



Key lessons from the COVID-19 public health response in Australia

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Summary

Australia avoided the worst effects of the COVID-19 pandemic, but still experienced many negative impacts. Reflecting on lessons from Australia's public health response, an Australian expert panel composed of relevant discipline experts identified the following key lessons: 1) movement restrictions were effective, but their implementation requires careful consideration of adverse impacts, 2) disease modelling was valuable, but its limitations should be acknowledged, 3) the absence of timely national data requires re-assessment of national surveillance structures, 4) the utility of advanced pathogen genomics and novel vaccine technology was clearly demonstrated, 5) decision-making that is evidence informed and consultative is essential to maintain trust, 6) major system weaknesses in the residential aged-care sector require fixing, 7) adequate infection prevention and control frameworks are critically important, 8) the interests and needs of young people should not be compromised, 9) epidemics should be recognised as a 'standing threat', 10) regional and global solidarity is important. It should be acknowledged that we were unable to capture all relevant nuances and context specific differences. However, the intent of this review of Australia's public health response is to critically reflect on key lessons learnt and to encourage constructive national discussion in countries across the Western Pacific Region.

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Background

The COVID-19 pandemic continues to pose a major global public health challenge. Australia was able to avoid the worst effects with an initial maximum suppression strategy, but the pandemic still had, and continues to have, major negative impacts on people's health and well-being.¹ After more than two years of dealing with the crisis it is apparent that we must find optimal ways of 'living with COVID', while minimising the harms to those at risk of severe disease and ensuring

better preparedness for future outbreaks. Despite new SARS CoV-2 variants and subvariants of concern fueling recurrent waves of infection, countries are slowly emerging from the COVID-19 shadow and it is timely to reflect on key lessons that will enhance future pandemic preparedness and response.

For context, Australia is a Federation of six states (Queensland, New South Wales, Victoria, Tasmania, South Australia and Western Australia) and two territories (the Northern Territory and the Australian Capital Territory). These jurisdictions have a large degree of independence in their decision making and it is important to specify that individual jurisdictions carry the constitutional responsibility for health protection. As such, disease outbreaks are primarily managed by jurisdictional teams who coordinate local data collection, analysis and public health response. Australia does not have a national Centre for Disease Control and Prevention

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(CDC), although the newly elected Australian government has a policy to establish such an agency. The effective utilisation of national data to inform public health responses is dependent on timely reporting by all jurisdictions, as well as adequate capacity to ensure rapid data collation and analysis (see Lesson 3).

Process

We facilitated an expert consultation of lessons learnt from the COVID-19 pandemic response, involving a diverse group of experts with geographic representation from across Australia. Expertise represented included public health, surveillance, epidemiology, infectious diseases, virology, child health, vaccination, modelling, social sciences, health literacy, nursing, and infection prevention and control (co-authors and acknowledged contributors). Discussions were led by the Sydney Infectious Diseases Institute (Sydney ID) and the Sydney Policy Lab at the University of Sydney. Sydney ID (www.sydney.edu.au/infectious-diseases-institute) is a multi-disciplinary research institute that represents infectious disease expertise within the University of Sydney, whilst the Sydney Policy Lab (www.sydney.edu.au/sydney-policy-lab) provides high-level policy reflection, including reflection on how Australia should re-build following COVID-19 pandemic disruption,² which provided the motivation for this expert consultation. The authors focused on public health perspectives using a Delphi-style consensus approach. This opinion piece represents the views and opinions of the co-authors, acknowledging that we were unable to capture all relevant nuances of the complex challenge that COVID-19 continues to pose. However, it should complement other pandemic review processes in Australia and provide a useful basis for national-level reflection in other countries across the region.

Summary of key lessons learnt

Table 1 presents an overview of key lessons learnt from the COVID-19 public health pandemic response in Australia. Each statement (lesson) below is followed by a brief explanation.

