COVID-19 Scenario and Planning Workshop

3 February 2020
Australian Government Department of Health

Executive Summary

On 31 December 2019, China reported an outbreak of pneumonic and lower respiratory tract infections – COVID-19 – from a novel coronavirus named SARS-COV-2. Cases linked to the outbreak have been detected globally, with most cases in the first month linked to the Hubei province. On Monday 3rd February 2020, the Australian Government Department of Health convened a meeting of experts in mathematical modelling, epidemiology, infectious disease control and response agencies to determine the objectives of pandemic response, examine different scenarios for the novel coronavirus outbreak over the next 3-6 months, and define response strategies to enable planning for implementation.

In the early 2000's, Australia developed the Australian Health Management Plan for Pandemic Influenza, which was subsequently modified after the global pandemic of H1N1 influenza and most recently updated in 2019. At the time of the workshop, Australia was in the Initial Action Phase of responding to COVID-19, which aligned with international efforts by taking a precautionary approach to contain the spread of infection. Measures taken were informed by the Australian Health Management Plan for Pandemic Influenza 2019 (AHMPPI), which participants endorsed as an appropriate plan for this novel virus spread via the respiratory route. It was agreed that the overarching objectives of the response should be to maintain public trust, promote equity of outcomes and reduce harms to individuals and society.

Participants noted that while evidence was rapidly emerging about the characteristics of novel coronavirus, more information was urgently needed about its infectiousness and clinical severity. This information would enable us to understand the impact it might have on the population's health and society more generally.

While evidence was being gathered for COVID-19, modelling studies represented a useful way to consider plausible future scenarios, including those where infections became more widespread in the community. This approach was used in the AHMPPI to prepare for future influenza pandemics and provided a principled framework to guide targeted response activities.

Specific recommendations arising from the workshop regarding COVID-19 included:

- Adaptation of the AHMPPI for COVID-19 to guide appropriate response actions and tailor it to our emerging understanding of this new disease;
- Commissioning of a suite of modelling studies to understand ongoing risks of imported infections, and guide scenario analysis planning should this novel coronavirus become more widely transmitted within Australia. These studies would estimate future workforce capacity and resource requirements and the likely effectiveness of interventions, enabling identification of the most efficient strategies for sustained response;
- Enhancing and co-ordinating information collection about the clinical course of novel coronavirus cases and their close contacts. Synthesis of information from a range of studies conducted in the community and health sector would generate needed evidence about the infectiousness and severity of the virus, and groups most at risk of severe outcomes, to inform a targeted and proportionate response;

- Consideration by Public Health Units of the need for any additional measures at the present time to strengthen and promote case finding and support self-isolation, given that our current understanding of the virus suggests that containment may be possible;
- Consideration by all jurisdictions of alternative models of care that might be implemented in their context to reduce the acute burden on health services should infections become widespread. These might include fever clinics, remote triaging or cohorting of patients and staff to ensure service continuity.
- Engagement with the Public Health Laboratory Network to ensure that diagnostic testing practices make best use of national capacity, both now and in future should the infection become more widespread in Australia;
- Endorsement of the usefulness of serologic studies once tests become available, to see whether our population has any existing immunity to novel coronavirus and allow identification of very mild or asymptomatic infections to know whether they are common. This information is needed to understand how severe the disease is overall;
- Consideration of the need for a review of available evidence about the potential infectiousness of novel coronavirus to species other than humans;
- Reinforcement of the need for clear and effective communications to help people understand how important it is that everyone in our community contributes to preventing this infection from spreading.

Introduction

An expert workshop was convened at Scarborough House on Monday 3 February 2020 to consider the nature of the COVID-19 pandemic response, to examine different scenarios for the COVID-19 outbreak over the next 3-6 months, and to define response strategies to enable planning for implementation.

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. At the time of the workshop, an increasing number of cases were being reported in Chinese provinces other than Hubei leading to an increased risk of imported infections associated with travellers from mainland China more broadly, which was the rationale for changes to Australia's border measures.

