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Commentary

Opportunities to strengthen respiratory virus surveillance systems in Australia: lessons learned from the COVID-19 response

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Abstract

Disease surveillance data was critical in supporting public health decisions throughout the coronavirus disease 2019 (COVID-19) pandemic. At the same time, the unprecedented circumstances of the pandemic revealed many shortcomings of surveillance systems for viral respiratory pathogens. Strengthening of surveillance systems was identified as a priority for the recently established Australian Centre for Disease Control, which represents a critical opportunity to review pre-pandemic and pandemic surveillance practices, and to decide on future priorities, during both pandemic and inter-pandemic periods. On 20 October 2022, we ran a workshop with experts from the academic and government sectors who had contributed to the COVID-19 response in Australia on 'The role of surveillance in epidemic response', at the University of New South Wales, Sydney, Australia. Following the workshop, we developed five recommendations to strengthen respiratory virus surveillance systems in Australia, which we present here. Our recommendations are not intended to be exhaustive. We instead chose to focus on data types that are highly valuable yet typically overlooked by surveillance planners. Three of the recommendations focus on data collection activities that support the monitoring and prediction of disease impact and the effectiveness of interventions (what to measure) and two focus on surveillance methods and capabilities (how to measure). Implementation of our recommendations would enable more robust, timely, and impactful epidemic analysis.

Keywords: viral respiratory infections; public health surveillance; COVID-19 pandemic

Background

The coronavirus disease 2019 (COVID-19) pandemic demonstrated the critical role of surveillance data for the management of an epidemic disease. During the COVID-19 pandemic, existing approaches to viral respiratory surveillance—such as community-based testing—were scaled up, and many new or enhanced surveillance activities were deployed, including wastewater testing,[1] behavioural monitoring,[2] and country-level genomic data platforms.[3] The data generated by COVID-19 surveillance systems informed myriad public health actions both in Australia and globally, from guiding contact tracing investigations[4] to informing decisions on the strengthening and easing of social restrictions.[5]

The unprecedented circumstances of the COVID-19 pandemic revealed both strengths and shortcomings of existing surveillance systems.[6] Many insights about epidemic dynamics and the effects of COVID-19 interventions were only possible because of the rapid establishment of novel systems that did not exist pre-pandemic.

For example, country-level infection prevalence surveys provided near-real-time insight into the dynamics of SARS-CoV-2 infection in the United Kingdom (UK)[7,8] and the systematic collection of behavioural data in many settings provided information on transmission risk[9] and the impact of social restrictions.[10,11]

In Australia, the COVID-19 pandemic catalysed the establishment of new national surveillance planning processes, building on principles outlined in the Australian Health Management Plan for Pandemic Influenza.[12] The Communicable Diseases Network of Australia convened a National Surveillance Plan Working Group, consisting of a range of experts and officials in disease surveillance, public health, epidemiology, data analytics and modelling, to advise on national priorities for surveillance. The working group's membership and remit aimed to ensure that the surveillance plan[13] addressed the needs of diverse data users nationally, within jurisdictional government departments and in other institutions. This organisational structure was also valuable for establishing a whole-of-system view, where potential synergies or redundancies could be identified among multiple disparate surveillance components. Committee meetings were an opportunity for surveillance objectives to be deliberated and defined, and for determining what indicators and analyses were required to support those goals and the consequent data needs. Crucially, identifying the public health objectives of surveillance was the starting point for planning, rather than assessing what could be achieved with existing data streams. As a result, new surveillance methods that were beyond the scope of pre-pandemic (or inter-pandemic) surveillance systems and planning could be, and were, implemented to fill information gaps.

Many countries, including Australia, have now discontinued or have scaled back enhanced COVID-19 surveillance activities and are moving towards integrated 'business-as-usual' surveillance of COVID-19, influenza, and other viral respiratory infections of public health significance. At the same time, national governments, and multi-lateral organisations including the World Health Organization (WHO), are building on lessons learned from COVID-19 to prepare for future pandemics. Reflecting global preparedness agendas, and following a long consultation process, the Australian Government has now established the Australian Centre for Disease Control (ACDC) with the strengthening of disease surveillance systems identified as a priority.[14] The establishment of the ACDC represents a critical opportunity to review pre-pandemic and pandemic surveillance practices, and to decide on future priorities during both pandemic and inter-pandemic periods.