Border closures and lockdowns worked as a crisis measure, but we need a better understanding of when and how these measures should be deployed to maximise their protective effect and minimise adverse impacts

As an island nation Australia was in the privileged position of being able to markedly decrease SARS-CoV-2 importation by the early closure of its international borders. This approach was also used by many Pacific Island Nations and Territories. Although Australia formally adopted a maximum suppression strategy, it was

1	Border closures and lockdowns worked as a crisis measure, but we need a better understanding of when and how these measures should be deployed to maximise their protective effect and minimise adverse impacts.
2	Disease modelling was valuable to assist decision making and public understanding of risk, but its limitations should be adequately communicated and transparency is key.
3	At a national level, comprehensive data were not readily available to guide decision making, which requires careful assessment of optimal disease surveillance and response structures.
4	The pandemic demonstrated the utility of advanced pathogen genomics and novel vaccine technology, raising the bar for future disease surveillance and response.
5	Timely, clear and open communication, combined with decision making that is evidence informed and as consultative as possible, is essential to maintain population cooperation and trust.
6	Existing preparedness plans were insufficient and major system weaknesses were exposed in the Australian residential aged-care sector.
7	Effective Infection Prevention and Control (IPC) measures were important to keep health-care workers safe and to limit population transmission.
8	The interests of children and young people were at times compromised and it is important to ensure adequate representation of their best interests in decision making processes.
9	Epidemic risk should be recognised as a standing threat with ongoing investment in workforce development and research.
10	Nationalistic pandemic responses demonstrated the need for stronger global solidarity and regional engagement.

Table 1: Overview of key lessons learnt from the COVID-19 pandemic response in Australia.

essentially a zero COVID response that kept the virus out through border closures (both international and internal state borders) and quarantine, combined with rapid containment responses when quarantine measures were breached. This initial aggressive containment response was highly effective in buying time to develop and deploy protective measures, primarily vaccines.^{3,4} There were two distinct peaks in 2020; the first one in March/April with the ancestral strain affecting all states and territories with infections mainly brought into Australia by overseas travellers, and the second one from June to September primarily affecting Victoria with active community transmission.⁵ However, once the SARS-CoV-2 virus was globally established (including in animal reservoirs), and given incomplete vaccine protection against virus transmission,^{6,7} it became clear that eradication (which was possible with SARS-CoV) was unachievable. The higher transmissibility of later SARS-CoV-2 variants,⁸ and sub-variants, of concern made the pursuit of a zero COVID policy unattainable and incompatible with global connectedness. Viral spread was also fueled by inequitable global access to COVID-19 vaccines and transmission by individuals

with mild disease or even asymptomatic infection. Since the emergence of the Omicron variant in 2021, there have been three distinct waves of transmission defined by the predominant Omicron subvariant circulating (BA.1, BA.2 and BA.5).⁹

Despite the benefits of a zero COVID policy, strict border closures and lockdowns generated a multitude of adverse health, social and economic impacts.^{1,2,10} Some travel restrictions were considered discriminatory towards specific groups and countries, and although the actual number is not known, tens of thousands of Australian citizens were trapped overseas for prolonged periods.¹¹ Within Australia, the closure of internal State borders was a natural extension of the national zero COVID approach, but created economic disruption and public confusion, as well as emotional hardship for those unable to travel to be with loved ones in times of distress, or to return home. While acknowledging that initial decisions were difficult, as they were made under great uncertainty and with limited data on the effectiveness or broader societal consequences of strict containment measures, it is now timely to critically evaluate whether any were disproportionately harsh and disruptive when measured against their incremental contribution to pandemic control. Given that the legal responsibility for health protection resides at State/Territory level in Australia, some variation in practice depending on the local risk calculus was inevitable, but the appropriateness of such variations must be judged against their contribution to national confusion and disruption.