From 1 February 2020 Australia restricted entry to anyone who had left or transited through mainland China, with the exception of Australian citizens, permanent residents and their immediate family and air crew who had been using appropriate personal protective equipment. Based on these revised border measures the acting Chief Medical Officer was keen for the workshop participants to consider likely future scenarios for the regional spread of novel coronavirus, and associated strategic response alternatives for Australia, including the ability to escalate present border measures.

COVID-19 – Overview

Situation update

The global epidemiological picture of COVID-19 is rapidly changing, and available information only partially describes the present status of the epidemic. Within Australia, all states and territories have implemented nationally consistent surveillance, along with rapid information sharing. The Australian Government Department of Health's National Incident Room (NIR) Surveillance Team is producing daily situational reports and a weekly epidemiological summary of Australian cases and the international context.

At the time of the workshop (Monday 3 February 2020), the global number of confirmed COVID-19 cases was 14,561, with 14,380 confirmed in mainland China. Of the 14,380 case 63% (9,074/14,380) were confirmed in Hubei Province, China. Outside mainland China, 181 confirmed cases were notified in 26 countries and Special Administrative Regions. The number of deaths totalled 305, with 97% (294/305) from Hubei Province and 3% (10/304) from other provinces in China. The first death outside mainland China occurred in the Philippines in a Wuhan resident. The crude case fatality rate (deaths/number of confirmed cases) at that time was estimated to be approximately 2%.

In Australia, 12 confirmed cases were notified from four jurisdictions (4 in NSW, 4 in VIC, 2 in QLD and 2 in SA) from 25 January to 1 February 2020. The median age was 45 years (range 21-66) with 58% (7/12) male. The majority had a travel history to Wuhan (92%, 11/12). The remaining case had direct contact with a confirmed case from Wuhan while in China. Most cases developed mild to moderate symptoms. All cases reported a fever, 83%

(10/12) had a cough and 17% (2/12) had pneumonia. The natural history of COVID-19 is yet to be fully understood. No deaths were reported in Australia.

Globally, availability of information regarding key epidemiological features of cases has varied with surveillance and detection capacity in relation to case burden, including from mainland China where the overwhelming majority of infections have occurred. Sustained human-to-human transmission was considered likely to be occurring in several Chinese provinces other than Hubei, although the extent and magnitude of the epidemic could not be accurately quantified from available data. Limited instances of human-to-human transmission had been observed in a number of countries outside of mainland China at the time of the workshop (Germany, Japan and Vietnam).

On 2 February 2020 WHO announced a number of developments. France reported the first instance of infection in a healthcare worker outside China. The healthcare worker treated two patients who were later identified as probable cases. Germany reported the first instance of third-generation human-to-human transmission outside China in an individual who was exposed to a confirmed case from a small cluster in Bavaria. South Korea reported the first instance of a case being exported from a country other than China. A patient identified in South Korea had exposure to a confirmed case in Japan.

Analyses of the early epidemic phase in Wuhan, based on a mixture of public facing information sources and some cases series, gave broadly concordant estimates of the reproductive number (R_0) in the order of 2-3, indicating transmissibility similar to SARS (pre-intervention R_0= 2-3) and higher than MERS (R_0=0.7). The ECDC estimated a mean incubation period of 5.2 days (95% confidence interval, 4.1 to 7.0), with the 95th percentile of the distribution at 12.5 days, supporting the use of 14 days as an operational definition for contact tracing and monitoring.

Estimation of the severity and case fatality rates is currently difficult and current estimates require cautious interpretation. It was noted that there are significant uncertainties in both numerator (hospitalization and deaths) and denominator (infections). The denominator informing these estimates is likely to continue to increase as testing expands from the initial focus on severe acute respiratory infections (SARI) to more mild and moderate cases in China, and estimation of these quantities during the growth phase of the epidemic introduces a bias even when accounting for the delay between infection and outcome (hospitalisation or death). The WHO has previously reported that approximately 20% of cases were severe. A more recent report of the proportion of infected persons that develop severe disease from mainland China is around 15%. Limited information is available regarding the age and sex distribution of cases in mainland China. On 27 January 2020 WHO reported the median age of cases detected outside of China was 45 years (range 2-74 years) and 71% of cases were male (*n*=37).

