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RESPONDING TO THE COVID-19 PANDEMIC IN VICTORIA, AUSTRALIA

an epidemiologist's perspective

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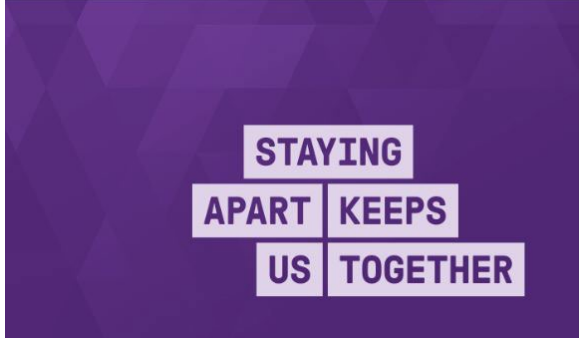
- There are no known or perceived conflicts to declare

A shared global experience



Source: Victorian State Government Department of Health

Context setting

Victoria's COVID-19 story

Melbourne in the media

Some retrospectives

COVID-19 Data and Intelligence

- Building an Intelligence workforce
- Developing and maintaining data sources and systems
- Generating intelligence and informing policy
- Gaps and challenges / Lessons learned

Learning objectives

1. Gain insight into the COVID-19 pandemic experience in Victoria, Australia, and the resultant public health responses.
2. Gain insight into the development and implementation of a COVID-19 Data and Intelligence team to support the pandemic response in Victoria, Australia.
3. Improve their understanding of the gaps and challenges in generating intelligence as part of a major public health response, and solutions to address these.

Acknowledgements
Public health intelligence colleagues and co-leads: Dr Charles Alpren; Lucinda Franklin; Kira Leeb; Andres Hernandez; Daneeta Hennessey, Dr Kara Martin; Dr Robert Kennedy; Daniel West; and countless others.
Victoria COVID-19 Pandemic Response team

Australian population → 25 million

- **Victoria** is the southern-most mainland state
  Population ~ 6.6 million

- **Melbourne** is Victoria's capital city
  Population ~ 4.9 million

Demographic profile

- Culturally and linguistically diverse population
  >50% residents (or parents) born outside Australia

- Generational shift: Baby boomers == Millennials

- 3% Aboriginal and Torres Strait Islander (1.6%, Victoria)

Economic activity

- Victoria's economy larger than New Zealand and Singapore

- Key industries include technology services; transport and construction; **international education**; **tourism, events and visitor economy**

Legislative landscape

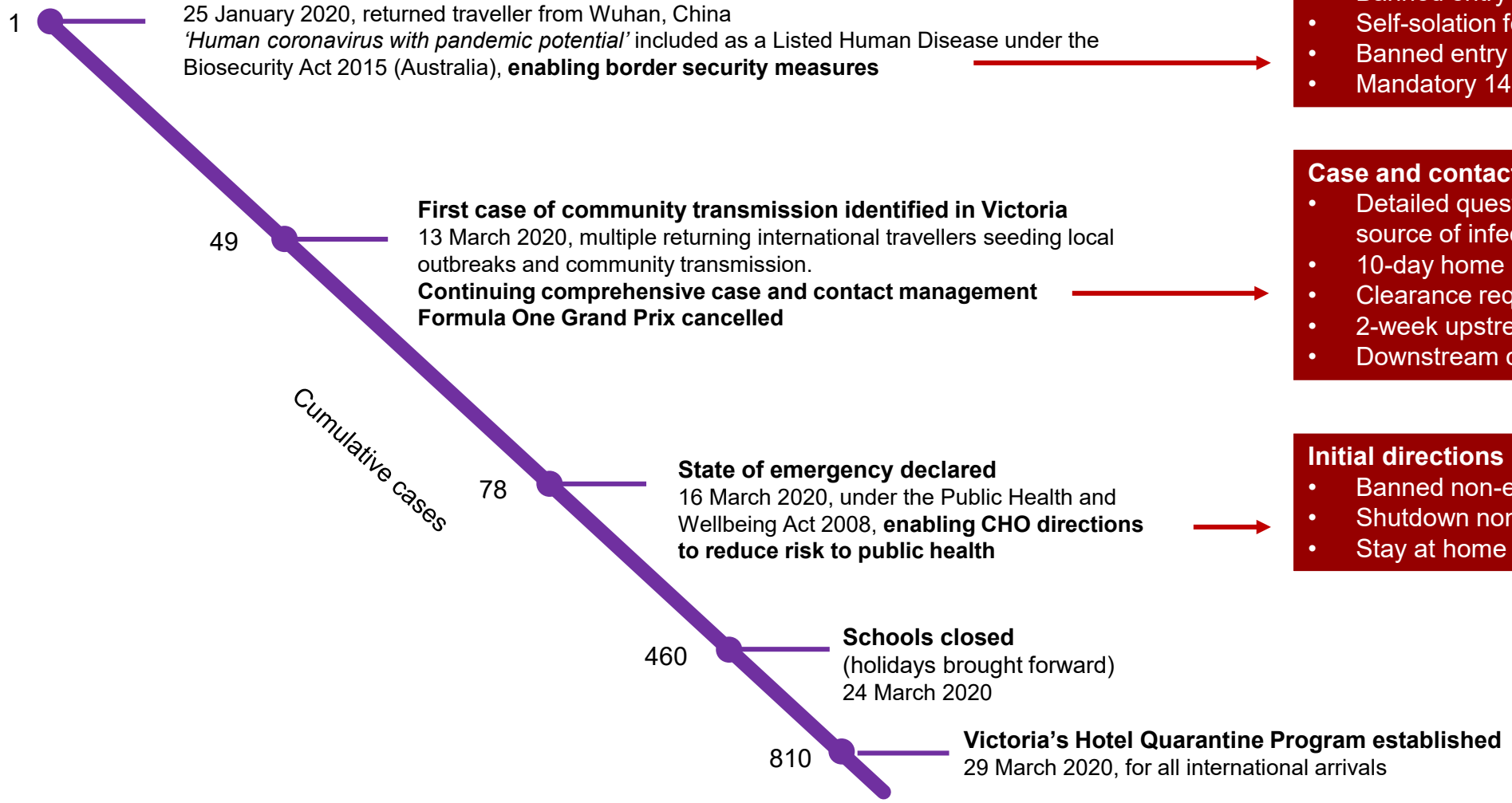
- A federated system of government
- **Public health policy and practice** devolved to States/Territories
  → *Public Health and Wellbeing Act* and associated *Regulations*
  → Considerations under *Charter of Human Rights and Responsibilities Act*
- **Emergency powers** also provided for by State/Territory legislation
  → *Emergency Management Act*
- States/Territories free to define 'emergency', and **delegate special powers**
- This legislative landscape was a key enabler for Victoria in implementing their public health and social measures

"Australia's response to COVID-19 has intensified questions relating to the balance between public safety, rule of law, human rights and the distribution of power"

Source: Mclean and Huff (2020); Emergency powers, public health and COVID-19; https://apo.org.au/node/307587

MELBOURNE

Victoria's early COVID-19 story



Australia's first case of COVID-19 identified in Victoria
25 January 2020, returned traveller from Wuhan, China
'Human coronavirus with pandemic potential' included as a Listed Human Disease under the Biosecurity Act 2015 (Australia), **enabling border security measures**

National biosecurity measures (progressive)
- Banned entry from selected countries
- Self-solation for returned travellers
- Banned entry for non-citizens (19 Mar)
- Mandatory 14-day quarantine (27 Mar)

First case of community transmission identified in Victoria
13 March 2020, multiple returning international travellers seeding local outbreaks and community transmission.
Continuing comprehensive case and contact management
Formula One Grand Prix cancelled

Case and contact management
- Detailed questionnaire to assess risk and probable source of infection
- 10-day home isolation period
- Clearance required 2x –ve PCR
- 2-week upstream contact tracing
- Downstream contact tracing (infectious period)

State of emergency declared
16 March 2020, under the Public Health and Wellbeing Act 2008, **enabling CHO directions to reduce risk to public health**

Initial directions (progressive)
- Banned non-essential mass gatherings >500
- Shutdown non-essential activity (Stage 1)
- Stay at home (Stage 2)

Schools closed
(holidays brought forward)
24 March 2020

Victoria's Hotel Quarantine Program established
29 March 2020, for all international arrivals

Source: Press statement, Hunt and Murphy: ttps://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id%3A%22media%2Fpressrel%2F7158085%22; Macreadie 2022: https://doi.org/10.1071/MA22002; Mclean and Huff (2020); Emergency powers, public health and COVID-19; https://apo.org.au/node/307587; Premier of Victoria, State of Emergency Declared in Victoria over COVID-19; https://www.premier.vic.gov.au/state-emergency-declared-victoria-over-covid-19

