

PLANNING FOR PANDEMIC INFLUENZA SURVEILLANCE IN NSW

*David J Muscatello, Michelle A Cretikos,
Mark J Bartlett and Tim Churches*
NSW Department of Health

Ian W Carter
Microbiology Department, St George Hospital

Keith Eastwood
Hunter New England Population Health

Leon G Heron
National Centre for Immunisation Research and
Surveillance

Kenneth A McPhie
Institute of Clinical Pathology and Medical Research

ABSTRACT

Early detection of a novel strain (genotype) of influenza virus in the NSW population is the key to controlling a pandemic. If this occurs, ongoing surveillance will help determine the epidemiology and risk factors of the virus as well as its impact on essential services. Important components of surveillance preparedness in NSW include: border surveillance; hospital-based screening for suspected cases; protocols for efficient transport and testing of viral specimens; flexible, robust electronic tools for rapid surveillance data collection; management and reporting; and creation of surveillance surge capacity.

This report is presented in two parts: the first part describes the factors and challenges that need to be considered in planning a surveillance system for pandemic influenza in NSW and the second reviews international and national surveillance planning guidelines and introduces NSW surveillance plans.

The broad objectives of surveillance for pandemic influenza in Australia are to:

- detect a novel influenza virus strain (genotype)
- monitor for cases of that strain in both animals and humans
- monitor the development and progress of a pandemic if the strain becomes capable of efficient human-to-human transmission
- monitor the impact of the pandemic on the population and on essential services
- provide epidemiological intelligence. (Epidemiological intelligence involves compiling statistical information that can reveal the natural history of the disease, the mode of transmission, the geographic spread of disease, and the population groups that are at greatest risk of infection, serious illness and death.)

The information generated from all surveillance activities must be capable of being rapidly collected, managed and communicated to inform public health action.

The challenges posed in planning and developing pandemic influenza surveillance systems, both internationally and

in Australia, are that: the epidemiological characteristics of the next pandemic strain are as yet unknown; the role of animal reservoirs in the development of a pandemic influenza virus is unknown; establishing effective methods for border surveillance involves numerous difficulties; and managing the enormous volume of data generated by both surveillance and public health response activities will also be difficult.

Because a new influenza virus capable of causing a human pandemic has not yet emerged, the epidemiological characteristics of such a virus remain unknown. Despite this, the generally short incubation period (one to three days) of known influenza viruses and the potential for rapid spread¹ mean that mechanisms for rapid identification of the first cases occurring or arriving in Australia are essential.

While our understanding of the role of animal reservoirs in facilitating genetic re-assortment of influenza viruses has increased, the probability of the virus evolving into a strain capable of efficient human-to-human transmission also remains unknown.² The need for vigilance has been underscored by the recent bird-to-human transmission of a genetic lineage of the H5N1 avian influenza virus, which has caused more than 250 confirmed cases of human disease and over 150 human deaths³, representing a case fatality rate of 59%. Until efficient human-to-human transmission occurs, the linkage between animal and human health surveillance must be strongly maintained, and consequently human and animal disease activity and influenza viral lineages are being closely monitored internationally. Fortunately, the risk of the introduction of this virus to Australia through animal populations is thought to be low because the main host of the virus—waterfowl such as ducks, geese and swans—do not migrate to Australia.⁴

It is most likely that a pandemic strain of the influenza virus will develop overseas and arrive rapidly in Australia by international air travel. The major gateway for international travellers in Australia is NSW, or more specifically Sydney Airport, which has approximately 13,000 international arrivals daily.⁵ While increased surveillance at entry points could improve detection of the first cases arriving in Australia, infected cases could also enter the community before symptoms develop.

With the advent of a pandemic, the volume of surveillance information to be managed could grow enormously. An often underestimated and under-emphasised component of preparedness is the need to develop and test electronic tools that facilitate rapid, reliable and efficient collection, analysis and dissemination of surveillance information. Geographic information systems, for example, can be useful for describing disease spread. The Internet is a powerful and flexible resource that can be harnessed for secure capture and dissemination of information. The need for personnel with the skills to develop, manage, and use these tools cannot be underestimated.

INTERNATIONAL SURVEILLANCE PLANNING

World Health Organization

The World Health Organization (WHO) outlines the following surveillance priorities for each phase of a pandemic.

