

## INVESTING IN CAPACITY TO MEET THE CHALLENGE OF AN INFLUENZA PANDEMIC

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We welcome you to the second issue of the *NSW Public Health Bulletin* that is devoted to aspects of influenza pandemic planning and response. Recent simulation exercises designed to test preparedness for pandemic influenza, Exercise Cumpston 06 on a national scale and Exercise Paton in NSW, have shown that the public health system in NSW has made substantial progress in preparing for what many consider to be an inevitable event. Of equal, if not greater, importance is a recognition that the work done has strengthened the health system's capacity to meet a much wider range of challenges. This work is the focus of this issue of the *Bulletin*.

The opening article by Letts, 'Ethical challenges in influenza pandemic planning', highlights a number of domains where the common good, individual rights and individual responsibility may conflict. In addition to the need to isolate or quarantine infectious or potentially infectious individuals to protect the health of the population, the overwhelming nature of a pandemic raises the likely need to ration health resources such as influenza antiviral medications, critical care beds, ventilators and vaccine (if one is available). Furthermore, experience with SARS has raised questions about the obligations of healthcare workers to patients when clinical care entails a significant risk to the worker's own health or that of their family. In order to deal with the likely surge of patients, it may be necessary to assign less experienced personnel, such as students or retired health professionals, to clinical or public health duties. Through all these possibilities, the message is reiterated: an ethical framework for clinical and public health care and workforce management is required, and this framework should be transparent, appropriate and consistently applied throughout the NSW health system.

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The soon to be published 'Primary care annex' of the Australian Health Management Plan for Pandemic Influenza<sup>1</sup> outlines the roles of general practitioners, community health services and community pharmacists in a pandemic, and will provide guidance for their preparations. Moore's paper, 'A general practice perspective of pandemic influenza', prompts general practitioners to think about what they will need to do before and during a pandemic. Moore encourages them to maintain close links with their local Division of General Practice and their local public health unit. Their staff will need to be aware of local pandemic-related health services and know, for example, how to refer a patient to the nearest public hospital influenza clinic (formerly referred to as a 'fever clinic'). The article provides a framework to inform planning and, as Moore states, this will leave practices better able to do their normal work or to respond to simpler crises such as a case of measles or unexpected staff absences.

The importance of planning in general practice reminds us of the need for all organisations to have contingency plans for sustaining key functions and remaining viable during a pandemic, when there may be high rates of employee absenteeism, breakdowns in the supply chain of some goods and a fall in demand for some services. Dalton, in 'Business continuity management and pandemic influenza', observes that getting ready for a pandemic is not solely the province of health authorities, nor even of government, which does however have a clear duty to keep the community informed of risks. His article proposes actions that governments, businesses and individuals can take to minimise these risks. Businesses may be adept at responding to mechanical, infrastructure and supply difficulties but may have less experience in incorporating the human element into contingency planning. Likely concern among staff about the spread of contagion in the workplace, consequent risks to family members (especially children), and fear of being unable to gain access to health services or resources can be met by including staff in planning processes and providing staff with information from authoritative Australian sources. The proposed NSW Health communication strategy is outlined by Geddes in this issue.

Among the strides forward that have been made in Australia in preparing for a pandemic is the enhanced coordination and referral capacity among clinical microbiology laboratories. In the early phases of a pandemic, prompt detection and reporting of the influenza A pandemic strain will be necessary for controlling the pandemic, as it is key to the public health management of cases and contacts. However, in addition to the diagnosis of the pandemic strain, a small number of reference laboratories will need to characterise the virus as a prelude to vaccine production and to provide profiles of antiviral drug susceptibility to guide the use of these agents in influenza prophylaxis and treatment.

Dwyer and colleagues, in 'Challenges for the laboratory before and during an influenza pandemic', summarise the variety of testing modalities available for diagnosis and their respective advantages and disadvantages.

The timely and effective gathering, analysis and dissemination of data are essential to the proper management of any emergency, and will be critical during the early phases of an influenza pandemic if containment is to be achieved. Reliable reporting of surveillance data by NSW to the Australian Government will be necessary to allow a coordinated national and international response. The Australian Government in turn must comply with good practice described in the recently revised International Health Regulations<sup>2</sup>, by demonstrating prompt and accurate reporting of diseases of international public health concern to the World Health Organization. In recent years, NSW Health has developed multiple approaches to health surveillance that will enable an effective response to both old and emerging public health threats. These approaches are described by Muscatello and colleagues in the article 'Planning for influenza pandemic surveillance in NSW'. Statutory case-based reporting by clinicians and laboratories in accordance with the *Public Health Act 1991 (NSW)* is complemented by a near real-time system for collating and analysing reasons for patient presentations to hospital emergency departments. This latter system has the ability to detect sudden increases in the number of patients presenting with specific combinations of symptoms, including influenza-like illness. Further developments and improvements in both systems, including the staged introduction of electronic transfer of laboratory notifications and the linking of influenza diagnostic data from animal and human sources, will place NSW in a good position to provide timely and accurate data for public health action.