Victoria adopted an aggressive suppression strategy

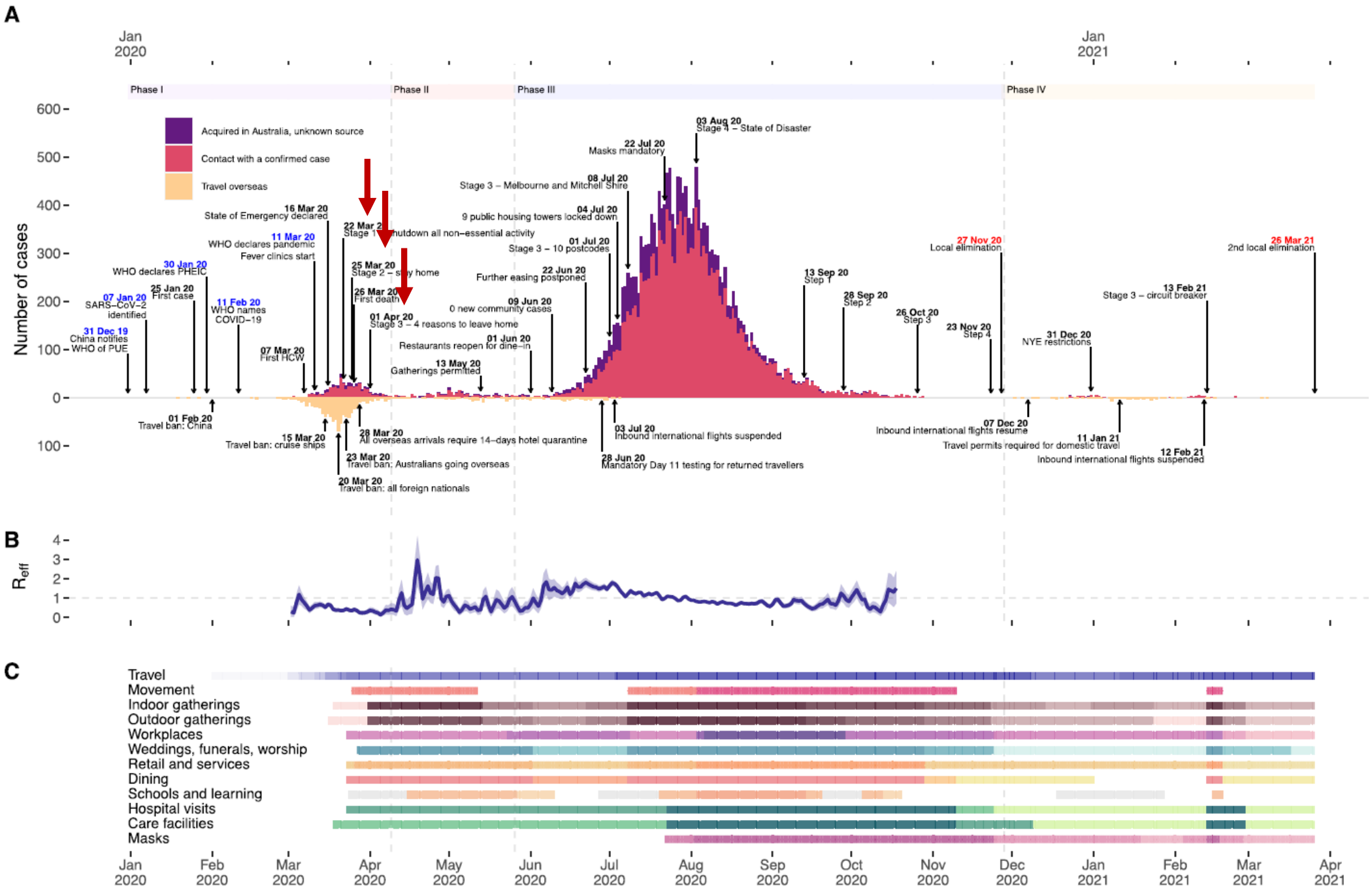
- The goal was to **reverse epidemic growth** and **reduce case numbers**
- Hold cases at bay until availability of vaccines through application of **aggressive public health and social measures**
- **"Go hard, go fast"** philosophy

Some of the key lockdown measures implemented from March 2020 and beyond

- Four (or five) reasons to leave home: getting food, exercising for up to 2 h, care or care giving, for authorised work or education (to get vaccinated).
- Work from home where possible.
- One person per household per day allowed to shop.
- Curfew from 9 pm to 5 am.
- Mask to be worn outside the home.
- No travel beyond 5 km from one's home.
- No visitors to homes.
- No visitors to old-aged care homes.
- No one to leave Greater Melbourne. There was a period when this was enforced by police roadblocks supported by the Australian Defence Force, a so called 'ring of steel' around Melbourne.

"Australia is an island continent that was relatively easy to isolate from the rest of the world for almost 2 years by international border controls"

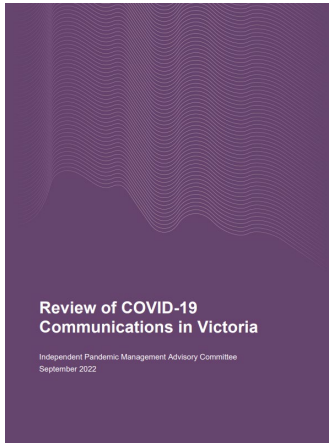
Source: Macreadie, 2022; https://doi.org/10.1071/MA22002



Source: Department of Health writing group; The Lancet Regional Health – Western Pacific; 17(2021) 100297, https://doi.org/10.1016/j.lanwpc.2021.100297;

Melbourne in the media:
initial compliance

- Melbourne's population was **initially** highly compliant of pandemic orders
- Daily press conferences played a vital role in keeping the public informed (ceased in Oct 2021)
- Use of **trusted voices** in message delivery gave **credibility** to the message and was important to counteract misinformation.

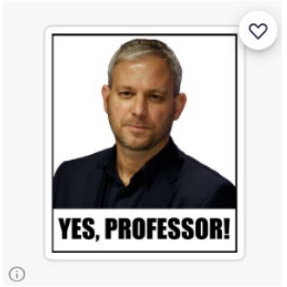


Source: Review of COVID-19 Communications in Victoria, 2022 https://www.health.vic.gov.au/research-and-reports/review-of-covid-19-communications-in-victoria

Victoria's CHO gained cult status during the pandemic

An unusual array of products for purchase through online retailer

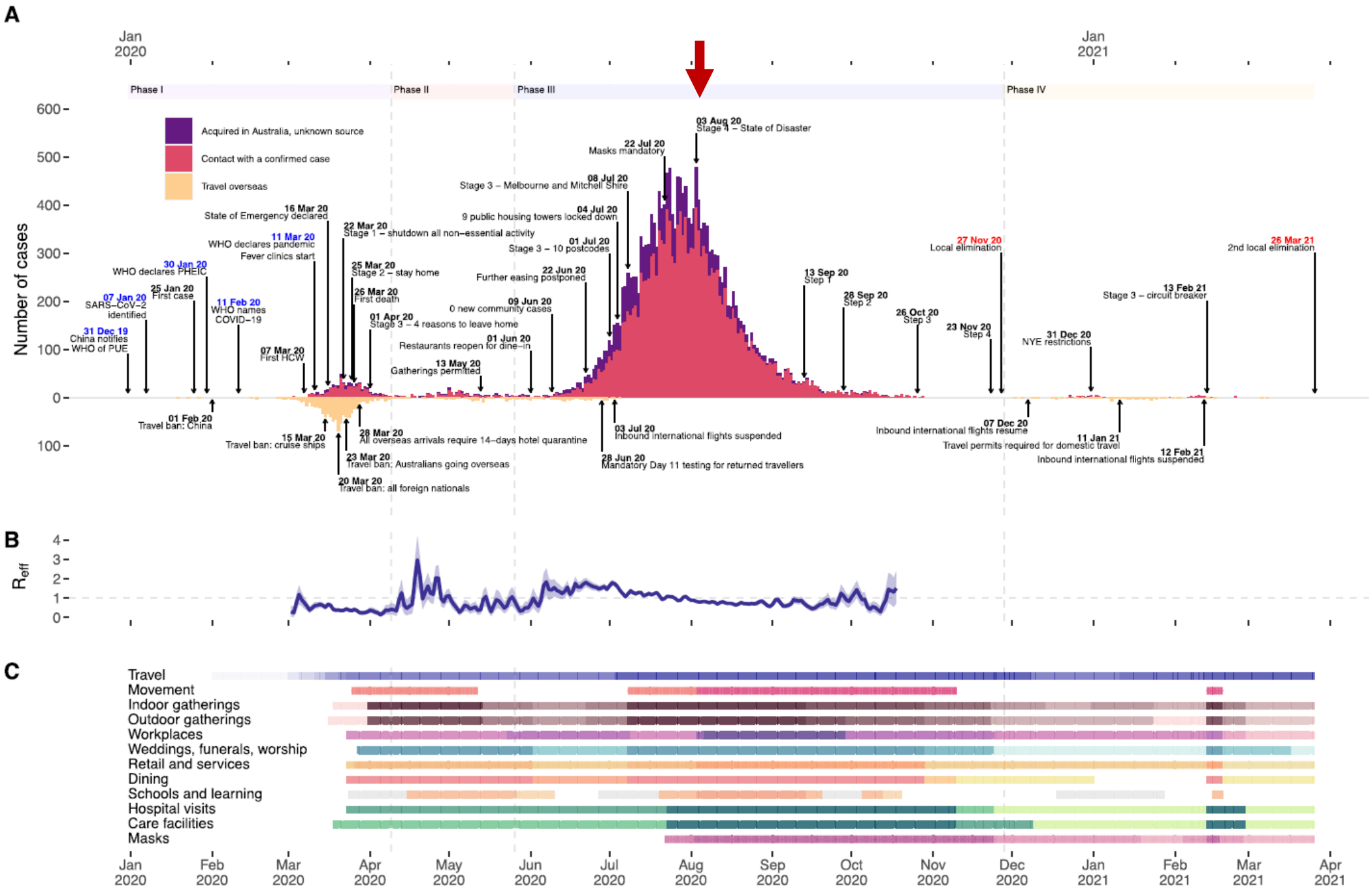
https://www.redbubble.com/shop/brett+sutton



Uniquely Australian communication style

*"You won't be able to go to the pub, because the pub is shut. That doesn't mean you can have all your mates around to home and '**get on the beers**"*

Source: https://www.theguardian.com/world/video/2020/mar/23/no-getting-on-the-beers-at-home-with-mates-as-coronavirus-clampdown-increases-video



Source: Department of Health writing group; The Lancet Regional Health – Western Pacific; 17(2021) 100297, https://doi.org/10.1016/j.lanwpc.2021.100297;

Genomic epidemiology

- Genomic epidemiology was integral to understating Victoria's main epidemic wave in 2020

Genomic analyses revealed

- HQ staff and community cases were genomically linked to a family detained in hotel quarantine facilities
- This breach led to a large transmission network
  → 10,426 cases over 187 days
- Two further breaches in a separate hotel led to
  → 2 networks comprising 26 and 145 community cases

Public health response

- International arrivals into Victoria were stopped
- Victorian hotel quarantine programme was suspended
- Interstate travel within Australia was temporarily restricted

Genomics-informed responses in the elimination of COVID-19 in Victoria, Australia: an observational, genomic epidemiological study