Key aspects of the outbreak that require ongoing investigation and monitoring include the mode of transmission, transmissibility (R_0), incubation period, serial interval, potential for pre-symptomatic and asymptomatic transmission, disease severity, case fatality rate, age distribution, vulnerable groups for severe disease, effectiveness of treatment and control measures and the virology of COVID-19.

Defining COVID-19 response objectives

It was agreed that the overarching societal objectives of response should be to maintain public trust, promote equity of outcomes in all population groups and reduce harms to individuals and society. Disease impact objectives during successive response stages are containment, transmission reduction and mitigation. A change in strategy or escalation between these stages would be informed by rapid collection and analysis of robust epidemiological data both within Australia and internationally. s 47B

. Master of Philosophy (Applied Epidemiology) students were noted to be well placed to assist with surge capacity as requested by state and territory public health units, including institutional settings, such as hospitals, to support public health data collection and response activities should human-to-human transmission become widely established in Australia.

Governance and decision making around these objectives and associated implementation strategies lies with the AHPPC. Modelled scenarios exploring alternatives should be provided to the CDNA for technical review and, where appropriate, be escalated to the AHPPC to inform decision making.

What is the evidence base for decision making? Where are the gaps?

The potential clinical burden and impact of COVID-19 are currently unknown, due to very limited information about its transmissibility and severity. Although WHO suggests the crude case fatality is 2% this estimate is likely to be biased for a number of reasons, including due to underreporting of mild cases in China, the delay between infection and outcome (death) and that the estimate is made during the growth phase of the epidemic. Combined, these factors make assessment of the true CFR challenging.

Modelling scenarios that considered different latent and infectious characteristics were discussed by infectious disease modelling specialists. Models were based on the biology and characteristics of both influenza and Severe Acute Respiratory Syndrome (SARS-CoV) infections. These diseases, with differing disease dynamics provided useful contrasting scenarios. The serial interval for influenza is much shorter and infected individuals transmitted almost half of their infections while pre-symptomatic. In contrast, the serial interval for SARS was longer and infected individuals were infectious only after symptoms had developed. The effectiveness of interventions that might be employed during the Australian response to this disease would differ depending on the course of disease for COVID-19.

Figures 1 and 2 detail our current understanding of transitions through different phases of the infectious course for COVID-19, including key uncertainties about the relative timings of symptom onset and infectiousness. The red arrows indicate when an individual begins to show symptoms. For influenza, this transition corresponds to the time of peak infectiousness, with about half of all transmissions occurring before apparent illness and the

remainder shortly after symptom onset. For SARS, an individual shows symptoms early in the incubation period but becomes maximally infectious a few days later as symptoms progress. SARS is therefore more controllable because individuals can be observed and effectively isolated before they become infectious.

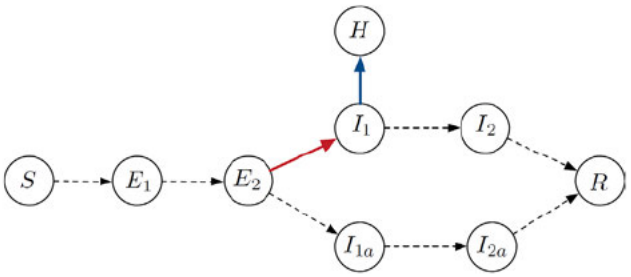

Figure 1: Influenza model. S = susceptible, E = exposure, I = infected, H = hospitalized, R = recovered, subscript = multiple stages, a = asymptomatic. Red arrows indicate the time at which a case is first observable due to the onset of symptoms. The blue arrows indicate possible hospitalisation events that would also be observed. All other events, shown by he dashed arrows, are unobservable.