Disease modelling was valuable to assist decision making and public understanding of risk, but its limitations should be adequately communicated and transparency is key

Modelling provided an efficient mechanism to rapidly assess population risk and compare potential public health outcomes linked to different disease control measures.¹² It also provided an estimation of health system and clinical care impacts, given the importance of preserving clinical response capacity and minimising the risk that the health system becomes overwhelmed.¹³ However, it remains only one component of informed public health decision making.¹⁴ Real-time analytic epidemiology, ideally based on individual level data, is important to provide robust parameters to modellers and to enable evidence-informed decision making. It is also important to recognise that mathematical models have variable sophistication, are limited by the availability and reliability of input data, and are greatly influenced by their underlying assumptions. Most models provide disease incidence, morbidity and mortality predictions associated with different interventions, but there is a need to also consider the social, educational, economic and broader well-being impacts of proposed

interventions. A review by modelling expert groups of their methods should consider how these broader adverse impacts are best accounted for in decision-making. Models used for public health decision making should clearly communicate their purpose, assumptions and key uncertainties to a lay audience, and be open to critical peer review. As a principle, making the modelling code available at the time results are published or being used for policy is important for transparency, encourages productive collaboration, and facilitates model refinement.

At a national level, comprehensive data were not readily available to guide decision making, which requires re-assessment of optimal disease surveillance and response structures

In the absence of a CDC-like entity, Australia lacks a mechanism to proactively collate, analyse and monitor disease surveillance data at a national level, with variable capacity in different States and Territories. There are also limited mechanisms to coordinate national public health responses, evaluate the effectiveness of interventions, and undertake or commission timely applied research to guide decision making and inform national policy. The Australian Health Protection Principal Committee (AHPPC) provided valuable guidance and coordination, as did other entities such as National Cabinet, State/Territory Department of Premier and Cabinet (DPC) forums, first secretary groups and the health ministers round table, but all were limited by the lack of timely national data. The National Notifiable Diseases Surveillance System (NNDSS), established under the auspices of the Communicable Diseases Network Australia (CDNA), coordinates surveillance on an agreed list of communicable diseases, but its remit is limited and insufficient for newly emergent infections and outbreak response. The NNDSS is due to be replaced by a new National Interactive Notifiable Diseases Surveillance System (NINDSS), but this has not been launched and it is unclear if its features will address the NNDSS limitations identified during the pandemic.

In Australia, States and Territories have independent systems for public health action, since they carry the constitutional responsibility for public health protection. National surveillance and response efforts are hampered by the lack of linked datasets (laboratory, vaccination and hospitalisation data), slow and inadequate data flows at a national level, and the lack of a sufficiently large and experienced epidemiology workforce within the Australian Government Department of Health to collate and analyse data in near real time. Any new national disease surveillance model should be fit for purpose within Australia's federated system and provide better information exchange, more timely data analyses and, therefore, improved intelligence to inform decision-making and policy setting than the current

model. Such a national disease surveillance entity will require adequate resourcing and a governance structure that ensures both effective engagement with policy and protection from undue political interference, with a transparent process for providing advice to government. Whatever model is adopted, it should establish more effective mechanisms for national data sharing, cross-jurisdictional communication and workforce upskilling, without compromising jurisdictional competence.¹⁵

Recent outbreaks of Japanese encephalitis and monkeypox viruses also demonstrate the need for better linkage between human and animal disease surveillance. An integrated One Health surveillance approach will assist early identification of zoonotic disease threats, which is important to keep people safe.¹⁶ Regional health security will benefit from better communication and data exchange between countries, but the establishment of such platforms has been complicated by excessive politicisation of the COVID-19 pandemic.

The pandemic demonstrated the utility of advanced pathogen genomics and novel vaccine technology, raising the bar for future disease surveillance and response

The speed with which new diagnostic tests and vaccines were developed during the pandemic is unparalleled. Highly accurate polymerase chain reaction (PCR) testing was developed rapidly and deployed widely at scale. Accurate PCR testing opened avenues for innovative surveillance, such as SARS-CoV-2 viral fragment detection in waste water, which guided public health testing and communication based on localised risk. Advanced pathogen genomics provided key insights into the origin, evolution and spread of the pandemic.^{14,17,18} Its recognised value in outbreak identification, transmission tracking and better targeted public health control measures requires infrastructure investment and urgent workforce upskilling to be able to benefit from these new developments.