Courtney R Lane, Norelle L Sherry, Ashleigh F Porter, Sebastian Duchene, Kristy Horan, Patiyan Andersson, Mathilda Wilmot, Annabelle Turner, Sally Dougall, Sandra A Johnson, Michelle Sait, Anders Gonçalves da Silva, Susan A Ballard, Tuyet Hoang, Timothy P Stinear, Leon Caly, Vitali Sintchenko, Rikki Graham, Jamie McMahon, David Smith, Lex EX Leong, Ella M Meumann, Louise Cooley, Benjamin Schwessinger, William Rawlinson, Sebastiaan J van Hal, Nicola Stephens, Mike Catton, Clare Looker, Simon Crouch, Brett Sutton, Charles Alpren, Deborah A Williamson, Torsten Seemann*, Benjamin P Howden**

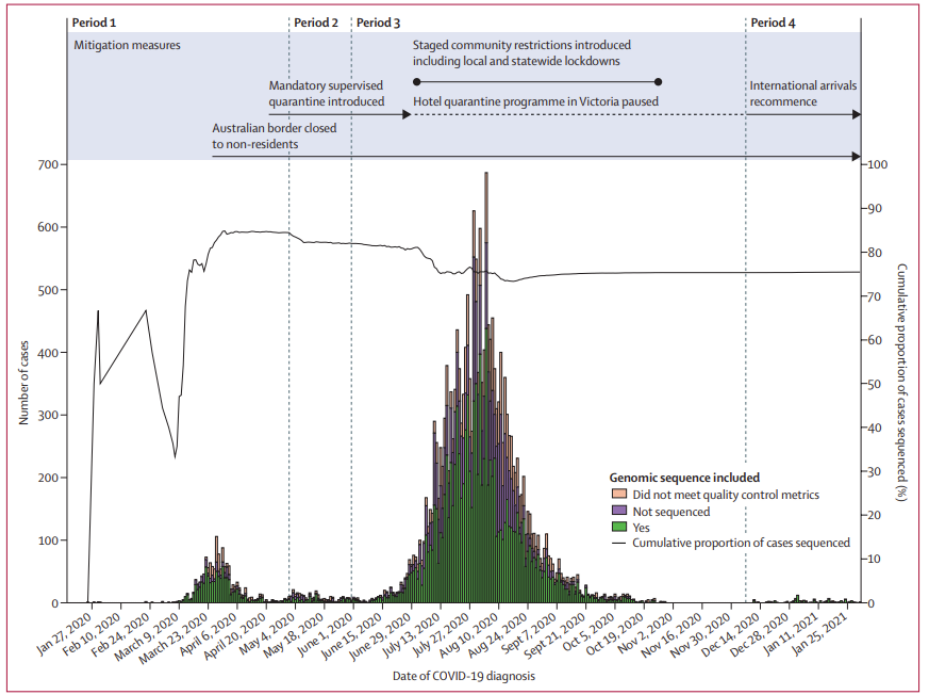


Figure 1: **Epidemic curve of COVID-19 in Victoria, Australia between Jan 25, 2020, and Jan 31, 2021**
Cases of COVID-19 are plotted by reported date of COVID-19 diagnosis and coloured according to availability of sequence data for inclusion in our analysis. Cases will not have included sequence data if a sample collected from the case was not received at the sequencing laboratory, or the sample was unable to be sequenced due to insufficient volume, or failure of presequencing DNA extraction or library preparation steps, or both.

Source: Lane et al, 2021, The Lancet Public Health; DOI:https://doi.org/10.1016/S2468-2667(21)00133-X

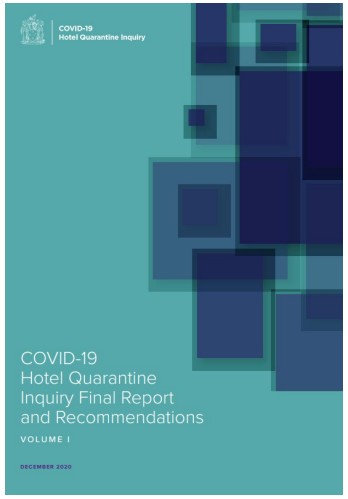
Hotel Quarantine Inquiry

- Victoria had no pre-established quarantine facilities, requiring swift implementation of hotel-based quarantine
- ~1550-2000 people in quarantine by the first week;
  peak use ~4000 people across 10-16 hotels
- Private security and cleaning contractors heavily relied upon
- Key informant interviews, expert reviews, and genomic epidemiology informed Victoria's Hotel Quarantine Inquiry

Key deficiencies

- No prior plans for mandatory mass quarantine
  (at national or state level)
- Unclear lines of accountability
- Lack of training
  → *Informants described training as being "on the job"; policies/procedures developed iteratively*
- Lack of full hierarchy of infection control levers
  e.g. engineering controls to reduce aerosol transmission risk
- Staff movement between hotels and hospitals
  (security guards, nurses etc)
- Lack of monitoring and evaluation of hazard controls

"Almost all cases in the community (not acquired overseas)… can be traced back to transmission that started in [two hotels involved in the Hotel Quarantine program]"



Source COVID-19 Hotel Quarantine Inquiry; URL: https://www.quarantineinquiry.vic.gov.au/
Cheng et al Review of Management of Variants of Concern of COVID-19 in Hotel Quarantine Settings

Changing epidemiology

socioeconomic status

- Second epidemic wave disproportionately impacted areas with:
  ↑ socioeconomic disadvantage; ↑ cultural/linguistic diversity
- **Transmission across and between essential workforce**

  → food manufacture and distribution
  → health care / aged care workers and support staff
  → security; transportation; logistics

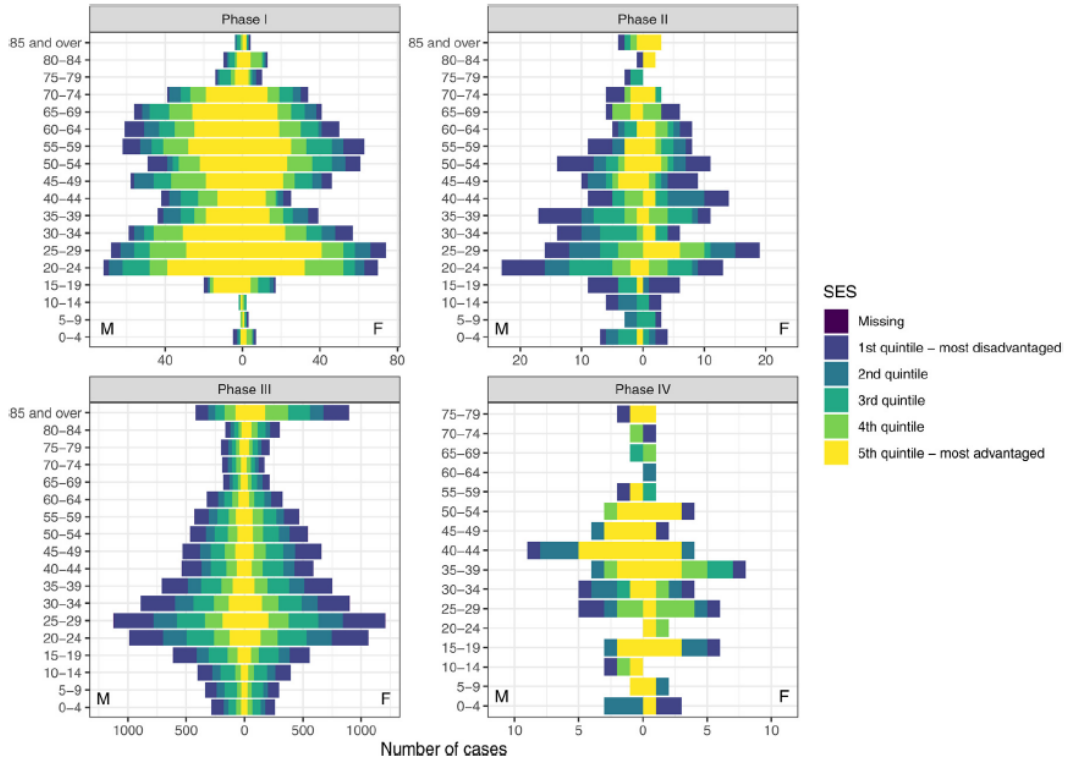


Figure 4. The distribution of cases by age, sex and socio-economic position, by epidemic phase.
Note: Socio-economic position is based on postcode [8,9].

Source: Department of Health writing group; The Lancet Regional Health – Western Pacific; 17(2021) 100297, https://doi.org/10.1016/j.lanwpc.2021.100297;

Changing epidemiology

geographical distribution

- Place-based restrictions
- Snap lockdown of 9 public housing towers in Melbourne's inner north (ordered to quarantine for 14 days, immediate effect)
- Need to assess balance of risk to public health against human rights
- Several inquiries
  → Victorian Ombudsman investigation
  → Public Accounts and Estimates Committee Inquiry
  → Class action against the Victorian Government ($5m payout)

FINDING 25: Department of Health and Human Services' outreach to some multicultural communities regarding COVID-19 and minimising its spread during the pandemic, particularly in the early stages, was considered by some communities to be inadequate.

Source: Public Accounts and Estimates Committee, Inquiry into the Victorian Government response to the COVID-19 pandemic, https://www.parliament.vic.gov.au/get-involved/inquiries/inquiry-into-the-victorian-governments-response-to-the-covid-19-pandemic/reports

'If you live in public housing, it's easier to shut you up'

The Victorian Government said residents in these towers had to be locked down because of the number of active coronavirus cases. *(ABC News: Simon Winter)*

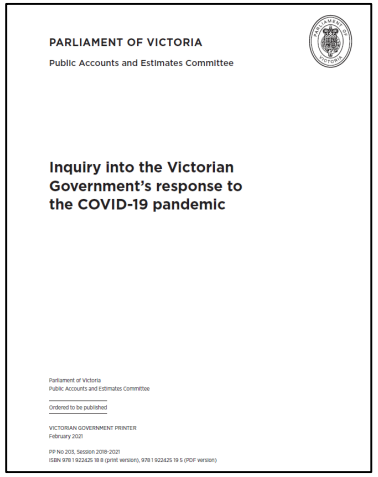
71. While the temporary detention of residents at 33 Alfred Street may have been an appropriate measure to contain the outbreak of COVID-19 sweeping the building, the imposition of such restrictions with more or less immediate effect – absent further preparation, and without specific health advice recommending such an approach – did not appear justified and reasonable in the circumstances, nor compatible with the right to humane treatment when deprived of liberty.