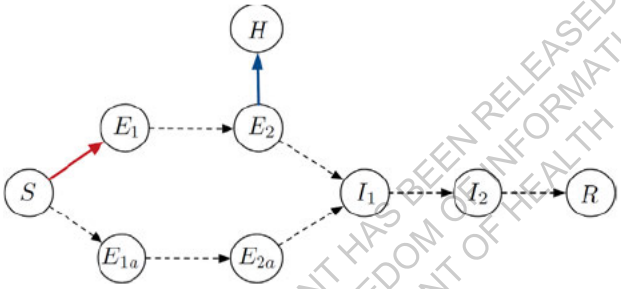

Figure 2: SARS model. S = susceptible, E = exposure, I = infected H = hospitalized, R = recovered, subscript = multiple stages, a = asymptomatic. Red arrows indicate the time at which a case is first observable due to the onset of symptoms. The blue arrows indicate possible hospitalisation events that would also be observed. All other events, shown by the dashed arrows, are unobservable.

Substantial uncertainty remains about other key modelling assumptions including the proportion of the population susceptible – based on the novelty of COVID-19 we presently assume that 100% of the Australian population will have no effective immunity to this virus. The proportion of infections that go on to show symptoms (labelled "asymptomatic" in Figures 1 and 2) is also unknown for COVID-19. Collection of enhanced epidemiological data through detailed studies of the 'first few hundred' (FF100) cases in Australia and internationally would enhance situational awareness by refining estimates of severity, transmissibility, pre-symptomatic transmission, and how common asymptomatic infection may be, within households. Researchers commented that modelling assumptions could be strengthened by access to non-identifiable COVID-19 case data from Australia and internationally, such as date of contact with a confirmed case and date of illness onset.

Commented [JM1]: Do we need to point out hat this is common for influenza (and so a major issue) and was, to the best of our understanding, almost non-existent for SARS (a big factor in controlling SARS).

How relevant is the AHMPPI to COVID-19 preparedness?

Following the H1N1 pandemic in 2009 the Australian Government Department of Health substantially revised the Australian Health Management Plan for Pandemic Influenza (AHMPPI), in 2014 (amended in 2019). This document outlines the national arrangements and approaches for management of an influenza pandemic, supported by an operational plan and decision-making framework.

Participants of the workshop agreed that the AHMPPI should be adapted to respond to the COVID-19 outbreak. The AHMPPI offers a suite of interventions, including five infection control, seven pharmaceutical, eight social distancing and 13 border measures.

Current antivirals held in the National Medical Stockpile are of unknown effectiveness for COVID-19. For a "SARS-l ke" response pharmaceutical interventions are currently unavailable and would have to be removed from modelling scenarios.

Interventions – which are relevant?

The group agreed we were in the Initial Action Stage of this outbreak, with applicable measures in place including reduction of exposure to people who are infected, precautionary self-isolation of close contacts of a confirmed case, communications with a range of groups to reduce infection transmission and enhanced border measures that reduced the number of individuals travelling from China into Australia.

Work presented on the days 22 sponsored work (Appendix) provided a ""SARS-like"" extension to the AHMPPI. In the Targeted Response Stage, the AHMPPI interventions that could be recommended for a ""SARS-like"" pathogen include – cohorting patients, communications on hand hygiene, personal protective equipment (PPE) for healthcare workers (HCWs) and mask wearing by symptomatic individuals in the community. For an influenza-like scenario mask wearing by symptomatic individuals in the community was only recommended in high severity scenarios. The most effective infection control measure was cohorting of patient populations and healthcare workers (HCWs), measures which also reduce the use of personal protective equipment (PPE) by focusing nosocomial infection exposures in specific clinical settings.

The most effective social distancing intervention of the AHMPPI adapted for a "SARS-l ke" scenario was contact tracing, although participants recognised public health units could quickly become overwhelmed if the outbreak was prolonged. Jurisdictions should consider alternative scaleable and sustainable methods for follow up, such as SMS messaging to such individuals, where not presently in use.

Broader measures, such as closing schools, universities, workplaces and cancelling mass gatherings were not recommended in both an influenza- or ""SARS-like"" scenario unless the severity was high, due to social and financial implications on families and businesses. Such measures would also be ineffective if individuals were continuing to interact outside of these settings. Participants acknowledged that school closures might be driven by public concern

rather than epidemiological and clinical evidence, reinforcing the importance of clear risk communication with the public.