The workshop

On 20 October 2022, we ran an academic-led workshop, 'The role of surveillance in epidemic response', at the University of New South Wales, Sydney, Australia. Workshop participants (N = 36) had contributed to the COVID-19 response in Australia (2020–2022) through roles in the academic (n = 14) or government sector (n = 15) or both (n = 7). Participants brought expertise in a range of relevant disciplines including public health, infectious disease surveillance, data management, data analytics, infectious disease modelling, and behavioural science. Key themes/questions explored during the workshop are listed in Table 1.

Table 1: Workshop themes

Theme	Questions
Theme 1	What is the purpose of respiratory virus surveillance?
	How is surveillance different under routine versus emergency response?
Theme 2	How has surveillance data supported COVID-19 decisions in Australia?
	What types of policy decisions were made?
	What analyses supported those decisions?
	What data were used in those analyses?
	What data would have enhanced those analyses and decision-making processes?
Theme 3	What are the strengths and limitations of COVID-19 surveillance systems in Australia?
	What did other countries do that we could emulate or should avoid?
	How can we strengthen surveillance in Australia to prepare for future epidemics?

Following the workshop, we established a core writing team (FMS, LE, MK, JK, AC, JW, JMM) and drafted five recommendations to strengthen respiratory virus surveillance systems in Australia, drawing on workshop discussions, particularly on the attendees' insights into local and international COVID-19 surveillance and response. The wider group of workshop participants were then invited via email to provide feedback on the draft recommendations and manuscript, with this feedback incorporated into the final version presented here. While the article's discussion and recommendations reflect the consensus views of the authors, they do not necessarily reflect the opinions of all individuals involved in the workshop, nor the views or policies of the organisations they represent.

Recommendations

We make five recommendations to strengthen respiratory virus surveillance systems in Australia (Table 2). Three of the recommendations focus on data collection activities that support the monitoring and prediction of disease impact and the effectiveness of interventions (what to measure) and two focus on surveillance methods and capabilities (how to measure).

A wide range of challenges and opportunities in viral respiratory surveillance were discussed at the workshop. In particular, the COVID-19 pandemic highlighted that traditional 'case-based' surveillance systems have a dual function. They (1) support immediate public health actions, such as case and contact management; and (2) are a critical input for decision-making on the use of population-level interventions and overall response strategy. However, case-based surveillance systems were not *designed* for this second purpose. For surveillance to best support decision-making, planned collection of data specifically for supporting the monitoring and prediction of disease impact and the effectiveness of interventions is required. Box 1 uses Australia's response to COVID-19 to highlight the exceptional circumstances (pre-Omicron era) under which case-based surveillance was able to very effectively support function (2), but also its limitations under more typical circumstances (post-Omicron era).

Our recommendations therefore focus on strengthening Australia's surveillance capabilities for the monitoring and prediction of disease impact and intervention effectiveness. Other critical activities that operate in tandem with surveillance, such as identifying and supporting the management of individual cases and contacts, are likely to require other approaches to system design and are not the focus of this article. Furthermore, our recommendations are not intended to be exhaustive; they primarily relate to the monitoring of transmission dynamics, because it is required to estimate and anticipate clinical burden, yet typically is an under-recognised component of surveillance and done poorly. Hence while Recommendations 1–3 are *necessary* for monitoring disease impact and the effectiveness of interventions; they are not *sufficient* (Box 2). For example, infection denominators (Recommendation 2) are required for estimating infection fatality ratios, but we also require clinical data (not discussed in the article). As part of a broader surveillance system, the implementation of our recommendations would enable enhanced epidemic analysis and insight, whether that be for supporting pandemic or inter-pandemic responses.