While there are substantial costs involved in preparing our health system and society for a future pandemic and exercising key elements of our response, the likely deleterious nature and magnitude of the event justifies the scale of this investment. In addition, if pandemic preparations result in a health system that is better equipped to respond to major public health crises, this will deliver a significant return on our investment.

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# ETHICAL CHALLENGES IN PLANNING FOR AN INFLUENZA PANDEMIC

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## ABSTRACT

Pandemics have devastated humankind throughout history and the threat they pose is just as great now, at the beginning of the 21<sup>st</sup> century. Managing a public health emergency of the scale and complexity of a pandemic, and with the potential societal ramifications, poses enormous challenges. Public health planners must grapple with the intersection of competing values and priorities. This article provides a preliminary discussion of some of these ethical issues, specifically the necessary limitations on individual liberty posed by quarantine, the unavoidable need to prioritise health care resources, and the complexities associated with the obligations of health care professionals.

Planning how Australia will respond to an influenza pandemic touches on multiple core ethical issues for public health. Australia is currently renewing its plans for dealing with a potential influenza pandemic, as outlined by Horvath.<sup>1</sup> While this is a complex challenge, many of the associated ethical issues are grappled with on a daily basis. Nonetheless, the scale and context of this kind of public health emergency may justify solutions than are different to those used in non-pandemic conditions. This article briefly discusses some general principles for achieving fairness and public cooperation in managing pandemic influenza, and specifically examines the relevant ethical issues associated with quarantine, limited health care resources, and the obligations of health professionals.

## PRINCIPLES FOR MANAGING PUBLIC HEALTH EMERGENCIES

Various authors have articulated criteria for managing public health emergencies.<sup>2,3,4,5</sup> They propose considered approaches to managing such emergencies, but they recognise that successful containment and eradication of an infectious disease threat usually requires the imposition of constraints on the freedoms of citizens by voluntary, or sometimes compulsory, means.

A public health emergency like the recent SARS outbreak understandably generates anxiety. However, if introduced with care and sensitivity, public health measures can harness energy and generate a community spirit of cooperation that may be important for the successful containment and eradication of an influenza pandemic. The following principles are important in achieving fairness and public cooperation.<sup>3</sup> First, a public health intervention, whether it involves testing, treatment, vaccination, quarantine or isolation, must be *necessary and effective*; that is, the public health threat must be serious and likely, and there must be

a sound scientific basis for the intervention. Where there is a range of possible restrictions, the *least restrictive* one should be used first, providing it will effectively respond to the threat. There should be *transparency* of official decision-making during a pandemic; that is, decisions should be made in an open and accountable manner. This extends to honesty with the public where there may be lack of conclusive evidence for the value of various forms of community hygiene, such as wearing masks in public settings.

Public health officials also need to be *flexible and responsive* to an evolving pandemic, given that scientific knowledge about the disease and its transmission will be incomplete, at least at the outset of the pandemic. Finally, *consistent* implementation of public health guidelines is also essential, unless need dictates otherwise. Inconsistency in statements to the public about such measures may foster perceptions of unfairness, undermine support for compulsory measures, and suggest that the threat is not as serious as officials claim.

## ISOLATION AND QUARANTINE

Isolation, quarantine and voluntary social distancing measures (such as home quarantine or 'sheltering in place'<sup>6</sup>) raise questions about restraining freedom for the common good. This is more problematic in societies such as our own, which value individual liberty. However, balanced against individual liberty are arguably greater concerns about the costs of failing to apply these restrictive measures, or failing to do so in a timely manner, and the potentially preventable increase in collective morbidity and mortality.

A practical concern with quarantine or similar measures is the potential to drive influenza cases 'underground' should the public perceive that restrictive measures have been applied too early, inequitably, or without adequate clinical justification. Lack of compliance with restrictive measures has also occurred where individuals believe they have compelling reasons to ignore such directives, such as loss of income and/or the need to support dependants.<sup>7</sup> Extreme heavy-handed tactics, such as use of the military to enforce quarantine, are likely to destabilise a community by creating panic, causing people to flee and spread disease. This occurred in China where a rumour that all of Beijing would be quarantined during the SARS epidemic led to 250,000 people fleeing the city overnight.<sup>6</sup> Clearly, a significant issue is how quarantine or social distancing measures can be applied to optimise compliance. This means leveraging more than just people's instinct for self-preservation. Rather it requires catalysing a community's sense that there is more to be gained through co-operation. In Toronto during the SARS outbreak 'home quarantine' measures received overwhelming co-operation.<sup>9</sup> The critical elements appear to be that decision-makers provide adequate

and transparent justification for measures; that adequate social and economic supports are provided to enable people to remain in their homes; and that there is an appeal process for individuals retained in compulsory quarantine.