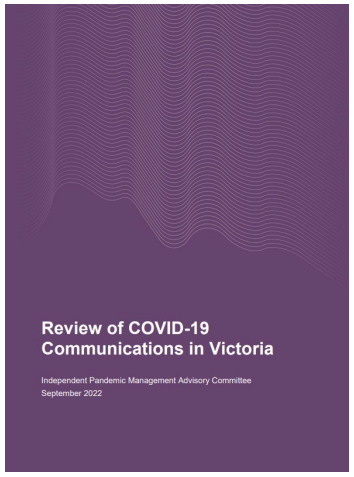
Source: Victorian Ombudsman; https://www.ombudsman.vic.gov.au/our-impact/investigation-reports/investigation-into-the-detention-and-treatment-of-public-housing-residents-arising-from-a-covid-19-hard-lockdown-in-july-2020/

Key reflections
engagement with community

- Experience not unique to Victoria nor Australia → not unique to COVID-19
- Related to social determinants of health:
  Poverty, overcrowding, low education, limited access to services, structural racism
  → increased risk of infection and spread
- Address **underlying structural factors** that drive these health disparities
- Requires **authentic engagement** / **trust-building** between government and those likely to be disproportionally affected
- Establish relationships **before you need them** → cultural, faith and community leaders

"Need to think about systemic factors that influence viral propagation, not simply the characteristics of individuals or the places they go" *Muge Çevic*

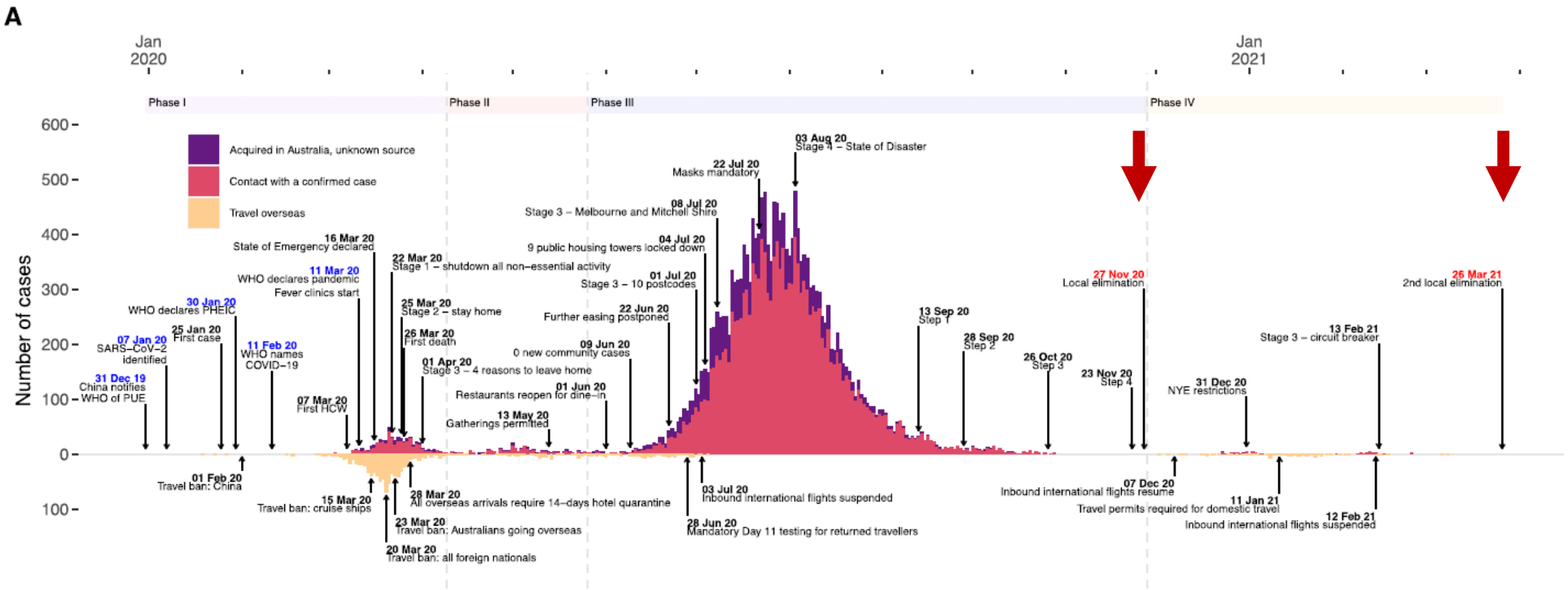




Source: Abrams & Szefker 2020. https://doi.org/10.1016/S2213-2600(20)30234-4; Review of COVID-19 Communications in Victoria, 2022 https://www.health.vic.gov.au/research-and-reports/review-of-covid-19-communications-in-victoria ; Victorian Ombudsman; https://www.ombudsman.vic.gov.au/our-impact/investigation-reports/investigation-into-the-detention-and-treatment-of-public-housing-residents-arising-from-a-covid-19-hard-lockdown-in-july-2020/; Public Accounts and Estimates Committee, Inquiry into the Victorian Government response to the COVID-19 pandemic, https://www.parliament.vic.gov.au/get-involved/inquiries/inquiry-into-the-victorian-governments-response-to-the-covid-19-pandemic/reports; Cevik et al 2020; Clinical Infectious Diseases.

Early successes
local elimination

- Local elimination – 28 days with 0 cases – achieved on **27 November 2020**
- Most sporadic cases were those identified in hotel quarantine; some well-managed community outbreaks
- **22 February 2021 –** COVID-19 vaccination program commenced
- Local elimination re-achieved on 26 March 2021



Early successes
cases averted

- Study examining impact of control measures introduced in Victoria from 1 July 2020 (Saul et al, right)
  - → Reduction in R_{eff} 1.76 to 1.16
  - → averted 9,000-37,000 infections in the month of July

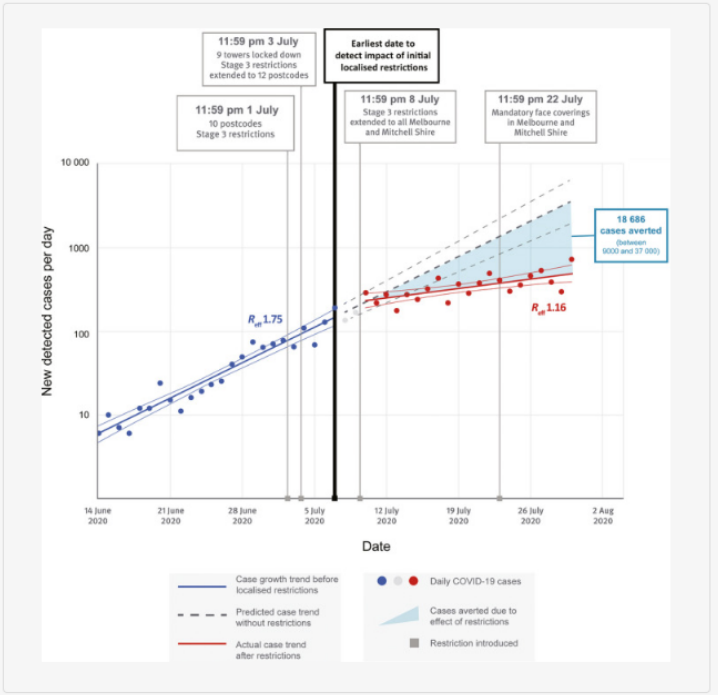
- Revised modelling estimates suggest the number of infections averted was ~18500 infections per day

FINDING 5: Revised modelling of the pandemic's impact suggested that at the height of the pandemic had there been no restrictions in place, there would have been 18,500 infections per day.

Source: Public Accounts and Estimates Committee 2021, Inquiry into the Victorian Government's response to the COVID-19 pandemic; available at: https://www.parliament.vic.gov.au/paec

Box 1

Victorian coronavirus disease 2019 (COVID-19) daily cases

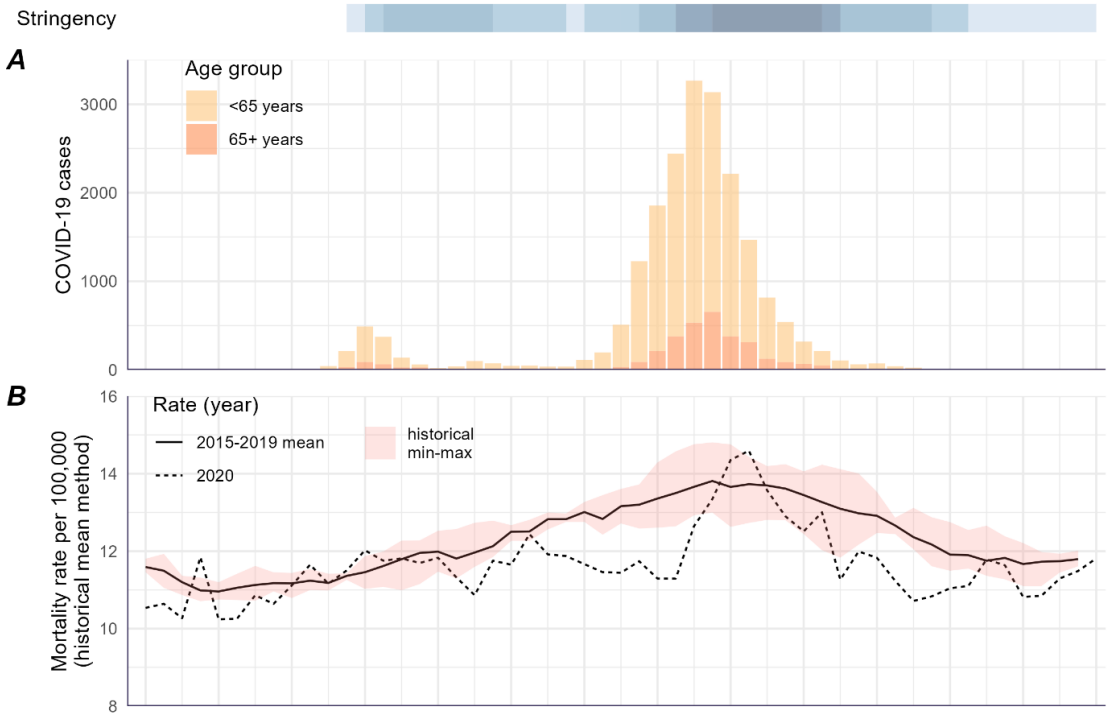


Dots = observed daily cases. Solid thick lines = fitted exponential growth curves; thinner lines = upper and lower 95% confidence intervals (CIs) on the fitted growth curves. Dashed lines = projected exponential increase in daily cases, with upper and lower 95% CIs assuming no intervention. Blue = pre-intervention period (14 June – 7 July); red = post-intervention period (10–30 July); grey = transition period. The vertical black line marks the time when the initial ten-postcode Stage 3 restrictions could begin to influence daily cases.