Table 2: Five recommendations to strengthen respiratory virus surveillance in Australia

Category	Recommendation
What to measure	1. Establish protocols for monitoring biological and epidemiological characteristics affecting transmission
	2. Establish systems for monitoring infections (as distinct from notified cases)
	3. Ensure systematic collection of behavioural data related to disease transmission and control
How to measure	4. Build Australia's local surveillance capabilities and infrastructure to ensure that public health responses can be tailored to the Australian context
	5. Implement appropriate statistical designs to maximise the efficiency and utility of surveillance systems

Box 1: Limitations of Australia's COVID-19 surveillance data were highlighted by the Omicron era

During the period March 2020 – November 2021 when Australia strongly suppressed community transmission of SARS-CoV-2 (with minimal transmission prior to March 2020), testing and tracing systems were expanded to rapidly identify infections, with the explicit goal of detecting all infections in chains of transmission.[15] Supported by other public health measures, particularly border closures, and by (relatively) low disease prevalence, these systems were highly effective at controlling transmission. They had the additional benefit of providing high visibility of the underlying infection dynamics of SARS-CoV-2 in Australia i.e., with case data in Australia likely closely reflecting the true number of infections until December 2021.

However, the rapid growth of the epidemic of the Omicron variant in Australia in December 2021 quickly outstripped the capacity of polymerase chain reaction (PCR) testing and contact tracing. This occurred during a period in which state and territory governments were already transitioning from a response objective of strong suppression of community transmission to one of transmission that was at 'manageable' levels, in that the consequent burden on clinical services did not overwhelm health system capacity.[16] Consequently, the fraction of infections detected by case-based reporting likely dropped dramatically and rapidly, as demonstrated in England (see Figure 7 of ref. 17). The fraction could not be measured or easily inferred, since Australia had no surveillance system for monitoring the age-specific incidence of infections in the community in real-time (see Recommendation 2). This hampered the ability of epidemiologists to robustly assess the current and future impact of Omicron BA.1 (and subsequent Omicron sub-lineages) on the Australian population and the likely relative effectiveness of alternative intervention options (e.g., age-specific vaccination recommendations) to minimise the impact of future waves.

Projections of the anticipated clinical burden required understanding of the biological mechanism(s) for Omicron's transmission advantage. During the escalating phase of the first Omicron epidemic, Australian researchers analysed emerging global data to delineate plausible values of key biological parameters affecting transmissibility.[18] The analysis drew on near real-time data on reinfection rates in population testing data from South Africa,[19] on vaccine effectiveness from the UK,[20] and on household transmission rates from Denmark.[21] This analysis was critical in guiding Australia's response to the Omicron BA.1 epidemic, including adjustments to the third dose vaccine program, yet it fundamentally relied on the surveillance systems of other countries. None of these data sources were available nationally at that time in Australia; and importantly, nor would they be if a similar event occurred in future (see Recommendation 4).