During inter-pandemic periods when no new influenza virus subtypes are circulating in humans and the risk of humans becoming infected by a subtype circulating in animals is low (WHO Phase 1), the focus is on detecting novel influenza strains and strengthening preparedness at all levels of government.⁶

If an influenza virus subtype circulating in animals poses a substantial risk of human disease (WHO Phase 2), then the surveillance in affected countries focuses on early detection of disease transmitted to humans from other species.⁶

During the pandemic alert period (WHO Phases 3 to 5), when infection of humans with a subtype of the influenza virus with pandemic potential has been confirmed, but human-to-human spread remains limited, affected countries and countries likely to receive infected animals or people need to be vigilant in surveillance for individual cases of disease. As the frequency of human-to-human transmission increases, these activities will intensify and provision for surveillance and laboratory surge capacity needs to be activated. The resulting data will allow crucial assessment of the epidemiology of the subtype in humans. As the risk increases in affected countries, unaffected countries also need to intensify all surveillance measures.⁶

With the development of an influenza virus subtype that has sustained and efficient transmission between humans (the pandemic period—WHO Phase 6), affected countries must be able to identify geographic spread to facilitate containment at the front-line of disease transmission. At this stage virological confirmation of each case becomes less important because a clinical case definition will be acceptable for surveillance purposes. Ongoing situational assessment during the pandemic should include population morbidity and mortality, identification of groups most at risk, health care and other essential worker availability, health-care and mortuary capacity, and general rates of employee absenteeism. Virological surveillance will be maintained at a reduced level to detect further antigenic drift (mutation of the virus that could alter its disease-causing characteristics). Because of the potential for waves of transmission, subsidence of the pandemic will not permit complacency but will mark a return to enhanced surveillance to identify a reappearance of large-scale transmission.⁶

Other international plans

Pandemic surveillance plans vary from country to country. Selected features of surveillance planning in other countries include: Canada recognises the need for emergency department surveillance, real-time influenza-related death surveillance, management of laboratory demand and supply issues, and improved communication strategies among

stakeholders.⁷ Both Canada and the United Kingdom have highlighted the importance of tracking the immune status of individuals to identify those susceptible to a second wave of infection or who may be available as an immune workforce for deployment.^{7,8} The United Kingdom conducts syndromic surveillance for respiratory infections using its National Health Service telephone help-line.⁹ The United States is placing a strong emphasis on requirements for laboratory infrastructure, capacity and procedures, shifting from seasonal-only to year-round routine influenza surveillance, and real-time surveillance of laboratories, emergency departments, intensive care wards and other inpatient settings, and deaths.^{10,11} New Zealand identifies astute clinicians as key players in early identification and reporting of the arrival of pandemic influenza and advocates the use of simple, flexible, consistent, re-usable and multiple-purpose surveillance systems.¹²

THE AUSTRALIAN CONTEXT

The recently released Australian Health Management Plan for Pandemic Influenza¹³ emphasises the importance of early and efficient containment strategies that rely heavily on sensitive surveillance mechanisms. This plan also describes the national surveillance systems that track international disease outbreaks, as well as providing a mechanism for disease surveillance within Australia. This plan emphasises the need for heightened border control and quarantine activities, and the need to strengthen capacity to identify new strains of influenza viruses.

If the risk to Australia of the introduction of a pandemic strain increases, important players in surveillance will include public microbiological laboratory facilities, particularly viral reference laboratories and the WHO Collaborating Centre for Reference and Research on Influenza (www.influenzacentre.org) in Victoria; primary care providers, including general practitioners and pharmacists; hospital clinicians; public health practitioners; passenger management personnel in airports and seaports; Australian Quarantine and Inspection Service officers; and national and state governments. Some viral reference laboratories are designated WHO National Influenza Centres. These include the Institute for Clinical Pathology and Medical Research (ICPMR), the Victorian Infectious Diseases Reference Laboratory (VIDRL), and the Western Australian reference laboratory (PathWest).

NSW SURVEILLANCE PLANS

The NSW surveillance plan is based on the surveillance and monitoring plan of the *NSW Health interim influenza action plan*.¹⁴ The plan is structured according to the NSW emergency management framework of prevention and preparedness, response and recovery.¹⁵ The response stage has been divided into early containment, later containment, and maintenance stages. Specific actions that address the surveillance requirements of each stage have been identified. A summary of the surveillance strategies developed by NSW, according to the stage of the pandemic response, is provided in Table 1.

In relation to border surveillance, a team of nurses has been trained for deployment at short notice to Sydney international airport to screen passengers for influenza-like illness if the risk of cases arriving in Australia increases.