In the Initial Response Phase in a “SARS-like” scenario, information for border staff, in-flight/on-board announcements, travel advice to high-risk areas and communication material for traveller were recommended. In addition to these measures, in the Targeted Response Phase in a “SARS-l ke” scenario screening of cruise ship passengers would be effective in reducing transmission. This would be important before community transmission in Australia became well established.

Key difference between influenza and COVID-19

Identifying and isolating cases was a key intervention strategy in a “SARS-like” scenario. This intervention would be effective because individuals infected with SARS show symptoms before they become infectious. The understanding of COVID-19 at the time indicated similar likely effectiveness.

What level of response is proportionate?

Clinical severity

The clinical severity of COVID-19 is currently unknown. There are currently no data regarding the proportion of cases needing ventilation, the number admitted to intensive care units (ICU), or the length of time cases spend in hospital. Available information may be biased by Chinese hospitals being overwhelmed and discharging cases early, versus other countries who have capacity to keep cases in hospital longer than necessary on medical indications alone. It is unknown how many mild cases of COVID-19 might present to general practices (GPs). Participants discussed the ability of Flutracking[1] surveillance data to help interpret the severity pyramid, particularly for milder cases in the community.

Infection prevention and control (IPC) recommendations for personal protective equipment (PPE)

Suspected cases are recommended to ring the GP/hospital before arrival. As COVID-19 is thought to be transmitted via droplet and not generally aerosolised (except during defined procedures), HCWs should wear surgical masks and not a P2 respirator when collecting a naso-pharyngeal swab as this procedure is considered to confer negligible risk. A P2 mask may not provide more protection than a surgical mask in many routine clinical practice settings as they are often poorly used and are uncomfortable if used for prolonged lengths of time. For cases with pneumonia and/or severe cough, the viral load is thought to be higher, justifying referral to hospital and use of a P2 mask. This advice was conveyed to CDNA which has commissioned a subgroup to review infection prevention and control guidelines for AHPPC approval. IPC and PPE communication factsheets to healthcare providers should reflect these messages.

How will we know if our systems are overwhelmed?

Health service delivery and models of care

Post 2009 H1N1, various models of care delivery for infectious patients with influenza were considered, and their requirement compared for differing levels of transmiss bility (high and low) and severity (low, moderate and high). These models considered daily presentations through the course of an epidemic to GP practices, hospitals and intensive care units. The utility of service substitution pathways to ease pressure on service delivery was evaluated, with alternatives including influenza assessment clinics, pre-presentation triaging through online and phone consultations (Healthdirect[2] model) and patient cohorting (isolating influenza cases within settings). In a high severity and high transmiss bility scenario, alternative models of care delivery had only a slight benefit, as services were quickly overwhelmed, but benefits were observed for milder events. Cohorted care was particularly useful, but recognised not to be achievable in all contexts, particularly rural and remote settings where providers are fewer and practices typically smaller. The group recommended jurisdictions review their ability to respond and consider alternative models of healthcare delivery, such as fever clinics and cohorted services.

Infection prevention and control

Cohorted care was a particularly useful way of considerably reducing 'overhead' use of masks by cleaners, receptionists and other staff, particularly in prolonged epidemics. Modelling of surgical mask use was a good proxy for other medical supplies, however the models also enable a comparison of surgical and P2 mask use. Participants recommended a formal review of the current PPE stockpiles based on the new modelling scenarios, to ensure there is availability in the epidemic when most needed, and to compare usage scenarios for different clinical practice indications.