Effective implementation of COVID-19 vaccine programmes was the most important public health intervention. Excellent effectiveness against severe disease was demonstrated by a range of novel vaccine technologies approved for emergency use by the WHO, including mRNA, viral vectored and protein subunit vaccines.^{7,19} Despite initial delays, vaccine roll-out was highly successful once implemented, although regional and socio-economic differences in vaccine distribution capability and uptake highlighted ongoing inequities. The establishment of large vaccination hubs demonstrated that mass vaccination is possible in a short period of time, especially when combined with delivery through community vaccination clinics, Aboriginal Community Controlled Health Organisations, general practices and pharmacies. The pandemic identified the use of new vaccine technology and partnerships with

industry groups to ensure local production capacity, as crucial health security investments.

Timely, clear and open communication, combined with decision making that is evidence informed and as consultative as possible, is essential to maintain population cooperation and trust

In the very early phases of the pandemic there was a lack of information about what might be expected, and how the public could prepare.^{20,21} This was followed by more concerted government communication efforts, often in the form of daily media conferences. These enabled the public to access regular updates and advice, but messages from different jurisdictions were often inconsistent, resulting in public confusion. Communication with specific at-risk populations was often lacking in the early phases of community lockdowns and vaccine rollout. It took some time to organise appropriate messages and communication channels to reach culturally and linguistically diverse communities, First Nations people, those living with a disability and other groups at risk of severe disease.^{22,23} Some response measures were deemed to be inequitable by communities with high levels of disadvantage who were disproportionately affected by more stringent public health measures, leading to mistrust in government. Building and preserving public trust requires decision-making that is evidence-informed, transparent, and consultative in process.²⁴ It requires community partnership, consideration of the social determinants of health, health systems that are functional and accessible, and communication that is culturally appropriate and inclusive.

Communication should be multidirectional and involve systematic avenues for listening to communities and stakeholders in different sectors, along with informing them. To support behaviour change, messaging should inform and educate in a way that considers health literacy, makes information easy to access, and engages trusted spokespeople.^{24,25} During the vaccine rollout, governments and commentators often focused publicly on individual beliefs and attitudes as the main barrier to vaccination uptake, without sufficient acknowledgement of social and practical barriers, including early insufficient vaccine supply.²⁶ Ideally, there should be routine collection of data on the full range of factors influencing prevention behaviour, and these data should be publicly available to enable local community planning and tailoring. Platforms for community consultation and communication should be established and maintained as a routine service.

Vaccine uptake relies on people being able to access vaccines and services and being sufficiently motivated to use them. People are motivated by social norms and confidence in vaccines, including beliefs that the benefits of protection outweigh the risks.²⁷ Vaccine confidence can be enhanced by systems for monitoring,

assessing and communicating vaccine effectiveness and safety. This requires transparent and comprehensive vaccine-related adverse event monitoring. Rare, serious adverse events occurred with COVID-19 vaccines and people should be compensated for medical and other expenses when such events occur.²⁸ The creation of a national compensation scheme for COVID-related vaccine injury was a welcome initiative, but should be extended to all vaccines.

Evidence-based decision-making for national vaccination programmes is rigorous and well-established in Australia, with appropriate risk management. However, the pandemic introduced difficult trade-offs between well quantified risks and disease protection benefits of available vaccines (AstraZeneca viral vectored vaccine at the time), and the poorly quantified consequences of delayed vaccination and prolonged social restrictions while the nation awaited greater access to preferred alternatives (Pfizer/BioNTECH and Moderna mRNA vaccines). The Australian Technical Advisory Group on Immunisation (ATAGI) released regular and often detailed statements that explained the broad basis for decisions (e.g. <https://www.health.gov.au/news/atagi-statement-on-astrazeneca-vaccine-in-response-to-new-vaccine-safety-concerns>). Timely release of ATAGI meeting agendas and minutes, including routine publication of the data that underpinned decision making and provision of a readily accessible summary of the decision making process, as is done by the Joint Committee on Vaccines and Immunisation in the United Kingdom,²⁹ would further aid transparency. There is a need to re-assess how best to communicate uncertainty and vaccine safety signals, and to carefully prepare and consult on crisis communication plans.³⁰

Existing preparedness plans were insufficient and major system weaknesses were exposed in the Australian residential aged-care sector