The current Australian Health Management Plan for Pandemic Influenza is optimistic about the likelihood of containing a pandemic in this country.<sup>9</sup> It proposes the judicious use of quarantine and social distancing measures as part of a combined approach to maximise the containment phase of the pandemic and 'buy time' until a vaccine is developed. If containment is successful, this would result in the least net harms for the population.

## **PRIORITISATION OF HEALTH CARE RESOURCES**

### **Prioritisation of anti-viral drugs**

In the event of a pandemic, Australia is now relatively well placed internationally in terms of the available stockpile of anti-viral drugs to be used for treatment and prophylaxis until a pandemic influenza vaccine is developed. Nonetheless, there will never be sufficient anti-viral drugs to provide blanket prophylaxis of the entire population and thus some targeted use will always be required. The question is, on what basis should this limited resource be allocated? Should it be according to level of risk (be that through potential exposure or pre-exposure morbidity) or potential for individual benefit, or according to age, social utility or some other criteria?

Most pandemic plans recognise health care professionals as a priority group to receive antiviral prophylaxis, both because they will be the first line of defence in a pandemic, and because they will have to maintain a health service response for the entire community. This prioritisation must be weighed against the value of providing prophylaxis to other emergency personnel such as police, fire fighters, armed forces, and key emergency response officials, in addition to essential service providers such as transport workers and funeral providers. The aim of having these priorities is to achieve the greatest military good, enabling individuals to 'return to the fight' in maintaining threatened health systems and essential community services, hence supporting the 'fabric of society'.<sup>10</sup>

However, this approach to prioritisation also requires appropriate assessment of the risk of exposure to the influenza virus among and within these groups. It could be argued that society has a reciprocal moral obligation to provide for those who voluntarily expose themselves to high-risk circumstances through providing health care to the community, especially where the risk involves a life threatening illness. If we accept this argument, these 'front line' workers should be accorded priority for anti-viral prophylaxis and treatment, as should ancillary workers other than health professionals with equivalent risk in front-line settings. There would thus be health professionals in non-clinical settings who did not warrant top priority for

anti-viral prophylaxis, and similarly some essential services workers would become a second tier priority. This more nuanced approach, taking account of essential groups that must function during a pandemic and the relative levels of exposure within them, is largely the approach taken in the current Australian Health Management Plan for Pandemic Influenza<sup>9</sup>.

An alternative approach, and one that is not strongly reflected in the Australian Health Management Plan for Pandemic Influenza, is to allocate on the basis of greatest medical utility, or the related obligation to protect the vulnerable in society. This would include priority prophylaxis for those at high risk of severe or fatal outcomes following influenza infection, such as the elderly or those with high-risk medical conditions.

A third approach is based on recognising that a large-scale pandemic would pose great risk to the economic viability of society and that maintaining a functioning society will require an operational workforce. Using this approach, the (less defensible) strategy might be that anti-viral drugs should be prioritised to healthy adults who are in the workforce.

Whatever drug prioritisation approach is used, an unintended consequence may be personal stockpiling of anti-viral drugs purchased from unregulated sources. Persuading people not to stockpile is extremely difficult, in part because of difficulties managing individuals' perceptions of risk compared to actual risk. Unregulated personal use of anti-viral drugs may result in unnecessary or premature drug administration. This jeopardises the ability, critical during a pandemic, to minimise harms associated with either drug wastage or drug resistance. Individual prescribers may receive requests for anti-viral drugs outside public health guidelines. However, during a pandemic, a clinician's obligation to the common good supersedes that towards an individual patient.<sup>3</sup> In a public health emergency, a preferential decision for one patient may have a significant impact on the epidemic as well as on public trust and perceptions of fairness.<sup>3</sup> Such requests must be refused.

### **Access to intensive care unit beds**

Under non-pandemic conditions, patients are admitted to an intensive care unit (ICU) largely on a first come, first served basis. During a pandemic there will almost certainly be a significant increase in demand for these beds as large sections of the population develop rapid onset pneumonia that requires mechanical ventilation. At some point, demand for ICU support may outstrip resources.<sup>11</sup>

A first come first served system is unlikely to provide an equitable or effective use of resources in conditions of extreme scarcity. It is feasible that a worst-case pandemic scenario may be more akin to a wartime mass casualty situation. At some point, alternative strategies, be they military triage strategies or other approaches that sort and

prioritise patients for treatment, may need to be adopted.<sup>13</sup> Such prioritisation criteria would need to include not only consideration of patients' acuity, but also, and arguably more importantly, the prospects of surviving. The implication is that it would not be possible to treat all patients with the level of care that is normally possible, and indeed that the very sickest patients might be accorded a lesser priority for medical treatment than those less severely ill patients with better prospects of survival. A fair prioritisation process would require that all patients, whether they have influenza or not, be subject to the same criteria for ICU admission and treatment, and that the same criteria be applied in all hospitals.

