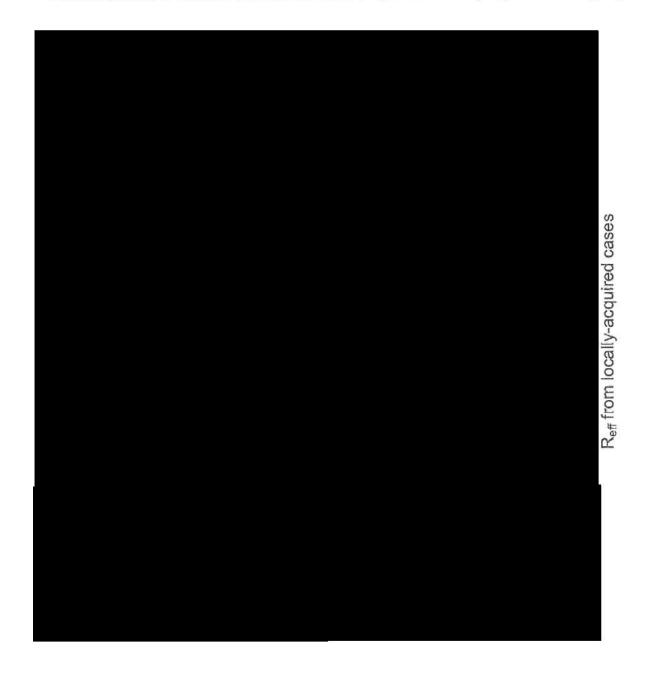


Figure 2: Estimate of average local transmission potential of active cases (Component 1&2) for each state/territory (light green ribbon=90% credible interval; dark green ribbon = 50% credible interval). Estimates are made up to 26 July based on cases with inferred infection dates up to and including 22 July (due to a delay from infection to reporting, the trend in estimates after 22 July is inferred from mobility data, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control. Where there is epidemic activity, this quantity may be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, this quantity reflects the ability for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).



Forecasts of the daily number of new confirmed cases in each jurisdiction

We report state-level forecasts of the daily number of new local cases up to 24 August synthesised from three independent models (known as an 'ensemble forecast').

Results



Forecasts of the daily number of new local cases for each state/territory

Figure 3: Time series of new daily local cases of COVID-19 estimated from the forecasting ensemble model for each jurisdiction (50–90% confidence intervals coloured in progressively lighter blue shading) from 27 July to 24 August. The observed daily counts of locally acquired cases are also plotted by date of symptom onset (grey bars). Recent case counts are inferred to adjust for reporting delays (black dots).

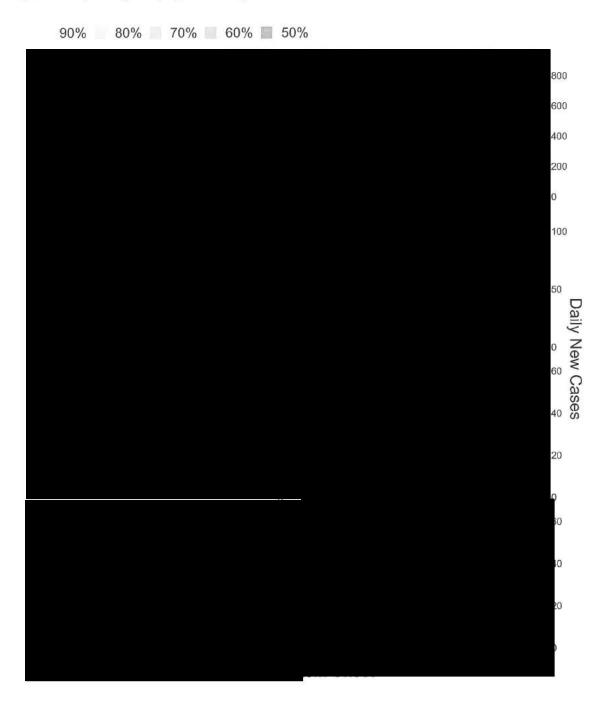


Figure 4: Time series of new daily local cases of COVID-19 estimated in Victoria from the forecasting ensemble model (50–90% confidence intervals coloured in progressively lighter blue shading) from 27 July to 24 August. Note that the y-axis is truncated at 1000 daily new cases (*i.e.*, zoomed in on lower projected case counts). Recent case counts are inferred to adjust for reporting delays (black dots).