Laboratory capacity/testing protocols

The laboratory test for COVID-19 is currently only available in some public health reference laboratories with an exemption from Therapeutic Goods Administration (TGA) for pathology testing. More widespread testing at public health laboratories will be available shortly. There are some commercial kits in development and there are likely to be issues scaling up testing. Assays in NSW have been harmonised, but NSW has identified blocks in capacity with specimen handling and providing specimen results. A protocol to triage specimens could be considered if testing volume increases. The group raised issues around testing, such as false positive test results where the pre-test probability was low, testing where public health were not aware, and validity and reliability. A serological test was currently unavailable, but development of a COVID-19 assay would be important and allow identification of asymptomatic or very mild cases through enhanced data collection studies and cohort or population serosurveys. The group was keen to endorse such studies to understand the proportion of mild and asymptomatic cases and if immunity existed in the community.

Medication supply

Participants had a limited understanding about the supply chain of medications into Australia, although some noted specific parts of respirators and many essential medications

were only manufactured in China. Participants suggested the Department of Foreign Affairs and Trade (DFAT) and the TGA could assess the medication and healthcare product supply chain to understand the impact of this outbreak on continuity of supply due to declining manufacturing capacity, increased demand or other restrictions.

Other departments

Agriculture Water and the Environment identified an inability to conduct temperature checks on returned travellers at the border and suggested the need to consider contractors to provide these health checks at airports and ports. Defence indicated they had additional capacity, if requested to provide humanitarian support. They were also uniquely placed to identify and investigate outbreaks among service personnel if they occurred in a closed cohort setting

Identifying challenges in the next 3-6 months as the scenario unfolds

We are presently in the Initial Action Phase of our response to the COVID-19 and aligned with international efforts by taking a precautionary approach to contain the spread of infection. Measures taken have been informed by the Australian Health Management Plan for Pandemic Influenza 2019 (AHMPPI), which participants endorsed as appropriate for the present situation and noted that it should be adapted for this specific outbreak

As the outbreak progresses it is important to maintain public trust, promote equity of outcomes and reduce harms to individuals and society. The use of appropriate language and transparency when communicating with the public was identified by participants as important. Everyone in our community contr butes to preventing this disease from spreading.

Participants noted that while evidence is rapidly emerging about the characteristics of COVID-19 at this time, more information is urgently needed about its infectiousness and clinical severity. This information will enable us to understand the impact it might have on the population's health and society more generally.

While this evidence is being gathered, modelling studies are a useful way to consider plausible future impact scenarios that might be observed, should infections become more widespread in the community. This approach has been used in the AHMPPI to prepare for future influenza pandemics and provides a principled framework to guide targeted response activities as we gain more knowledge about this disease.

Recommendations

The Australian COVID-19 response should continue to refer to the AHMMPI as an instrument to guide appropriate response actions.

- The forward planning team within the NIR will revise the AHMPPI to reflect a tailored response for COVID-19. The Australia Health Sector Emergency Response Plan For Novel Coronavirus (COVID-19)[3] is now published;

- Jurisdictions will be requested to review alternative models of healthcare delivery and their capacity to respond, considering resourcing, sustainability, feasibility and effectiveness, including automatic SMS responses to individuals if case identification becomes unsustainable; and
- Public Health Units should strengthen and promote case finding and support self-isolation.

A suite of modelling studies will be commissioned to guide scenario analysis planning should COVID-19 become more widely transmitted within Australia. These studies will:

- Estimate future workforce capacity and resource requirements and the likely effectiveness of interventions, enabling identification of the most efficient strategies for a sustained response;
- Enhance our understanding of the ongoing risk to imported infections; and
- Develop evidence-based approaches to inform escalation of additional border measures.

Collection of enhanced, standardised information about the epidemiology and clinical course of COVID-19 cases and their close contacts will be coordinated at the national level to keep the Australian response agile.

- This should be possible under jurisdictional and national health security legislation;
- It will contribute to the international knowledge on infectiousness and severity of the virus, vulnerable groups at risk of severe disease and inform a targeted and proportionate response; and
- Ensure researchers can access the Australian COVID-19 data in a timely fashion to assist with choice of appropriate modelling scenarios, and for providing model-informed determinations of the current epidemic state ("nowcasting") and short-term future behaviour ("forecasting").

Engagement with the Public Health Laboratory Network should occur to ensure that diagnostic testing practices make best use of national capacity, both now and in the future should the infection become more widespread in Australia.