Box 2: Surveillance needs in the context of decision-making

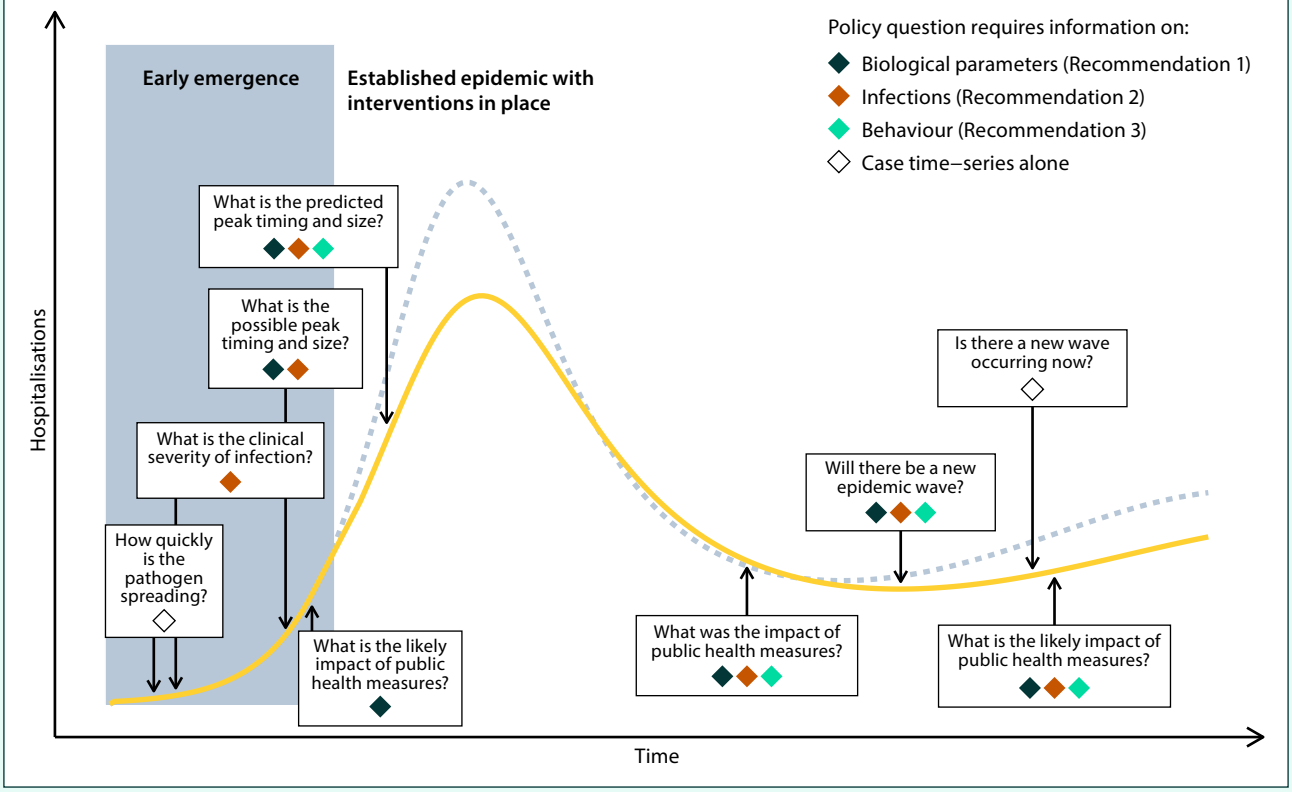
Exemplar policy questions for public health response to a new epidemic of a viral respiratory infection, and transmission-related information needs for addressing each question, are fulfilled by either analysis of surveillance data provided under Recommendations 1–3 or by analysis of case data alone (Figure 1). Where the data that would be provided under Recommendations 1–3 are unavailable, epidemiologists typically address relevant questions using expert opinion or inferences from less informative data streams, including but not limited to case data. The epidemic course in Figure 1 is represented by the number of hospitalisations over time to emphasise how the surveillance of transmission is required to answer policy questions relating to clinical loads (e.g. a peak in hospitalisations, or whether a new wave of hospitalisations will occur, can only be robustly predicted with information on infections).

Note that only transmission-related information needs fulfilled by Recommendations 1–3 or case data are displayed, and of course there are many other data needs. For example, clinical data are also required to determine the clinical severity of infection.

Figure 1 shows two phases of the epidemic: an early emergence phase (grey region) and a phase in which the epidemic is established, and response measures are in place (white region). The mitigated epidemic trajectory is represented by the solid yellow line and an unmitigated epidemic by the grey dashed line. In the earliest stages of pathogen emergence, data will be scarce. By using only information on key biological characteristics affecting transmission, such as the basic reproduction number and generation interval, and assuming that the population is 100% naïve to infection (which is often reasonable in this early phase), the likely impact of public health measures can be estimated. Once response measures have been applied and a substantial fraction of the population infected, data on behaviour and infection incidence are required to estimate the actual impact of those measures and to predict the timing and magnitude of the next epidemic.

Finally, the surveillance capabilities described under Recommendations 1–3 should be established in Australia (Recommendation 4) with appropriate statistical design to ensure efficient use of public health resources (Recommendation 5).

Figure 1: Exemplar policy questions and transmission-related surveillance needs



1. Establish protocols for monitoring biological and epidemiological characteristics affecting transmission

Knowledge of key biological and epidemiological characteristics affecting transmission are critical for epidemic response monitoring and planning.[22] These include measures such as the basic reproduction number, incubation period, and generation interval of the infection. From the earliest stages of the COVID-19 pandemic, estimates of these parameters were used to develop guidelines for case, contact, and outbreak management,[4] and for predicting the trajectory of the pandemic and anticipated impact of interventions.[5,23–26] Ongoing monitoring of such characteristics is also important, since they are expected to vary as the pathogen and host behaviour change through time.[27,28]