Trends in distancing behaviour

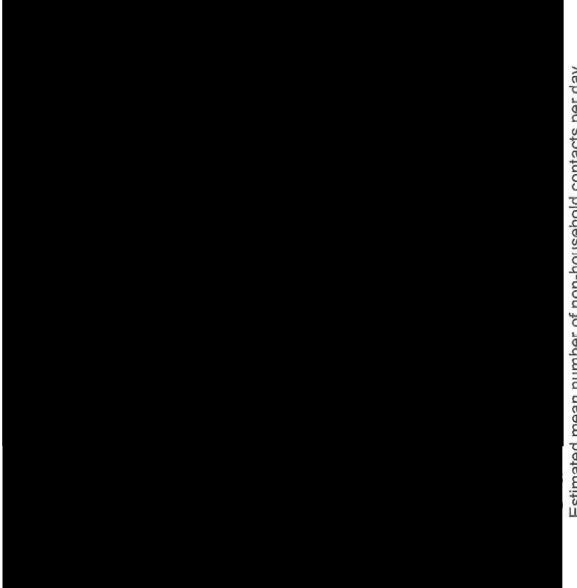
We use data from nationwide surveys and mobility data from technology companies to estimate trends in macro-distancing and micro-distancing behaviour over time.



Table 2: Left columns: estimates of the average daily number of non-household contacts (macro-distancing) at peak adherence on around 12 April and as of 26 July for each state/territory. Right columns: estimates of self-reported adherence to the 1.5m rule (micro-distancing) at peak adherence on around 10 April and as of 26 July for each state/territory.

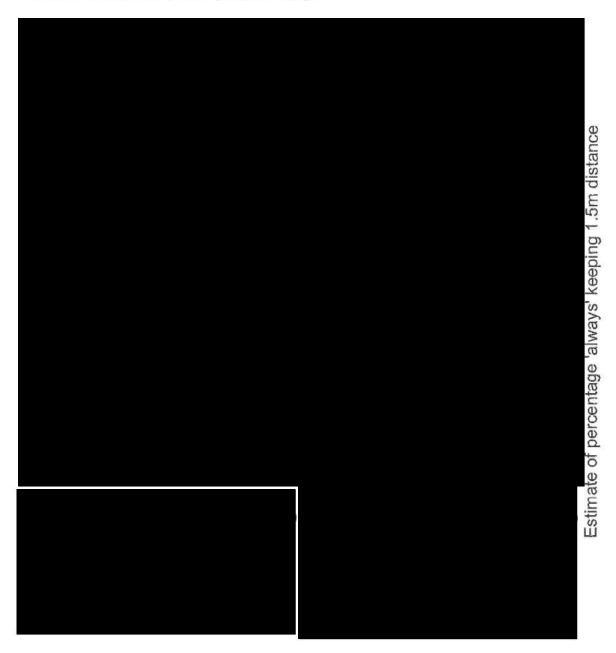
	Non-household contacts		Adherence to 1.5m rule	
State	Peak [90% CrI]	26 July [90% CrI]	Peak [90% CrI]	26 July [90% CrI

Figure 6: Estimated trends in macro-distancing behaviour, i.e., reduction in the daily rate of non-household contacts, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from two surveys conducted by the national modelling group in early April and early May, and eight BETA surveys conducted weekly from late May up to late July (indicated by the black lines and grey rectangles), and an assumed pre-COVID-19 daily rate of 10.7 non-household contacts taken from previous studies. The width of the grey boxes corresponds to the duration of each survey wave (around 4 days) and the green ticks indicate the dates that public holidays coincided with survey waves (when people tend to stay home, biasing down the number of non-household contacts reported on those days). Note that the apparent increase in contacts in a number of surveys in Tas and WA are statistical artefacts due to small sample sizes which happen to contain one or two respondents reporting 100+ contacts. In general, estimates depicted by the grey rectangles are very sensitive to individuals with high numbers of contacts.