International Health Regulations (2005) developed by the World Health Organization (WHO), mainly in response to previous SARS and Ebola outbreaks, focused on preventing and containing epidemics with high fatality and limited transmissibility.³¹ In Australia, State and Territory pandemic preparedness plans were mostly modelled on influenza (H5N1 and then H1N1), but regular revision and proactive simulation of these plans dropped off in the years leading up to the COVID-19 pandemic. At a global level, there is a need to revise and update global Public Health Emergency of International Concern (PHEIC) mechanisms to incorporate lessons learnt from the COVID-19 pandemic.³² The WHO is best placed to lead and coordinate such a review. Critical workforce and supply chain interruptions during the pandemic emphasised the importance of whole of government planning and consideration of national self sufficiency in times of a global crisis.³³

Major age-specific variability in disease virulence, which remains poorly understood, complicated response efforts. Children and young people experienced a relatively low risk of severe disease, with a dramatic increase in the disease risk and burden among older individuals.^{34,35} As highlighted by the recent Royal Commission into Aged Care Quality and Safety,³⁶ the pandemic exposed major system weaknesses in the Australian residential aged-care sector. Delays in vaccination, poor infection control practices, inadequate planning for staffing disruptions and failure to meet the social and emotional needs of residents and families during times of loneliness and end of life care were particularly distressing. Ongoing challenges in each of these areas, including rapid access to potent antivirals, continue to contribute to unnecessary deaths during the Omicron period.

Effective Infection Prevention and Control (IPC) measures were important to keep health-care workers safe and to limit population transmission

The COVID-19 pandemic highlighted the importance of strengthening the full hierarchy of Infection Prevention and Control (IPC) measures in health and residential facilities,³⁶ with potential adoption of national standards.³⁷ Shortages of personal protective equipment (PPE) were problematic in the early stages of the pandemic due to an over-reliance on off-shore supply chains. Supporting local manufacturers of PPE and hand hygiene supplies is important to improve health security, but a difficult problem that requires urgent attention is the excessive environmental footprint generated by PPE waste. High rates of health and residential care worker infection were reported, with associated workforce shortages, low morale and burn out,³⁸⁻⁴⁰ resulting in healthcare worker strikes around the country. New waves of SARS CoV-2 transmission, combined with the renewed circulation of traditional respiratory viruses that were suppressed by COVID-19 containment measures, present considerable ongoing workforce challenges with viral transmission now recognised as an important work health and safety issue.

Apart from health and residential care facilities, settings that posed high transmission risk included bars and night clubs, places of worship,⁴¹ music festivals, shopping centres, residential apartment complexes, correctional and detention facilities, homeless shelters and meat processing facilities. Poorly ventilated spaces pose a particular concern, not only for the spread of SARS CoV-2, but for many other respiratory pathogens as well. We still lack good quality studies on the value and cost effectiveness for many mitigation measures. Depending on mask quality and fit, mask wearing provides protection to those wearing masks and also decrease viral transmission to others, if an individual is infected. While data on the benefits and risks of mask

mandates remain limited, the available studies indicate that universal mask wearing likely reduces SARS CoV-2 transmission at a population level.⁴² Adequate IPC training is important for all staff working in health or residential care facilities, as is the development of practical risk reduction frameworks.⁴³

The interests of children and young people were at times compromised and it is important to ensure adequate representation of their best interests in decision making processes

Fortunately children and young people experienced a low incidence of severe disease,^{35,44} but messages from paediatric health care professionals to reduce unwarranted fear and emotional distress in children and their parents/carers were not heard. At times, children were mainly viewed as potential ‘vectors of transmission’ (using an inappropriate influenza paradigm) without adequately considering the detrimental impacts of school or playground closures on their education, emotional and physical development, and mental health, as well as the unequal effect of these measures on children from disadvantaged backgrounds.¹⁰