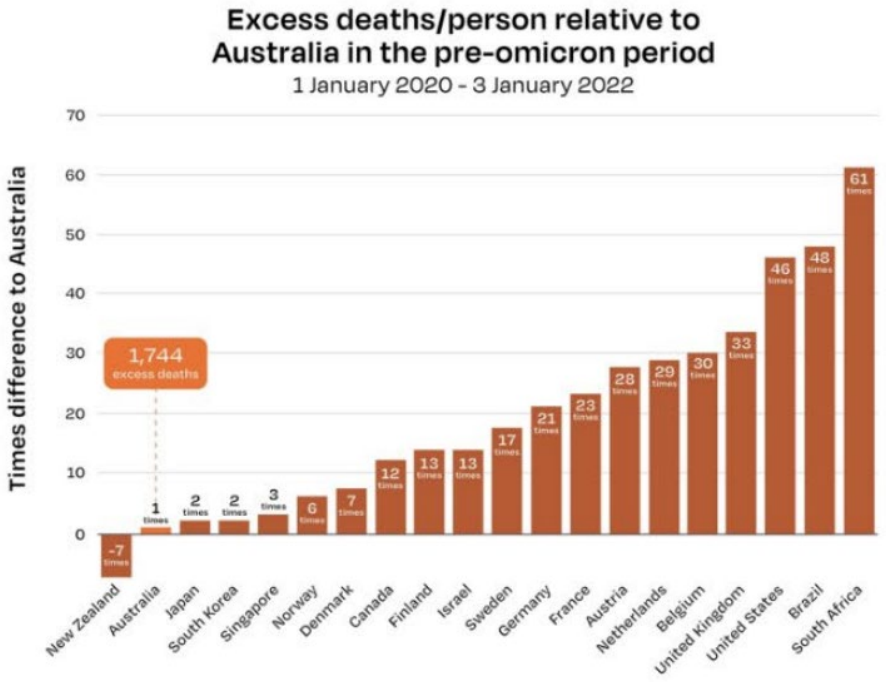
Source: Saul et al, 2020 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC77538

Early successes
reduced mortality

Figure: Weekly all-cause mortality rates in Victorians aged 65 or older in 2020 compared with the four-year average and overlaid against the COVID-19 epidemic and mitigation measures



- Australia was one of the few countries globally that saw a reduced risk of all-cause mortality in 2020
- Clinically (albeit not statistically) significant difference in the mean rate between observed and expected mortality across all age groups



Source: Sundaresan et al, Under review; not for further circulation

Source: Burnet Institute, URL https://www.burnet.edu.au/knowledge-and-media/news-plus-updates/burnet-institute-response-commonwealth-government-covid-19-response-inquiry/

Most locked-down city in the world

- Ongoing cases and a slow vaccination roll-out throughout 2021 led to **reintroduction of restrictions**
- Melbourne experienced **six** separate lockdowns totalling **262 days** (nearly 9 months) of pandemic restrictions March 2020 to October 2021
- **“Freedom Fighter” protests**
  Melbourne was not immune to COVID fatigue

  → Defiance against health orders, lockdowns, masks, mandatory vaccination, curfews…

Hundreds of anti-lockdown protesters clash with police in Australia

By Hande Atay Alam, CNN
2 minute read · Updated 12:00 PM EDT, Tue September 21, 2021

William West/AFP/Getty Images

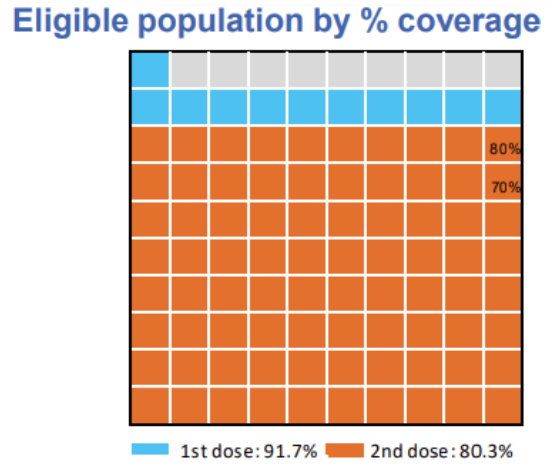
Protesters march through the streets during an anti-lockdown rally in Melbourne on September 18, 2021.

Source: https://www.cnn.com/2021/09/18/australia/australia-lockdown-protest-intl/index.html.

Melbourne reopens

- International flights resume **7 December 2020**
- **Vaccination Roadmap** committed Victoria to lifting restrictions to align with vaccination coverage targets
- Victorian restrictions ultimately lifted on **26 October 2021** to align with high vaccination coverage:

  → >90% 1-dose
  → >70% 2-dose



Source: https://www.reuters.com/world/asia-pacific/melbourne-reopens-worlds-most-locked-down-city-eases-pandemic-restrictions-2021-10-21/#:~:text=Australia's%20second%2Dlargest%20city%20has,any%20city%20in%20the%20world.; Australian Government Department of Health and Aged Care; https://www.health.gov.au/resources/collections/covid-19-vaccination-daily-jurisdictional-breakdown?language=en#october-2021

COVID-19 Data and Intelligence

- Expanding the public health intelligence workforce
- Developing and maintaining data sources and systems
- Generating actionable intelligence and informing policy

Workforce

Systems

Actionable intelligence

Minister's Office asking where we are on the curve

Photo credit: Charles Alpren 2020

Acknowledgement: Dr Charles Alpren; Lucinda Franklin; Kira Leeb; Andres Hernandez; Daneeta Hennessey, Dr Kara Martin; Dr Robert Kennedy ; Daniel West and many others.

Expanding the public health intelligence workforce

Evolved from a small team <20 FTE

- ~8 Epidemiologists each responsible for a major disease grouping (e.g. VPD, enteric, BBV/STI, TB, zoonoses , etc)
- ~4 Surveillance officers (supporting epidemiologists)
- ~6 Data entry staff
- ~1 Data architect

Peak of the pandemic ~250 staff

- Executive and senior leadership
- Informatics / data processing
- Routine and dynamic reporting
- Outbreak and field epidemiology
- Modelling and advanced analytics
- Enhanced surveillance systems
- Global awareness and evidence synthesis
- Strategy & planning

Early workforce challenges

Capacity

- Paucity of available workforce → >16 hours work-days → burnout
- Over-reliance on single specialities → epidemiologists

Operating model

- **Reactionary operating model** was difficult to shift

  → Descriptive epidemiology +++

  → Ministerial / media request for data +++

- **Underdeveloped reporting systems**

  → increased pressure on a stretched workforce to just '**report**' rather than delving deeper into the policy-relevant questions needing addressing → the '**actionable intelligence**'

Key reflections

Enlist help! Engage and diversify

Engage

- Build capacity through existing networks / decentralisation
- Engagement with academic and other partners
- Build productive partnerships **prior** to major public health events

  →Set out proposed functions / operating model

Diversity

- More epidemiologists are not necessarily the answer!

  → Data scientists, data engineers, data architects etc.
  (support development of robust data systems;
  underlying data architecture; automated and integrated reporting; data transparency and availability, etc.)

  → Operations; project management, leadership, etc

Organisational & functional structures matter

- Be intentional about how your workforce is organised
- **"Ring-fence"** a dedicated workforce to deliver on key intelligence functions

  → Situational awareness and time-sensitive "reactionary" reporting (e.g. Ministerial requests; media / press enquiries)

  → Advanced epidemiological analyses and modelling; scenario planning
  → slow "er"- burn policy-relevant questions

  → Surveillance system development and implementation

- **Strategy** and **Tactical** elements need not be mutually exclusive during emergencies

Data sources and surveillance systems

Strengthening data sources and systems is an important precursor to strengthening intelligence generation

Modernising data systems and infrastructure

Building enhanced surveillance systems

Enabling data access and integration

Modernising data systems and infrastructure

Passive notification systems: the bedrock of infectious disease surveillance and control

Early challenges

- Existing public health surveillance system unable to scale
- System well-placed for capturing clinical, epidemiological and laboratory data, not necessarily for “case management”
- Reporting functions strained due to testing volume
- Limited underlying reporting infrastructure

Enhancements

- Case and Contact Management Portal
- **Customer Relationship Manager** (Salesforce) platform

  Automation of almost all steps from:
  → case positivity → SMS alerts / result notification → contact notification → self-entry of interview data → public health messaging
- Re-design of underlying reporting infrastructure
  → **data model**
- Utilisation of business analytic tools (PowerBI)

Source: Dr Alan Finkel AO, National Contact Tracing Review; https://www.health.gov.au/resources/publications/national-contact-tracing-review