Estimating these parameters requires specific types of data. Little if any such data were available through Australia's surveillance systems or special studies; where they were available, the systems and processes to support analysis were largely absent. For instance, to estimate the basic reproduction number and the effective reproduction number,[29] both the observed growth rate in infections and the generation interval[30] are required. The generation interval is most directly estimated using dates of infection from infector-infectee pairs (or using sufficiently detailed household data and transmission modelling techniques). Australia's national response relied on publicly available estimates of the generation interval from international studies of contact tracing data.[9] The only relevant Australian data were also a by-product of contact tracing and outbreak investigations. These data were collected at the state/territory level and were not collated by national data systems to support national epidemic response.

Because collecting relevant data is resource intensive, it is important to consider triggers for when data collection protocols should be activated, such as when a novel pathogen is first detected, or when changes are suspected in an existing pathogen. Therefore, as part of an enhanced surveillance system, we recommend establishing both the surveillance capabilities for epidemiological monitoring of key parameters related to transmission in the Australian setting, and the associated plans to activate and deactivate these methods when required.

2. Establish systems for monitoring infections

Surveillance of infections (as distinct from notified cases) is necessary to track and predict temporal trends in the transmission dynamics of a pathogen in a population. Infection data—capturing information on infections irrespective of symptoms or clinical presentation—also provide a less biased, more stable denominator for assessments of symptomology, clinical severity, risk factors, and intervention effectiveness compared to case data.[17,31–36] Infection data are also essential for making robust projections of future trends in infection and clinical burden,[37] since knowing the time-series of infections (i.e. infection dynamics) is required to understand population susceptibility, which is a major driver of future dynamics. It is difficult to infer the true pattern of infection from case notification data, because reporting of cases is strongly influenced by testing behaviour, which in turn is linked in complex ways to demographic and socioeconomic variables, risk perception, symptoms, and testing recommendations.[38–40] Serosurveys which measure the proportion of the population with immunological markers of infection can provide a snapshot of how many people have cumulatively been infected,[41] but must be combined with other data (e.g., correlates of infection levels) to infer the incidence of infections.

Monitoring trends in infection was recognised in the third iteration of Australia's National Surveillance Plan for COVID-19 (published in June 2022) as one of five surveillance goals, where a national population infection survey was listed as an avenue for further investigation.[13] A key feature of this approach is that it would not rely on infected people interacting with health systems, reducing bias in the resulting data. The United Kingdom's national infection prevalence surveys provided near-real-time insight into SARS-CoV-2 infection dynamics, including infection rates over time by age group[7,8] and timely estimates of vaccine protection against infection and onward transmission from breakthrough infection.[35] Infection prevalence surveys of SARS-CoV-2 were conducted on a small scale in Australia in 2022, including in Perth and the Gold Coast,[42] but these efforts were not scaled to a frequency or size capable of monitoring infection dynamics over time.

The UK experience demonstrated the public health value of infection surveillance. To further develop this capacity in Australia and globally, modelling and statistical research, in conjunction with pilot field studies, are required to optimise and assess the feasibility of this approach within the broader context of respiratory infection surveillance. These considerations are important for both routine surveillance and enhanced emergency response.

3. Ensure systematic collection of behavioural data

Human behaviour is a major determinant of respiratory virus transmission; of the effectiveness of public health interventions; and of the functioning of surveillance activities. Respiratory viruses are transmitted primarily via close contact between infectious and susceptible individuals. Transmission depends on several factors, including the number of in-person contacts made by an infectious individual and the nature of those encounters (e.g., duration of contact). Furthermore, whether infected individuals are recorded within a surveillance system is impacted by behaviour, including people's choices on whether/how they interact with health systems (e.g., test-seeking behaviour) and health care providers' decisions on patient management (e.g., deciding to collect a swab for testing). Compounding these challenges, behaviours are influenced by individual- and area-level socio-demographic and physical environmental factors (e.g., distance to testing centres).[40,43,44]