Estimated mean number of non-household contacts per day

Figure 7: Estimated trends in micro-distancing behaviour, *i.e.* reduction in transmission probability per non-household contact, in each state/territory (dark purple ribbons = 50% credible intervals; light purple ribbons = 90% credible intervals). Estimates are informed by state-level data from 17 nationwide surveys conducted weekly by BETA from late March up to late July (indicated by the black lines and grey boxes). The width of the grey boxes corresponds to the duration of each survey wave (around 4 days).



State-level trends in population mobility

We use a latent variable statistical model to simultaneously analyse multiple population mobility data streams (publicly available from large technology companies) and quantify underlying changes in population behaviour.

Results



LGA-level trends in population mobility

We use a movement range data set which records the proportion of Facebook users who stay within a 0.6 km² map tile over the course of a 24 hour period ("stay put") aggregated by LGA. We report the proportion of users who "stayed put" each day between Saturday 29 February 2020 and Sunday 26 July 2020 (the latest date at which data are available) for each LGA in Victoria and New South Wales (Figure 10).

Results



Figure 8: Percentage change compared to a pre-COVID-19 baseline of three key mobility data streams in each Australian state and territory up to 26 July. Solid vertical lines give the dates of three physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer. The dashed vertical line marks 26 July, the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behaviours driving each data stream. Plots of each data stream and our model fits for each state and territory are shown in the Appendix (Figures S8–S13).

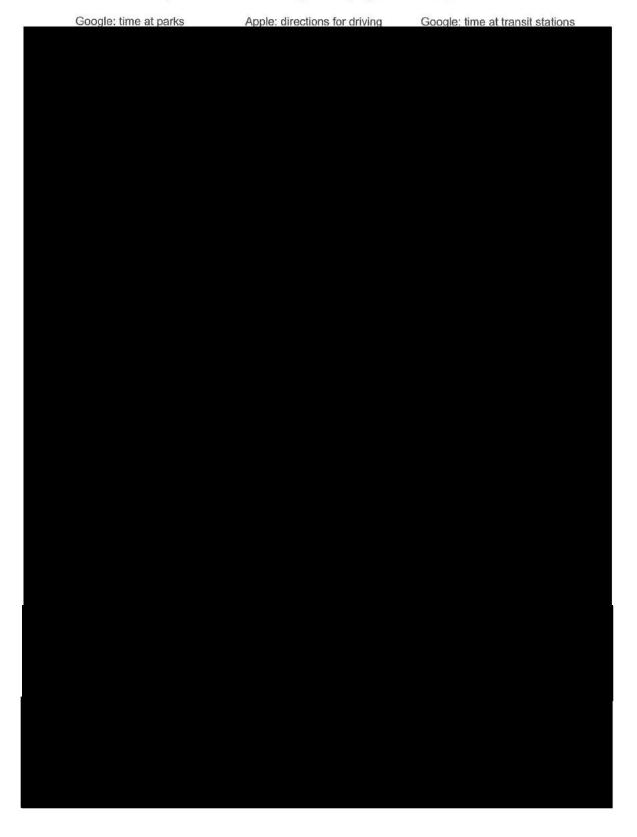


Figure 9: Percentage change compared to a pre-COVID-19 baseline of a number of key mobility data streams in Victoria. Solid vertical lines give the dates of implementation of five physical distancing measures: restriction of gatherings to 500 people or fewer; closure of bars, restaurants, and cafes; restriction of gatherings to 2 people or fewer; "Stay at Home" advice activated in selected Melbourne postcodes; "Stay at Home" advice activated in metropolitan Melbourne and Mitchell Shire. The dashed vertical line marks the most recent date for which some mobility data are available. Purple dots in each panel are data stream values (percentage change on baseline). Solid lines and grey shaded regions are the posterior mean and 95% credible interval estimated by our model of the latent behavioural factors driving each data stream.



Figure 10: Proportion of Facebook users who "stayed put" each day between Saturday 29 February 2020 and Sunday 26 July 2020 (the latest date at which data are available). Each line represents a single Victorian LGA. Blues lines are LGAs where "Stay at Home" advice is active in response to the June outbreak (thick blue line = median value). Orange lines are all other Victorian LGAs (thick orange line = median value). Grey vertical bars indicate weekend and Victorian public holidays. Red and green dotted vertical lines indicate the timing of government announcements increasing or decreasing (respectively) restrictions on movement and gatherings.