- Endorse serologic studies once tests become available, to see whether our population has any existing immunity to COVID-19, and allow identification of very mild or asymptomatic infections to know whether they are common.

The NIR should continue to monitor and review the international situation and published literature to adapt the national response and feed into national and local planning.

- Consider widening the case definition to other countries, guided by the epidemiology and mathematical modelling of potential risk of importation;
- Develop a tiered ranking of countries with the highest burden of disease, both by number of cases, but also ability of healthcare system to respond to understand where Australia might need to provide support in the region or escalate border measures; and
- Review available evidence about the potential infectiousness of COVID-19 to species other than humans and its ability to become zoonotic.

References

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2. Australian Government Department of Health. Healthdirct Canberra: Healthdirect; 2020 [cited 20 Feb 2020]. Available from: https://www.healthdirect.gov.au.
3. Australian Government Department of Health. Australian health sector emergency response plan for novel coronavirus (COVID-19) Canberra: Australian Government Department of Health; 2020 [Available from: https://www.health.gov.au/sites/default/files/documents/2020/02/australian-health-sector-emergency-response-plan-for-novel-coronavirus-covid-19_1.pdf.

Attendees

Attendance	Affiliation
s 47F	Agriculture
	Agricuture
	Agriculture
	Agriculture
	Australian Border Force
	Australian Capital Territory
	Australian Defence Force
Rhonda Owen	Australian Government Department of Health
s 22	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
Paul Kelly	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
	Australian Government Department of Health
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	Australian National University
	Australian National University
	Australasian Society for Infectious Diseases
	Department of Defence
	Doherty Institute
	Home Affairs
	Home Affairs
	Home Affairs
	Monash University, Alfred Hospital
	New South Wales

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Northern Territory
Northern Territory
Public Health Laboratory Network
Queensland
Queensland
Queensland
South Australia
Tasmania
Tasmania
University of Adelaide
University of Melbourne
University of Melbourne
University of Melbourne
University of Sydney
Western Hospital
Victoria
Western Australia

Appendix

Table of existing modelling studies that can be adapted to support COVID-19 preparedness and response

Modelling study	Information gained
Modelling of likely case numbers if an epidemic occurs in Australia. A range of possible scenarios will be considered, based on data-informed estimates of COVID-19 infectiousness and severity, updated with emerging evidence. Figures generated by these models will allow key public health implementation questions to be addressed.[1]	Estimation of case numbers over the course and at the peak of the epidemic, and how long it will last.
	Evaluation of response interventions most likely to be efficient and effective in different scenarios.
	Estimation of future public health workforce demands to continue case and contact isolation and case finding measures in relation to current capacity constraints.
	Estimation of likely clinical presentations to different health care settings in relation to capacity. Evaluation of the need for and likely benefits of alternate care pathways e.g. fever clinics, phone triage.
	Estimation of PPE requirements over the course of the epidemic, based on infection prevention and control guidelines in different health care settings.
Modelling of likely transmission of infection between countries in our region, based on emerging epidemiological evidence, the capacity of health systems in countries, and patterns of air travel.[2]	Development of a risk table of the likelihood of imported infections from countries in our region, should infection transmission become established there. This list will guide surveillance efforts and considerations of the need for any future border measures.
Modelling of the relative contributions of household, community and travel associated transmission of infection over time if an epidemic occurs in Australia.[3]	Determination of thresholds and indicators that would confirm established community spread and support relaxation of enhanced case-finding and isolation activities, and border measures.

1. Models of pandemic influenza have been developed in partnership with and funded by the Department of Health during the preparedness phase and will be adapted to reflect current and emerging understanding of COVID-19.
2. Models of regional infection transmission have been developed in partnership with and funded by the Department of Foreign Affairs and Trade to assess the risk of Ebola importation. These models will be adapted to reflect current and emerging understanding of COVID-19.
3. Household based models of infectious disease transmission have been developed in partnership with and funded by the Defence Science Technology Group and Defence Threat Reduction Agency (US) for pandemic influenza and SARS. They will be adapted to reflect current and emerging understanding of COVID-19.