While the use of behavioural data in understanding infectious disease spread and control is long established, it reached a new scale during the pandemic. Key temporal behavioural data streams that were established and or drawn on for COVID-19 surveillance globally included population-level mobility data published by large technology companies[45] and online surveys administered by research agencies and health authorities.[2] In Australia, national surveillance used a combination of data from Google's Community Mobility Reports (discontinued in October 2022), weekly nationwide surveys administered by the Australian Government Department of Health and Aged Care (established mid-2020 and ongoing as of mid-2023),[13] and weekly surveys administered by FluTracking (established pre-pandemic in 2006).[46] Google reports provided data on time spent by mobile phone users at different types of location and the Australian Government survey captured information on participants' self-reported social contact, precautionary, and test-seeking behaviours. FluTracking collects information on influenza-like illness and test-seeking behaviour. Novel data analytic methods were developed to combine these data streams with case data and other epidemiological data to provide insight into transmission risk[10] and the impact of social restrictions.[47,48]

In addition to behavioural data, the monitoring of knowledge, attitudes, and behaviours in relation to respiratory viruses and control measures[49,50] is also valuable for anticipating and estimating the impact of interventions.[51] While key behaviours relevant to infectious disease surveillance and response have been identified, and methodologies for monitoring them have been established, additional work is required to determine the appropriate frequency of behavioural monitoring as part of 1) routine surveillance and 2) enhanced emergency surveillance.

4. Build Australia's local surveillance capabilities and infrastructure to ensure that public health response can be tailored to the Australian context

Where possible, local data should be collected to enable analyses and responses to be tailored to the Australian context. Much of the data that were critical in guiding Australia's response to COVID-19 were collected by surveillance systems in other countries (Box 1). This was because either none of the required data sources were available locally in Australia, or the data were collected but not available for analysis. In some cases, data were not analysed because they were inconsistently collected or because there were administrative barriers to making them available. For example, the capacity to generate timely estimates of COVID-19 vaccine effectiveness based on Australian data would have helped plan response strategies, particularly given the increasingly divergent variant and vaccine exposure history at the country level which made international data less and less relevant to our context as the pandemic progressed. While mandatory COVID-19 vaccine reporting in Australia (for the purpose of monitoring coverage targets) was an enabler for conducting vaccine effectiveness studies, timely data linkage was lacking.

If a novel pathogen or COVID-19 variant emerged in Australia today, we argue that analyses of data from Australia-wide data systems would not be able to provide a comprehensive early risk assessment to Australian decision-makers, let alone the rest of the world.

5. Implement appropriate statistical designs to maximise the efficiency and utility of surveillance systems

As with any data collection activity, appropriate statistical design principles, such as sampling frameworks, should be employed to ensure surveillance can meet its objectives and maximise data utility while minimising resources. Otherwise, surveillance will generate biased and potentially misleading evidence, with prominent examples from influenza surveillance systems.[52,53]

The first step is to consider how data will be used and whether statistical design principles will be beneficial. For example, where treatment (or isolation) is indicated for cases, best practice is to collect data from as many cases as practical, and hence statistical considerations such as sample size are not relevant for guiding data collection. However, if direct action on the case is not required, it may be wiser to follow only a sample of cases, purposively selected under a rigorous statistical sampling approach.

Statistical design can improve the utility of data resulting from many surveillance activities, and once established, provide budgetary efficiency. For example, case and genomic data collected under an 'as much as feasible' or convenience-sampling approach tend to exhibit strong biases towards certain population groups, levels of disease severity, or transmission settings.[39,52,54] If these biases cannot be robustly quantified, subsequent epidemiological assessments will be similarly biased.[51] Randomised sampling approaches (and application of suitable analytic methods) result in less biased inferences from data and can require less surveillance effort.[54]

Random sampling approaches were developed to a limited degree during Australia's COVID-19 response. The June 2022 iteration of the Australian National Disease Surveillance Plan for COVID-19 describes a random sampling approach for collecting information on the characteristics of cases.[13] The goal of collecting surveillance data (for epidemiological assessment rather than case management) from *all* notified COVID-19 cases became untenable (and unnecessary) for public health authorities in the Omicron era. In response, the New South Wales Government Department of Health (NSW Health) worked with the national surveillance committee to design a sampling approach to case data collection. Fewer people were interviewed and those interviewed were, by design, more likely to be representative of the entire case population, enabling less biased epidemiological assessments.