On the whole, Australia maintained some of the best school attendance rates in the world, aided by the early generation of epidemiological reports demonstrating that schools were not epidemic amplifiers.^{45,46} However, this varied considerably by State and Territory. After community transmission became established and with high adult vaccination rates, schools did contribute to epidemic spread, but transmission rates in schools rarely exceeded that in the general community. With mitigation measures in place, case numbers and hospitalisations declined each time schools were re-opened for face to face learning following the peak of the ancestral, Delta and Omicron BA.1 waves in NSW and Victoria, the two States where most transmission occurred.⁴⁷ Alternative (non face-to-face) learning strategies were deployed with some success, but it reduced education quality and greatly increased inequities in education access. Going forward, an Australian national mitigation and recovery plan is needed to ensure that in future outbreaks, equal education access is prioritised and that the damage done to physical and mental health is addressed. Schools should be classified as providing an essential service, with school staff vaccinated as a priority group and remote learning only considered as a last resort.⁴⁸

Epidemic risk should be recognised as a standing threat, with ongoing investment in workforce development and research

Traditionally pandemic research receives a funding boost after a major disease outbreak, but interest dwindles quickly once the epidemic recedes and the threat is

reduced.¹⁶ Epidemic outbreaks have been recognised by the World Economic Forum as a major global risk for many years,^{16,49} but not as an important standing threat that requires ongoing investment in workforce development and research. General priority areas for pandemic research include improved understanding of pathogen evolution and spread, as well as disease surveillance, prevention, pandemic preparedness and response, health system resilience, human behaviour and effective risk communication.

The One Health dimension of infections that emerge at the human-animal interface, including the effects of climate change, reduced ecosystem services and biodiversity collapse, are complex problems that require inclusive cross-disciplinary approaches. The opportunities offered by new vaccine technologies have already been mentioned. The risk of bioterrorism and the misuse of technology that allows genetic manipulation of pathogens to increase their transmissibility and virulence, pose an increasing threat that require effective counter measures. Workforce development and education is essential to develop the full complement of skill sets required for optimal disease surveillance and control, with an ability to benefit from the latest technological advances.

In relation to COVID-19 much remains to be explored. Understanding how at-risk groups can be protected, including the optimal use of antivirals, is a priority. Better insight is also needed into the medium and long term consequences of COVID-19. The pandemic and its control measures caused a backlog of untreated chronic diseases and elective surgical procedures, as well as an increase in mental health issues and inequity that require mitigation and study. Children and young people experienced education and social disruption during critical stages of their development with potential lifelong adverse consequences, which would benefit from active monitoring and research. As a society we require a better understanding of the social and behavioural drivers of vaccine uptake and other preventive behaviours, with the development of more holistic preparedness, response and recovery frameworks.

Nationalistic pandemic responses demonstrated the need for stronger global solidarity and regional engagement

COVID-19 put global inequities into stark relief and high income countries (including Australia) did not always demonstrate strong global solidarity.^{50,51} However, the Australian Department of Foreign Affairs and Trade (DFAT) provided millions of vaccine doses and responded to multiple requests by Western Pacific countries for technical assistance with vaccine roll-out and outbreak management. The fact that Australia’s decision to caution against AstraZeneca vaccine use affected vaccine confidence in the region should be

carefully considered in Australia's public health communication response and emphasises the need to assist countries with evidence-informed decision making that is appropriate for their specific context. Australia also assisted regional workforce development and local health systems strengthening, but there is scope to do more, especially in regard to health system strengthening.

Australia is well-positioned to support regional health security and to share clinical and public health expertise across the Western Pacific region. At a time when society faces major existential threats, it is more important than ever for all countries to embrace regional and global solidarity. It is also the only way to effectively manage an evolving global health threat and to prevent and prepare for similar future challenges. Ongoing investment in infectious diseases research, building health system resilience, workforce development, infection prevention and control initiatives, community partnerships and multidirectional communication should be proactive rather than reactive and outbreak focused. Access to affordable treatments and vaccines for all, should be a guiding principle for pandemic preparedness and response, as emphasised by independent reviews of the global pandemic response.^{51,52} However, changes in the global health architecture to improve disease surveillance and prevention, incorporate the latest technological advances, and better address the diverse health and emergency response challenges posed by the 21st century require further consideration.

Declaration of interests

No conflicts of interests to declare.

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