Supplementary Appendix

For full methodological details on the mobility, distancing, $R_{\rm eff}$ and forecasting analyses please refer to our most recent Technical Report (17 July 2020) available at the following link:

https://www.doherty.edu.au/about/reports-publications

Brief descriptions of each analysis and supplementary figures are also provided below.

Estimating local transmission potential

We separately model local to local transmission (Figure 2) and import to local transmission for each state/territory using two components:

- the average state-level trend in R_{eff} driven by population-wide interventions (specifically changes in macro- and micro-distancing behaviour, surveillance measures, and quarantine of overseas arrivals);
- 2. short-term fluctuations in R_{eff} in each state/territory to capture stochastic dynamics of transmission, such as clusters of cases and short periods of low transmission.

Component 1 reflects the average local transmission potential at state level (Figure 1), and Component 2 captures transmission within the sub-populations that have the most active cases at a given point in time (Figure S1). Component 2 is therefore useful for estimating the specific (heightened) transmission among clusters of cases in high-transmission environments — such as in healthcare workers in Tasmania and in meat processing workers in Victoria — but does not reflect changes in state-wide transmission potential (Figure S5).

Note that Component 1 for local to local transmission incorporates the impact of improvements in surveillance on transmission rates. Using data on the number of days from symptom onset to testing for cases, we estimate the proportion of cases that are tested (and thus advised to isolate) by each day post-infection. We quantify how these times-to-detection have changed over time, and therefore how earlier isolation of cases due to improvements in contact tracing and clinical screening has reduced statewide $R_{\rm eff}$ for local to local transmission (Figure S2).

Interpretation

Where there is epidemic activity, local transmission potential of active cases (Component 1&2) is to be interpreted as the effective reproduction number, $R_{\rm eff}$. In the absence of epidemic activity, Component 1&2 represents the expected amount of onward transmission from any given member of the population if they were to become infectious. In contrast, Component 1 represents the average of this over the state population, indicating the potential for the virus, if it were present, to establish and maintain community transmission (> 1) or otherwise (< 1).

Note that Component 1&2 can be higher or lower than the estimate of Component 1. In the increasing phase of a localised outbreak, it will be higher than Component 1. In the decreasing phase of a localised outbreak, Component 1&2 will be lower than Component 1 due to public health interventions, local depletion of susceptibles and/or other transmission factors that decrease the number of offspring from active cases associated with the cluster compared to that from other cases in the community.

Figure S1: Depiction of the relationship between $R_{\rm eff}$ analysis components. TTD = time from symptom onset to detection.



Figure S2: Estimated trend in time from symptom onset to detection for locally-acquired cases (black ribbon = median estimate; yellow ribbons = 90% credible intervals; black dots = time-to-detection of each case). Note that we will continue to review how this trend is estimated, given changes in testing strategies, particularly noting the increasing use of serological assays for case ascertainment.



Figure S3: Estimate of average state-level trend in local transmission potential, if we assume that only 'macro-distancing' behaviour had changed and not 'micro-distancing' behaviour or time-to-detection, for each state/territory (light blue ribbon = 90% credible interval; dark blue ribbon = 50% credible interval). Estimates are made up to 26 July, based on cases with inferred infection dates up to and including 22 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