Enhanced surveillance and data sources

Complex public health problems require a multifaceted surveillance approach

- Multifaceted surveillance plan developed at outset → alignment with national plan
- Passive → active surveillance / screening to improve case ascertainment (high risk settings)
- Disease severity (morbidity and mortality monitoring)
- Genomic surveillance
- Wastewater surveillance
- Serosurveillance
- Established data linkage program useful in bringing disparate dataset together with notification data

Severity of disease monitoring

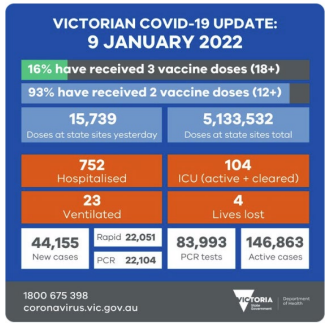
- New data collection, capitalising on existing nosocomial surveillance systems
- Established early (Feb 2020) **in anticipation of the outbreak scaling**
- Captured data on hospitalised cases:

  → **Severity indicators**
  (hospital in the home, ward, ICU); requirement for ventilation; death; length of stay

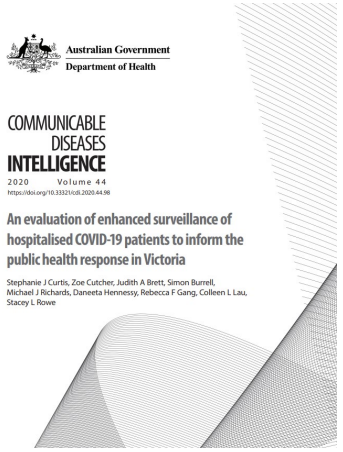
  → Ascertain **hospital acquired SARS-CoV-2 infections**

- Augmented with linkage to Victoria Death Index (vital statistics registry)

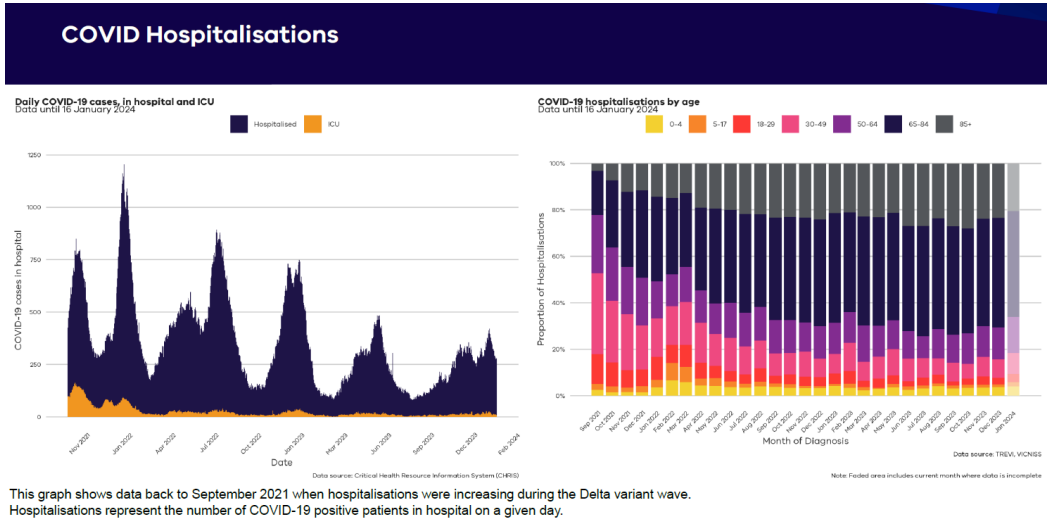
VICNISS
HEALTHCARE ASSOCIATED INFECTION SURVEILLANCE



@vicGovDH, https://twitter.com/VicGovDH/status/1479936767268515841



Source: Curtis et al, 2020
DOI: 10.33321/cdi.2020.44.98



This graph shows data back to September 2021 when hospitalisations were increasing during the Delta variant wave.
Hospitalisations represent the number of COVID-19 positive patients in hospital on a given day.

Source: Victorian COVID-19 surveillance report https://www.health.vic.gov.au/infectious-diseases/victorian-covid-19-surveillance-report?redirectSrc=coronavirus.vic.gov.au

Wastewater surveillance

- New program, evolved over time from proof-of-concept pilot to embedded program
- Three methods: grab sampling; composite sampling; passive sampling
- Quantitative levels AND variant trends (relative abundance)
- Results used for targeted testing and health promotion messaging (rural/remote areas with evidence of new incursions)

Moderately sensitive →
performs best in high prevalent conditions, but public health utility low

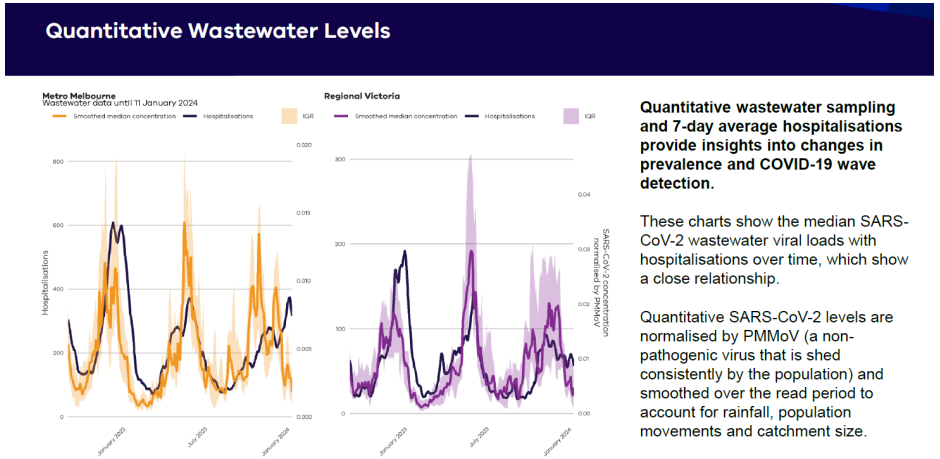
Highly specific →
catchments with positive wastewater detection likely contain infected residents to be targeted for public health action

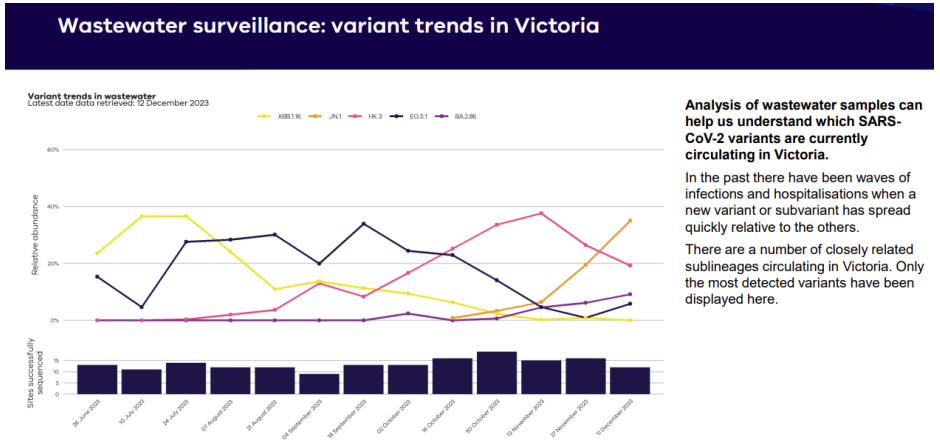
Source: See evaluation Yuen et al: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4191266

@vicGovDH, https://twitter.com/VicGovDH/status/1362319536020717568

CoSSoS Collaboration on Sewage Surveillance of SARS-CoV-2

Water Research AUSTRALIA





Source: Victorian COVID-19 surveillance report https://www.health.vic.gov.au/infectious-diseases/victorian-covid-19-surveillance-report?redirectSrc=coronavirus.vic.gov.au

Data access and linkage

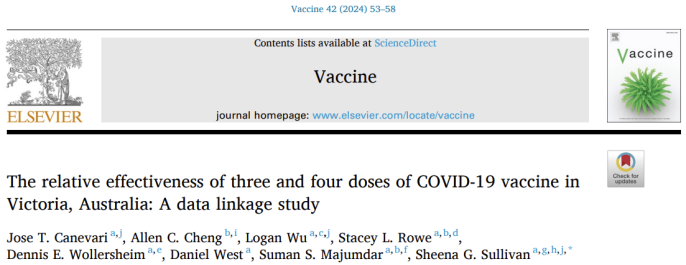
- Pre-existing linkage program turbo-charged for COVID-19
- Daily, near-automated, enduring linkage with key datasets (e.g. hospitalisation, deaths)
- Configurable to new datasets (e.g. immunisation registry, pharmaceutical data, census data)

Several applications to support Victoria's pandemic response

- Understanding people's pathway from testing, diagnosis, hospitalisation, and outcomes such as death
- Identify risk factors for severe disease
- Identifying adherence to isolation orders
- Quantifying vaccine effectiveness
- Quantify association between SARS-Cov-2 infection and other respiratory and non-respiratory conditions

DATA LINKAGE

Bringing together records belonging to the same individual (or family) from separate datasets


Vaccine 42 (2024) 53–58

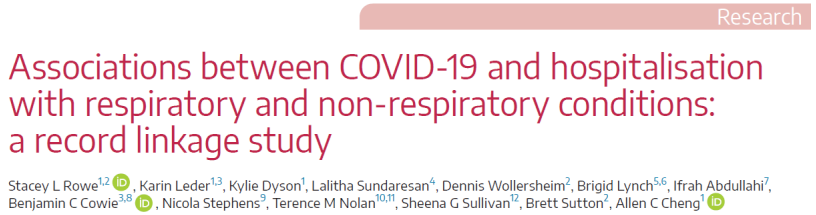
Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

The relative effectiveness of three and four doses of COVID-19 vaccine in Victoria, Australia: A data linkage study

Jose T. Canevari[a,j], Allen C. Cheng[b,i], Logan Wu[a,c,j], Stacey L. Rowe[a,b,d], Dennis E. Wollersheim[a,e], Daniel West[a], Suman S. Majumdar[a,b,f], Sheena G. Sullivan[a,g,h,j,*]


Research

Associations between COVID-19 and hospitalisation with respiratory and non-respiratory conditions: a record linkage study