At the early and later containment stages, rapid case identification will be facilitated by advising patients with symptoms of influenza-like illness to attend the

nearest hospital emergency department. At the emergency department, the person will be screened using the case definition for a suspected case and, if necessary, re-directed to an isolation zone or influenza clinic at the emergency department. Case management and viral specimen collection, transport, testing and result reporting protocols will ensure that public health personnel quickly become aware of suspected and confirmed cases.

TABLE 1

SUMMARY OF NSW SURVEILLANCE ACTIVITIES ACCORDING TO THE STAGE OF THE PANDEMIC IN AUSTRALIA

Stage	Goal(s) of surveillance	Surveillance activities
<p>Inter-pandemic No or extremely limited evidence of human-to-human transmission globally</p>	<p>To monitor overseas and Australian influenza activity, and to review and strengthen existing systems and assess readiness for response.</p>	<ul style="list-style-type: none"> Disseminate national and international influenza situation reports. Conduct year-round syndromic surveillance of influenza-like illness and continue seasonal enhanced laboratory-based surveillance. Develop effective communication protocols for the exchange of surveillance information among clinicians, laboratories, hospitals and the community. Develop effective local case finding, communication, data collection and management tools and plans. Identify and train personnel that could provide surge capacity for surveillance activities if the risk of a pandemic increases. Test surveillance systems within broader pandemic exercises
<p>Early containment Evidence of human-to-human transmission overseas; no local transmission in Australia</p>	<p>To enable early identification of cases of pandemic influenza in Australia so that further transmission within Australia can be prevented or slowed.</p>	<ul style="list-style-type: none"> Area health services with international entry points to conduct international border (entry) passenger screening. Implement area health service processes for: <ul style="list-style-type: none"> case finding by active surveillance and screening for suspected cases at emergency departments and influenza clinics timely transportation of clinical specimens for laboratory testing timely collection, collation, analysis and reporting of data obtained from case finding and tracing of contacts of cases. Maintain and deploy personnel with the necessary skills to provide surveillance surge capacity.
<p>Later containment Evidence of human-to-human transmission in Australia</p>	<p>To identify geographic spread in Australia, to limit or delay further spread within Australia and to other countries and to inform public health action.</p>	<ul style="list-style-type: none"> Area health services with international entry points to conduct international border (entry and exit) passenger screening. Continue to support area health service processes for: <ul style="list-style-type: none"> case finding by active surveillance and screening for suspected cases at emergency departments and influenza clinics timely transportation of clinical specimens for laboratory testing timely collection, collation, analysis and reporting of data obtained from case finding and tracing of contacts of cases. Maintain and deploy personnel with the necessary skills to provide surveillance surge capacity. Conduct health care worker influenza-like illness surveillance and monitor absenteeism in health-care workers.
<p>Maintenance Evidence of increasing human-to-human transmission beyond the capacity to contain the disease</p>	<p>To monitor and describe changes in the epidemiological characteristics of the virus to inform ongoing public health action and the capacity of the health system to provide services, and to delay spread to other countries.</p>	<ul style="list-style-type: none"> Consider 'winding-back' resource intensive strategies implemented in the early and late containment stages, particularly: individual case finding; detailed and intensive case management and data collection; and heightened transportation and tracking of laboratory specimens. Analyse information from influenza clinics to monitor transmission and describe the epidemiological characteristics of the virus, and inform public health action and service provision.
<p>Inter-pandemic or inter-wave Decreasing transmission within Australia</p>	<p>To monitor and describe changes in the epidemiological characteristics of the virus to inform public health action and to monitor the capacity of the health system to return to normal service provision.</p>	<ul style="list-style-type: none"> Consider recommending the resource intensive strategies implemented in the early and late containment stages, particularly individual case finding; detailed and intensive case management and data collection; and heightened transportation and tracking of laboratory specimens, in order to identify and possibly contain a resurgence in transmission of the influenza virus (the second wave). Analyse information from influenza clinics to monitor transmission and describe the epidemiological characteristics of the virus, monitor service provision, and inform public health actions.

Given the time-critical nature of pandemic surveillance and response, the Population Health Division of the NSW Department of Health is focusing on several important electronic, internet- and intranet-based infrastructure developments. These resources will provide a strong foundation for the rapid and effective surveillance and response capability demanded by pandemic influenza and other health threats that have emerged in recent years. These include:

- automated electronic reporting of scheduled medical conditions by laboratories
- near real-time syndromic surveillance of emergency department visits¹⁶, currently monitoring 33 urban and regional emergency departments and being expanded to a total of 50
- 'open source' web-browser-based software tools for outbreak data collection, laboratory specimen tracking, data analysis and case management (NetEpi: <http://sourceforge.net/projects/netepi>)
- flexible, web browser-accessible geographic information systems (GIS) and geocoding (translation of localities into geographic map coordinates) systems (FEBRL: <https://sourceforge.net/projects/febrl/>).