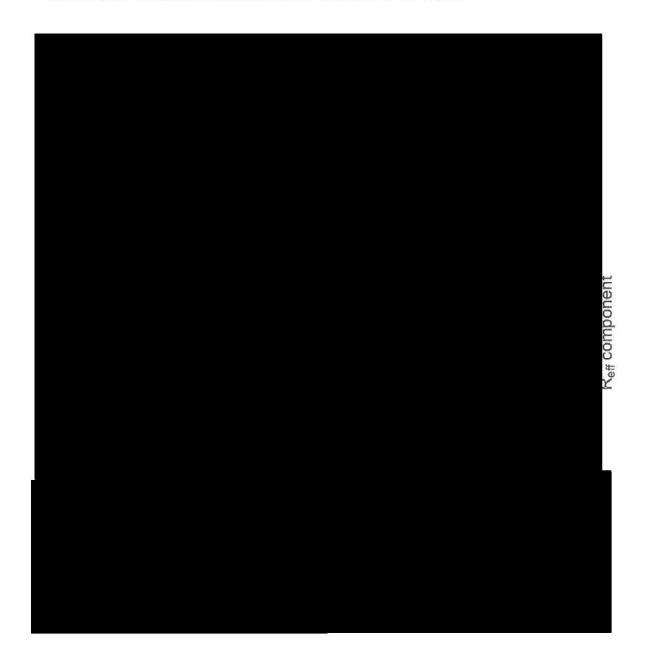


Figure S4: Estimate of average state-level trend in local transmission potential, if we assume that only 'micro-distancing' behaviour had changed and not 'macro-distancing' behaviour or time-to-detection, for each state/territory (light purple ribbon = 90% credible interval; dark purple ribbon = 50% credible interval). Estimates are made up to 26 July, based on cases with inferred infection dates up to and including 22 July. Solid grey vertical lines indicate key dates of implementation of various physical distancing policies. Black dotted line indicates the target value of 1 for the effective reproduction number required for control.

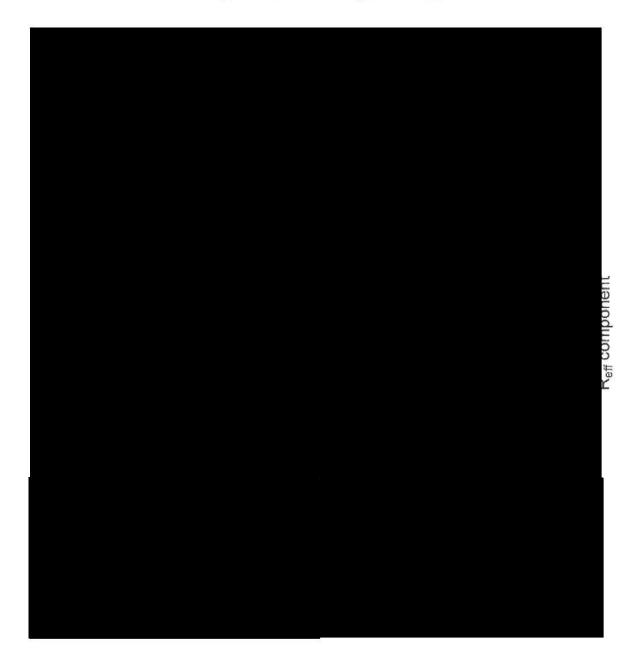
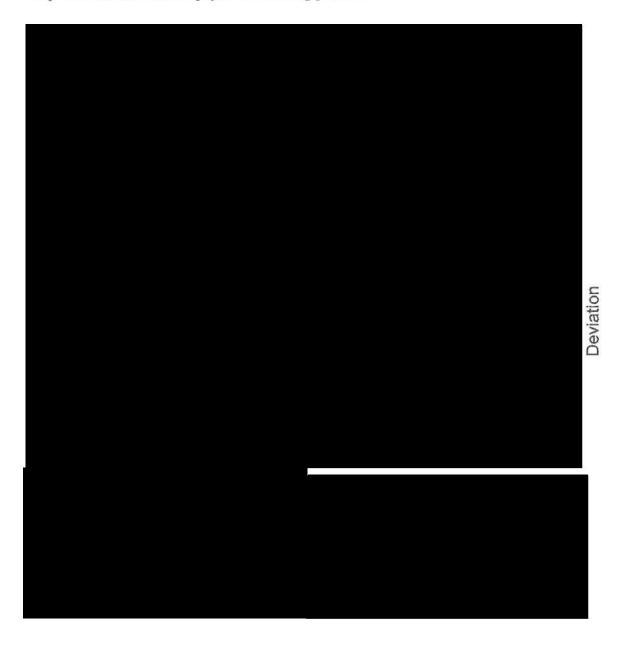


Figure S5: Deviation of transmission potential in local active cases (e.g., clusters) from state-level local transmission potential (Component 2) for each state/territory (light pink ribbon=90% credible interval; dark pink ribbon=50% credible interval. Estimates are made up to 26 July based on cases with inferred infection dates up to and including 22 July (due to a delay from infection to reporting, the trend in estimates after 22 July reflects the average range of deviations for that state, indicated by the grey shading). Solid grey vertical lines indicate key dates of implementation of various physical distancing policies.