Stacey L Rowe[1,2], Karin Leder[1,3], Kylie Dyson[1], Lalitha Sundaresan[4], Dennis Wollersheim[2], Brigid Lynch[5,6], Ifrah Abdullahi[7], Benjamin C Cowie[3,8], Nicola Stephens[9], Terence M Nolan[10,11], Sheena G Sullivan[12], Brett Sutton[2], Allen C Cheng

Source: Rowe et al 2022, doi: 10.5694/mja2.51778; Canevari et al 2024, https://doi.org/10.1016/j.vaccine.2023.11.047

Key reflections

Multiple sources of data are need

- **Identify** and **pre-establish** data sources / enhanced surveillance systems
- Enhanced surveillance system can capture data that is commonly “missing” in traditional surveillance systems:
  - → **Severity of disease / outcomes**
  - → **Vulnerable populations**
    (elderly, infants/children, CALD, Indigenous, pregnant)
  - → **Key settings**
    (aged care, prisons, childcare/schools, hospitals)
- Develop disease agnostic protocols, software and partnerships ahead of time
- Think about systems that can better capture prevalence

  → Sero-surveillance / Random population-based sampling

Data linkage is key

- **Pre-establish a program of enduring linkage between public health datasets and other disparate (health and non-health) dataset**
- Much of the data already exists! As well technological solutions to support it.
- Data sources collected for other purposes can justifiably be used on the grounds of public health and safety
- Legislative and administrative barriers can be overcome

Source: Rowe 2023 Using data linkage to improve communicable disease surveillance and control; available at https://bridges.monash.edu/articles/thesis/Using_data_linkage_to_improve_communicable_disease_surveillance_and_control/22306267

Actionable intelligence

Generating policy-relevant intelligence

Actionable intelligence is needed – not just the "daily numbers"

Early challenges

- Reactionary operating model limited capacity for more strategic comparative analyses
- Modelling useful in beginning when we lack empirical data (?over-reliance later in the epidemic)
- Death by dashboard: Too many reporting "products"
- Limited opportunity to share findings publicly

Solutions

- Dedicated teams to focus on analytical epidemiology
- Consolidated reporting established
- Advisory committee to support prioritisation of policy-relevant questions needing addressing
- Engagement with academic / research partners

Consolidated reporting

Actionable intelligence

Epidemiological Summary

Current indicators show decreasing levels of COVID-19 activity in Victoria.

Daily numbers last 12 weeks

The number of people in hospital with COVID-19 has continued to decline this week to a daily average of 294, compared to 369 last week. The current average remains high but below the peak in May/June.

The **7-day average of ICU patients also declined this week** (16 to 11).

The latest quantitative wastewater measures indicate decreasing COVID-19 viral loads in Victoria and regional catchments.

Higher levels of SARS-CoV-2 in wastewater suggest higher prevalence of COVID-19 infections in the co

(Plot shows metropolitan median relative quantitative levels of SARS-CoV-2 in wastewater)

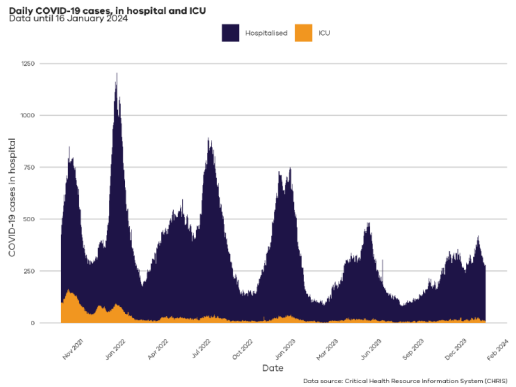
Deaths in the most recent 28-day period (06/12/2023 – 02/01/2024) declined compared to the prior 05/12/2023), with a current 28-day total of 157. Increases and decreases in the reporting of deaths att waves of infections and hospitalisations by several weeks.

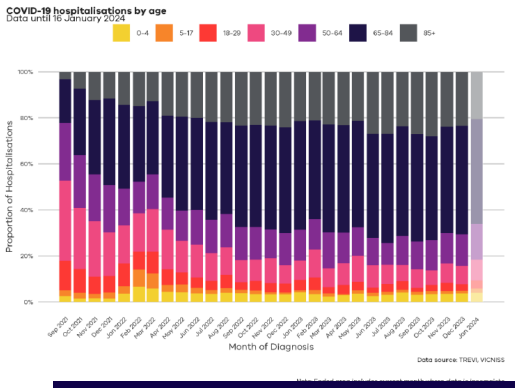
(Note that reporting periods for deaths are lagged by 2 weeks to allow for delays in data collection)

Following rapid growth in early December, **JN.1 (a sublineage of BA.2.86) has become the most prev wastewater samples.**

JN.1 is also the most prevalent variant of interest globally.

COVID Hospitalisations





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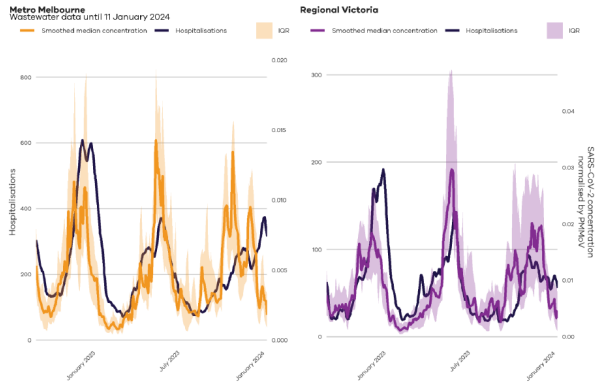
Source: Victorian COVID-19 surveillance report https://www.health.vic.gov.au/infectious-diseases/victorian-covid-19-surveillance-report?redirectSrc=coronavirus.vic.gov.au

Quantitative Wastewater Levels



Quantitative wastewater sampling and 7-day average hospitalisations provide insights into changes in prevalence and COVID-19 wave detection.

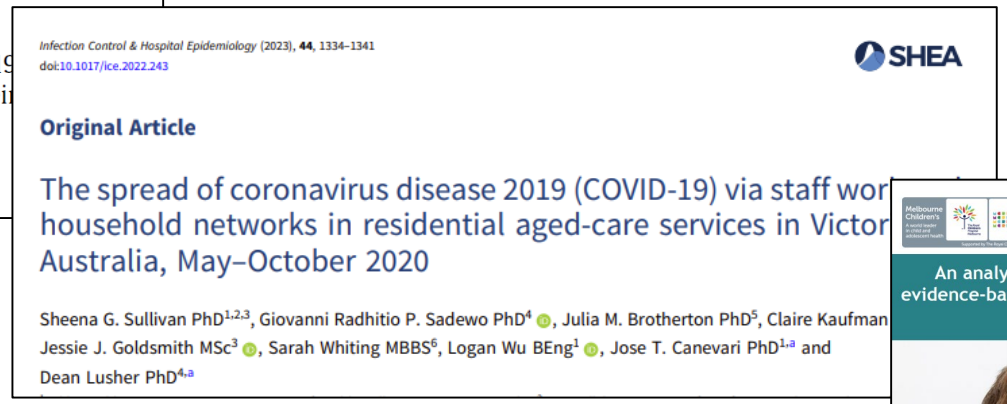
These charts show the median SARS-CoV-2 wastewater viral loads with hospitalisations over time, which show a close relationship.

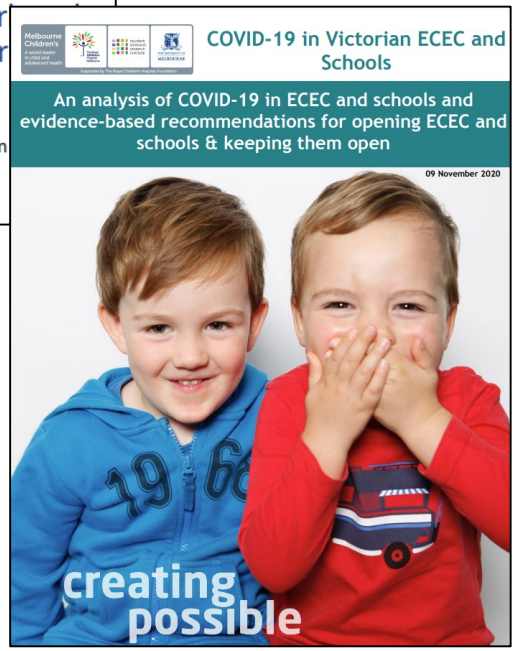
Quantitative SARS-CoV-2 levels are normalised by PMMoV (a non-pathogenic virus that is shed consistently by the population) and smoothed over the read period to account for rainfall, population movements and catchment size.