Surge capacity for surveillance data collection, collation, analysis and reporting will be drawn from staff within the NSW health system who may not routinely perform public health functions, but who have skills in telephone work, data entry, database development and management, statistical work and report development. These staff will need to be identified and trained to ensure their readiness for deployment at short notice.

CONCLUSION

Two recent papers have discussed the strengths and shortcomings of influenza preparedness plans in the Asia-Pacific area (which includes Australia) and the United States. Within the Asia-Pacific plans, surveillance strengths were found to be the linking of animal and human health, and the recognition of the need to strengthen surveillance and laboratory capacity. Weaknesses included inconsistency of local phase definitions with WHO phases, which could lead to confusion in the event of a crisis.¹⁷ The review of United States state-level preparedness highlighted the lack of real-time surveillance in most states, and the time delays inherent in the existing surveillance systems.¹⁸

NSW is well advanced in addressing many of these surveillance challenges. Details are still being finalised and will be included in the final pandemic action plan.

REFERENCES

1. Heymann, DL, editor. *Control of communicable diseases manual*. 18th Ed. Washington, DC: American Public Health Association, 2004.

2. World Health Organization. Responding to the avian influenza pandemic threat. Geneva: World Health Organization, 2005.
3. World Health Organization. Cumulative number of confirmed human cases of avian influenza A/(H5N1) reported to WHO. Geneva: World Health Organization, 31 October 2006. Available at: www.who.int/csr/disease/avian_influenza/country/cases_table_2006_10_31/en/index.html.
4. Australian Government Department of Agriculture, Fisheries and Forestry. Bird flu risk real but not high. Media Release DAFF06/3D; 10 March 2006. Available at www.daffa.gov.au/about/media-centre/dept-releases/2006/bird_flu_risk_real_but_not_high.
5. Southern Cross Airport Corporations Holding Limited. *Southern Cross Airport Corporations Holding Limited 2006 annual report*. [Sydney?]; Southern Cross Airport Corporations Holding Limited, 2006.
6. World Health Organization. *WHO global influenza preparedness plan*. Geneva: World Health Organization, 2005.
7. Health Canada. *Canadian pandemic influenza plan*. Ottawa: Health Canada, 2004. Available from www.phac-aspc.gc.ca/cpip-pclcpil/.
8. UK Department of Health. *UK influenza pandemic contingency plan*. 2005. Available from: www.dh.gov.uk/PolicyAndGuidance/EmergencyPlanning/PandemicFlu/fs/en
9. Doroshenko A, Cooper D, Smith G, Gerard E, Chinemana F, Verlander N et al. Evaluation of syndromic surveillance based on National Health Service Direct derived data—England and Wales. *MMWR Morb Mortal Wkly Rep* 2005;54 Suppl:117–22.
10. US Homeland Security Council. *National strategy for pandemic influenza*. US Government, 2006. Available from www.whitehouse.gov/homeland/pandemic-influenza-implementation.html.
11. US Department of Health and Human Services. *HHS pandemic influenza plan*. US Department of Health and Human Services, 2005. Available from www.hhs.gov/pandemicflu/plan/.
12. New Zealand Ministry of Health. *New Zealand influenza pandemic action plan*. Wellington: New Zealand Ministry of Health, 2006. Available from www.moh.govt.nz/moh.nsf/indexmh/pandemicinfluenza-resources-plans.
13. Australian Government Department of Health and Ageing. *Australian health management plan for pandemic influenza*. Canberra: Commonwealth of Australia, 2006.
14. Population Health Division. *NSW Health interim influenza pandemic action plan*. Sydney: NSW Department of Health, 2005.
15. NSW Government. *Human influenza pandemic plan*. Sydney: NSW Government, 2006.
16. Muscatello DJ, Churches T, Kaldor J, Zheng W, Chiu C, Correll P et al. An automated, broad-based, near real-time public health surveillance system using presentations to hospital emergency departments in New South Wales, Australia. *BMC Public Health*. 2005; 22; 5: 141. Available from www.biomedcentral.com/1471-2458/5/141.
17. Coker R, Mounier-Jack, S. Pandemic influenza preparedness in the Asia-Pacific region. *Lancet* 2006; 368: 886–9.
18. Holmburg SD, Layton, CM, Ghneim GS, Wagener DK. State plans for containment of pandemic influenza. *Emerg Infect Dis* 2006; 12: 1414:1417. ☒