Forecasts of the daily number of new confirmed cases in each jurisdiction

We report state-level forecasts of the daily number of new confirmed cases cases up to 24 August— synthesised from three independent models (known as an 'ensemble forecast'). Ensemble forecasts are more accurate than any individual forecast alone — biases and variances in each model that result from different modelling choices balance against each other to improve predictions. Hence, ensemble forecasts tend to produce improved estimates of both the central values, as well as improved estimates of the plausible yet unlikely forecasts (uncertainty). Here, the ensemble has been generated by equally weighting the forecasts from each model. In future weeks, we will continue to improve the ensemble performance by updating the weights for each model based on their past-performance. A brief description of each method incorporated in the ensemble is given below:

- SEEIIR Forecast: A stochastic susceptible-exposed-infectious-recovered (SEEIIR) compartmental model that incorporates changes in local transmission potential via the estimated time-varying effective reproduction number (as shown in Figure 2).
- Probabilistic Forecast: A stochastic epidemic model that accounts for the number of imported-, symptomatic- and asymptomatic-cases over time. This model estimates the effective reproduction number corresponding to local and imported cases, and incorporates mobility data to infer the effect of macro-distancing behaviour. This model captures variation in the number and timing of new infections via probability distributions. The parameters that govern these distributions are inferred from the case and mobility data (e.g., mean number of imported cases).
- Time-Series Forecast: A time-series model that does not account for disease transmission dynamics, but rather uses recent daily case counts to forecast cases into the future. Parameters of this 'autoregressive' model are estimated using global data accessible via the Johns Hopkins COVID-19 repository. Case counts from a specific time window prior to the forecasting date (the present) are used for model calibration. The number of days within this time window is chosen to optimise projections for Australia data.

The SEEIIR and Probabilistic Forecasts explicitly incorporate dynamics of disease transmission and the impact of public health measures on transmission over time via $R_{\rm eff}$. The Time-Series Forecast does not explicitly incorporate either of these factors. The Time-Series Forecast is expected to accurately forecast new daily case numbers over a shorter time period, whereas disease-specific models are anticipated to provide more accurate forecasts several weeks into the future. All forecasts assume that current public health measures will remain in place and that public adherence to these measures will be consistent into the future.

Estimating trends in distancing behaviour

Overview

To investigate the impact of distancing measures on SARS-CoV-2 transmission, we distinguish between two types of distancing behaviour: 1) macro-distancing *i.e.*, reduction in the rate of non-household contacts; and 2) micro-distancing *i.e.*, reduction in transmission probability per non-household contact.

We used data from nationwide surveys to estimate trends in specific macro-distancing (average daily number of non-household contacts) and micro-distancing (proportion of the population always keeping 1.5m physical distance from non-household contacts) behaviours over time. We used these survey data to infer state-level trends in macro- and micro-distancing behaviour over time, with additional information drawn from trends in mobility data.



the population simultaneously adopted both macro- and micro-distancing behaviours around the times that restrictions were implemented. The behavioural survey data was then used to infer the date of peak micro-distancing behaviour (assumed to be the same in all states), the proportion of the population adopting micro-distancing behaviour, and the rate at which micro-distancing behaviour is waning from that peak in each state.

Incorporating estimated changes in distancing behaviour in the model of R_{eff}

These state-level macro-distancing (Figure S3) and micro-distancing (Figure S4) trends were then used in the model of $R_{\rm eff}$ to inform the reduction in non-household transmission rates. Since the macro-distancing trend is calibrated against the number of non-household contacts, the rate of non-household transmission scales directly with this inferred trend. The probability of transmission per non-household contact is assumed to be proportional to the fraction of survey participants who report that they always maintain 1.5m physical distance from non-household contacts. The constant of proportionality is estimated in the $R_{\rm eff}$ model.

The estimated rate of waning of micro-distancing is sensitive to the metric used. If a different metric of micro-distancing (e.g., the fraction of respondents practicing good hand hygiene) were used, this might affect the inferred rate of waning of micro-distancing behaviour, and therefore increasing $R_{\rm eff}$.