- Succinct, consolidated reports capturing key indicators (activity, severity, genomics)
- Drawing on stable surveillance systems with good ascertainment and reliability
- Single-source-of truth reporting; automated & scalable

Focussed epidemiological analyses

Actionable intelligence





- Several highly valuable epidemiological analyses were generated containing **actionable intelligence** to inform Victoria's pandemic response
- Large program of work examining epidemiology of COVID-19 among early childhood and education settings and school leading to reopening of schools
  → Research partners Murdoch Children's Research Institute
- **Limited in the public domain** → limited contribution to the global scientific knowledge-base

Source: Murdoch Children's Research Institute, COVID-19 research briefs; https://www.mcri.edu.au/research/strategic-collaborations/flagships/covid-19/research/research-briefs

Sharing is caring

Actionable intelligence

- Experience in other countries was quite different

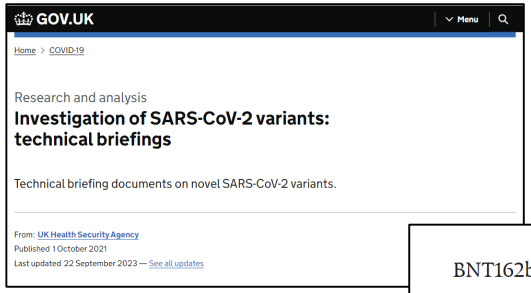
  → Technical briefings and reports (UK)

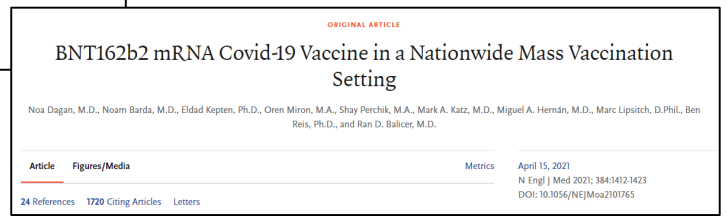
  → Multicentre clinical trials using linked data (UK)

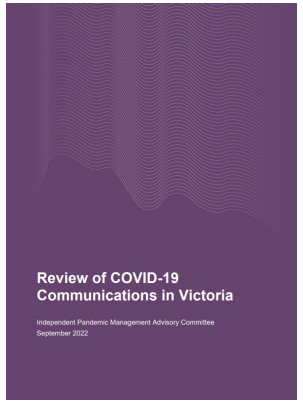
  e.g. RECOVERY trial in the UK
  (Randomised Evaluation of COVID-19 Therapy)
  - Linked trial-specific data with registries / routinely collected data
  - Demonstrated survival benefit of dexamethasone in hospitalised patients with COVID-19

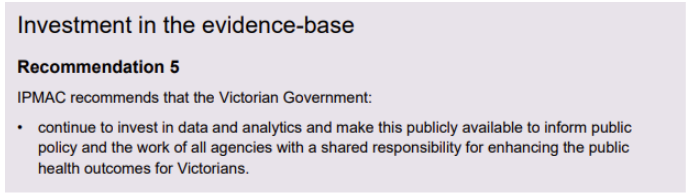
  → Peer-review publication in highly-respected medical journals (Israel, US, Scotland)

- False dichotomy between operational intelligence and “research”
- Helps **engender trust** in government / credibility / transparency
- Helps **broaden the scientific knowledge-base**









Source: UK Health Security Agency; https://www.gov.uk/government/publications/investigation-of-sars-cov-2-variants-technical-briefings
Rosen et al (2022); DOI https://doi.org/10.1186/s13584-022-00548-3; RECOVERY trial, see: DOI: 10.1056/NEJMoa2021436; PANORAMIC, see: DOI: https://doi.org/10.1016/S0140-6736(22)02597-1; ICES, see: doi: 10.12927/hcq.2021.26553; NY City, see: DOI: http://dx.doi.org/10.15585/mmwr.mm7208a4; **Source**: Review of COVID-19 Communications in Victoria, 2022 https://www.health.vic.gov.au/research-and-reports/review-of-covid-19-communications-in-victoria

Key reflections

Actionable intelligence

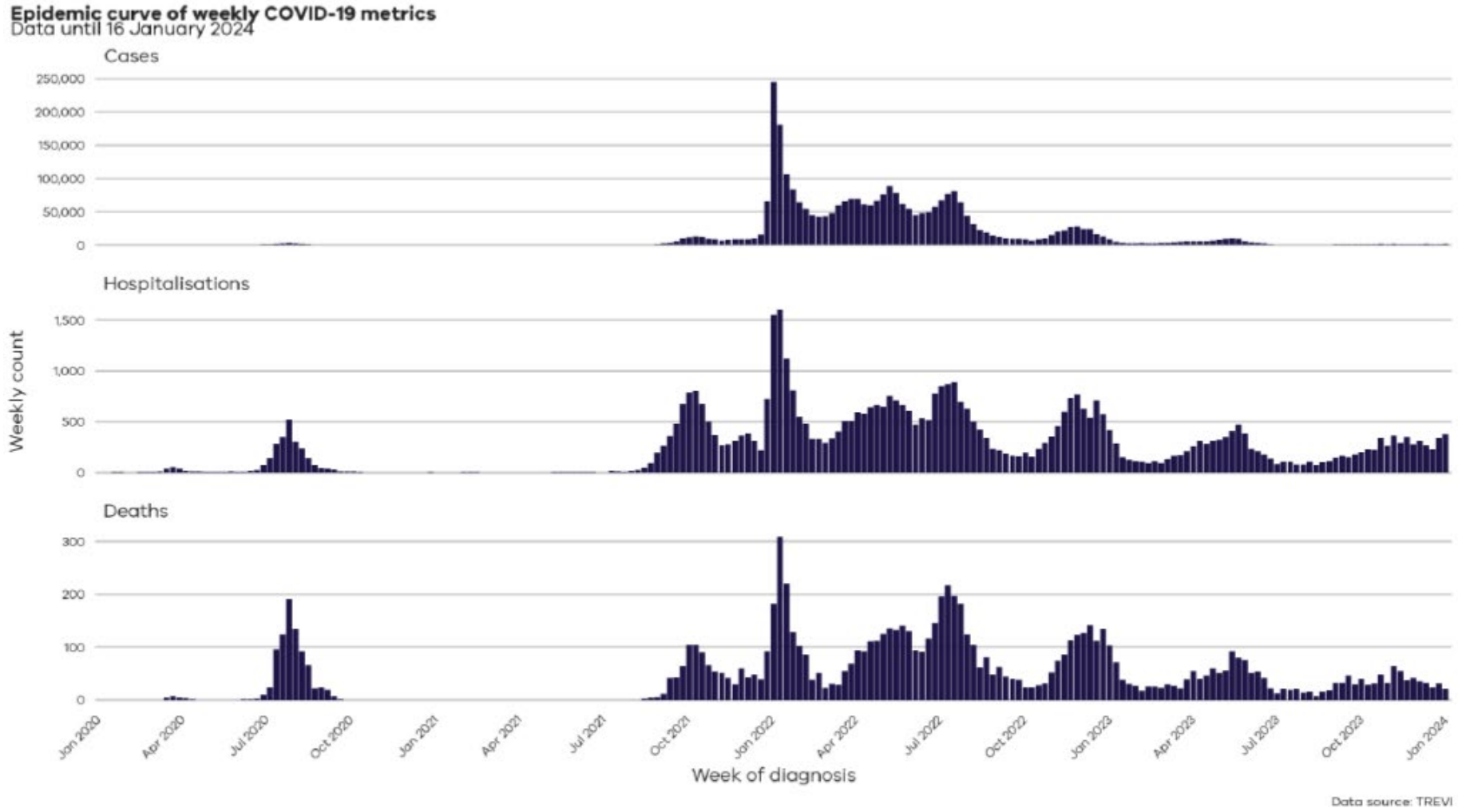
Invest in public health surveillance and research infrastructure

- Invest in public health surveillance and research infrastructure:
  - → Automate the routine
  - → Delve deeper into complex policy-relevant questions (AKA research questions)
- Investment in **data linkage** to support public health surveillance and response will pay dividends in the form of **actionable intelligence**

Local public health intelligence can benefit the globe

- Policy-relevant public health intelligence need not be limited to local application
- Governments have a responsibility to their citizens - and the broader community – to share key analytical outcomes and lessons learned

Despite early success, COVID-19 ensues

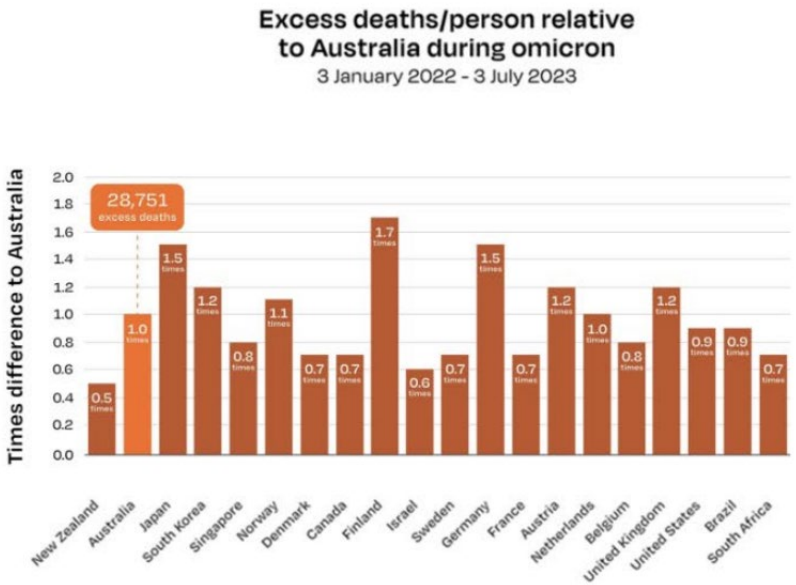


Source:, Victorian COVID-19 surveillance report https://www.health.vic.gov.au/infectious-diseases/victorian-covid-19-surveillance-report?redirectSrc=coronavirus.vic.gov.au;

Reflections and more questions

"On balance – [Australia's] COVID-19 mitigation strategy in 2020-21 was remarkably successful; tens of thousands of lives were saved, and these savings were sustained over subsequent years…

This globally unique federated response was largely effective, but resulted in inequitable health, economic, and social burden across Australia"



Source: Burnet Institute, URL https://www.burnet.edu.au/knowledge-and-media/news-plus-updates/burnet-institute-response-commonwealth-government-covid-19-response-inquiry/

Ongoing questions

- Always a trade-off between cost and benefit
- Is there a middle ground that is less punitive?
  → More carrot, less stick
- What is the role of collective action? Personal responsibility?
- Trust runs both ways → cannot underestimates people's ability to "do the right thing"

THANK YOU

Lessons learned

- Need for authentic engagement with diverse communities
- Address structural barriers to disadvantage (and viral propagation)
- Invest in public health surveillance and research infrastructure (including reporting architecture)
- Ensure workforce readiness and diversity
- Need for “actionable intelligence” as opposed to simple “stats”
- Share findings with citizens and the broader scientific community

A pathway forward for COVID-19 control

- Development of better vaccines and sustaining optimal coverage of existing vaccines
- Suite of non-pharmaceutical interventions to accompany vaccination
  → Normalisation of mask use
- Structural modifications
  → e.g. clean indoor air; systemic factors driving viral propagation
- Ongoing surveillance, research, risk reduction, treatment for long COVID-19

Get in touch!

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