Australia's national SARS-CoV-2 genomics surveillance plan published in November 2021 provides another example. It outlined a shift from 'comprehensive sequencing to selective and targeted sequencing'.[55] The European Centre Disease Prevention and Control provided similar guidance in May 2021,[56] detailing options for sampling strategies and sample size according to the sampling objective (e.g., situation awareness or novel variant detection) and epidemiological situation (e.g., variant proportion).

The benefits of imbedding appropriate statistical designs into surveillance activities are clear in terms of the epidemiological insights they provide. Statistically informed planning will identify where statistical design can and should be applied to improve utility for a given surveillance activity and policy objective.

Discussion and conclusions

We have argued that a key opportunity to enhance Australia's capabilities in viral respiratory surveillance is through the planned collection of data for estimating disease impact and the effectiveness of interventions. Planned data collection is necessary to robustly inform a range of policy questions: how many people will require a hospital bed? When will an epidemic peak? What combination of interventions are required to maintain hospital capacity? Australia's national surveillance systems were insufficient to robustly address these critically important policy questions. Nor were they designed to do so. Our recommendations focus on surveillance which was impactful during the COVID-19 pandemic but not widely available in Australia, and which should form part of Australia's future viral respiratory pathogen surveillance system.

We recommend establishing (or enhancing existing) approaches to monitoring: biological and epidemiological parameters affecting transmission (Recommendation 1); infection dynamics, as distinct from case dynamics (Recommendation 2); and human behaviours relevant to disease transmission and control (Recommendation 3). We recommend that these capabilities are embedded within Australian viral respiratory pathogen surveillance systems, ensuring the availability of local data streams for epidemic assessment, and reducing our reliance on international data (Recommendation 4). Finally, we recommend applying appropriate statistical design principles when developing data collection protocols to improve data utility while simultaneously minimising surveillance effort (Recommendation 5). The relationship between these recommendations and key policy questions asked during an epidemic is depicted in Box 2.

These recommendations are not intended to be exhaustive. Many other surveillance challenges that are not discussed in this article, because each warrants its own article, must be addressed to enable timely and robust predictions of disease impact and intervention effectiveness. These include (but are not limited to): achieving near-real-time data linkage; developing nationally consistent definitions of key quantities (e.g., hospitalisations); nationally coordinated sharing of data and associated analyses; addressing inequities in surveillance; and expanding analytical capacity (both methods and personnel). Here we chose to focus on data types that are often overlooked by surveillance planners as important components for supporting predictions of disease impact and intervention effectiveness.

The design of a surveillance system should be iterative, flexible, and scalable. Systems must serve the objectives of routine seasonal surveillance and must be rapidly scalable to meet emergency response needs. Flexibility is crucial for meeting distinct epidemic response objectives (e.g., suppression, elimination, eradication)[57] which necessarily change as an epidemic evolves and multiple objectives may need to be balanced (e.g., disease suppression and social equity).

We propose that Australia builds on and learns from its COVID-19 experience during this inter-pandemic period to establish surveillance protocols, supported by criteria for activation and deactivation of the various data collection systems required for decision-making. The design of these systems will be a compromise between the technical ideal and the constraints of funding. Furthermore, they will need to balance the benefits of flexibility and responsiveness against the value of measuring trends over time.

The implementation of our recommendations would require a major shift in public health surveillance culture and practice in Australia. Many of the required data collection activities we propose are typically considered research activities and hence have not traditionally fallen under the direct remit of public health surveillance. This must change. Further, we propose that public health surveillance should encompass any data collection for which the primary purpose is to support public health actions and disease management.

Strengthening Australia's disease surveillance systems has been identified as a priority for the newly established ACDC.[14] The implementation of our surveillance recommendations would enable more robust, timely, and impactful epidemic analysis, enhancing public health decision-making and thus improving health outcomes.

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This article's recommendations derive from discussions held at an academic-led workshop among a diverse group of infectious disease surveillance professionals from both academia and the public sector. We thank the workshop participants for their contributions to the workshop. We also thank Prof. Jenny Firman for facilitating the workshop discussions. The article's discussion and recommendations reflect the consensus views of the authors. They do not necessarily reflect the opinions of all individuals involved in the workshop, nor the views or policies of the organisations they represent.

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