Population mobility analysis

A number of data streams (publicly available from large technology companies) provide information on mobility before and in response to COVID-19 across Australian states/territories. Each of these data streams represents a different aspect of population mobility, but they show some common trends — reflecting underlying changes in behaviour. We use a latent variable statistical model to simultaneously analyse these data streams and quantify these underlying behavioural variables.

While changes in these mobility data streams are useful for detecting changes in "macro-distancing" behaviour, they do not capture changes in "micro-distancing" behaviour. For example, mobility data may indicate that people are spending more time in parks or at transit stations, but those data do not provide insight into the number of encounters an individual makes at those locations, nor the nature of those contacts (how long they were, whether there was physical contact, whether the 1.5m physical distancing rule applied, etc).

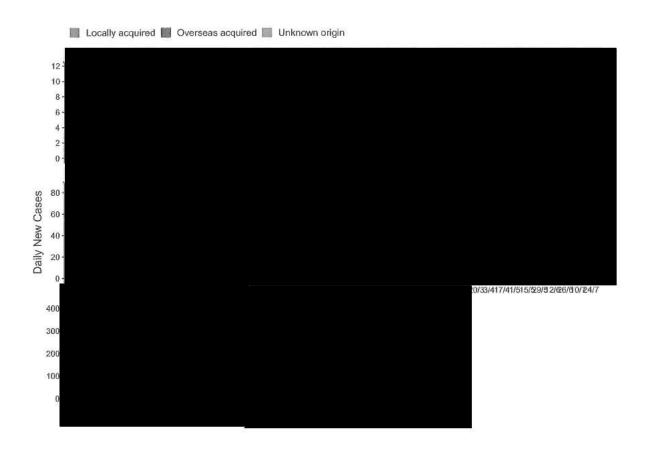
LGA-level population mobility analysis

We performed an LGA-level analysis of population mobility data from Victoria and New South Wales.

Facebook provide access to several aggregated and anonymised data sets on mobility for humanitarian use via their Data for Good program (https://dataforgood.fb.com). To preserve privacy, data are aggregated to the level of map tiles (which range in size from 0.6 km² to 4 km²) or administrative regions (corresponding to Local Government Areas), and data are not provided for any tiles or regions containing a small number of users (10 to 300, depending on the data set). Here we use a movement range data set which records the proportion of Facebook users who "stay put" over the course of a day (24 hour period) aggregated by LGA.

Supplementary figures

Figure S6: Time series of new daily confirmed cases of COVID-19 in each Australian state/territory (purple = overseas acquired, blue = locally acquired, green = unknown) from 14 February to 27 July 2020. Plotted by recorded or inferred date of symptom onset. Note that y-axis scales differ between states/territories.





Australian Health Protection Principal Committee

Australian Health Protection Principal Committee (AHPPC) Statement on positive coronavirus test in person who attended protest in Victoria

The Australian Health Protection Principal Committee (AHPPC) noted the positive coronavirus test in a person who attended the large protest in Victoria last week. It will take some days to determine whether other people have been infected. AHPPC noted Victoria's advice that a significant investigation to determine the source of the infection and identify close contacts is underway.

AHPPC emphasises once more the very high risk environment of a protest, with large numbers of people closely gathering and challenges in identifying all contacts. AHPPC again urges the Australian community to not participate in mass gatherings.

Anyone who attends protests must be vigilant and ensure they get tested if they develop any <u>symptoms</u>. Anyone who is feeling unwell or with symptoms should stay home. It is particularly important to avoid any interaction with <u>people who are at greater risk of severe illness from COVID-19</u>. Currently there is no requirement for people who attended the Melbourne protest or other protests to quarantine or be tested if they remain well (unless they have been identified as a close contact).

Situations like this are a reminder of how important it is for everyone to continue to take steps to protect themselves from COVID-19. This includes practising good hand and respiratory hygiene, staying 1.5m away from other people, staying home when sick, and getting tested if they have cold or flu like symptoms. AHPPC also reinforces the importance of downloading the COVIDSafe app to help public health authorities find people exposed to the virus quickly.