A further ethical consideration might be: how should the interests of patients already in ICU who may be deteriorating in spite of treatment, or failing to improve, be considered against those of new presenting patients also likely to die without ICU support? Ultimately, difficult decisions to refuse ICU admission, or withdraw treatment in order to allow admission of patients who are more likely to survive, may be needed. The obligation to continue providing alternative care in such circumstances remains. However, this raises questions about permissible harms, even under emergency conditions, as well as concerns about the fraught process of quantifying and comparing the potential therapeutic benefits of treatment to individuals. It also raises questions about what should be done if disputes about such triage decisions arise with patients' families, and the extent of legal vulnerabilities of health professionals making such decisions. At the least, it would extract a great personal toll on those making, and acting, on those decisions.

Should a pandemic escalate and demand on ICU beds become extremely critical, it is imaginable that implicit or explicit 'social worth' considerations might influence perceptions of appropriate use of ICU resources. The potential ramifications of giving preferential treatment to individuals on any social grounds are disturbing. While some factors, such as having dependants, are arguably a more legitimate reason for seeking preferential treatment, it is less defensible but feasible that those of high office, socio-economic standing, celebrity status or professional position might also attempt to seek special treatment. Conversely, the most socially disadvantaged in the community might be subject to exclusion and injustice.

#### **'OBLIGATIONS TO TREAT', ALTERED STANDARDS OF CARE AND WORKFORCE ISSUES**

Health professionals may be required, despite the availability of personal protective precautions, to treat patients in circumstances that pose significantly heightened personal risks, including risk of death. In addition, their professional role may jeopardise the safety of those close to them, such as partners and dependants, who may contract

disease. At what point, if any, may a health professional refuse to provide care on the basis of personal risk?

There is a commonly understood notion that health professionals' responsibilities have always entailed, and always will entail, acceptance of some degree of personal risk (from infectious disease, or violent patients), notwithstanding the obligations of employers to provide adequate occupational risk protection. This is arguably analogous to other professions, such as fire fighting, where some degree of risk is inherent to the work. However, both international and Australian professional medical and nursing codes of practice remain silent on obligations where a health professional faces significant personal risk in discharging his or her duties.<sup>13,14,15,16</sup> This situation is different to that in which a health professional refuses to provide treatment on 'conscientious' grounds: where he or she has a moral objection to the proposed treatment.

Professional bodies might be encouraged in future to formulate their codes to take a middle ground approach: one that neither coerces health professionals into providing care through problematic notions of enforceable duties nor allows strongly self-interested health professionals to withdraw care unchecked. Taking on some degree of professional risk where unavoidable should arguably be encouraged as an expectation of professional practice. However, in some circumstances, health professionals should not be coerced into providing care when, in good faith, they have moral difficulty doing so under high risk conditions, in particular where they perceive that taking this risk would conflict with their other obligations (for example, to dependants).

If some health professionals refuse to work in a pandemic because of the perceived risk to themselves or their dependents, this will significantly reduce the system's ability to cope with a pandemic, especially as staff numbers will already be reduced because of staff sickness or absenteeism. Staff to patient ratios are likely to be modified as part of a response. In addition, should a pandemic become widespread, large numbers of temporary staff may be recruited, including retired or trainee staff (such as medical and nursing students) or untrained volunteers. While different models of care will provide the best possible level of supervision and care under the circumstances, using such staff will inevitably challenge supervising health professionals' sense of professional responsibility should adverse patient events occur. Thus, the challenge for the community will be the need to accept that 'best practice' is context specific, and that at some point it will no longer be reasonable to expect the standards of care that exist under non-pandemic conditions.

#### **CONCLUSION**

Preparing to ensure the successful containment of pandemic influenza requires the ongoing efforts of public health officials, government, health professionals, and the

community. This involves planning appropriate responses and contingency plans before the public health crisis occurs, and considering the ethical underpinnings of these choices. Few pandemic plans, either in Australia or overseas, articulate an ethical framework that would guide difficult decision-making during such a public health emergency. Developing an ethical framework is likely to require significant deliberative processes, but may yield clarity and aid widespread understanding and cooperation in the event of a pandemic.

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# A GENERAL PRACTICE PERSPECTIVE OF PANDEMIC INFLUENZA

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## ABSTRACT

During an influenza pandemic, general practice will inevitably be involved at the front line; however, the nature of the role is likely to vary between jurisdictions and between metropolitan and rural locations. While most of the plans for general practice are still in evolution, measures that general practices can take to prepare for a pandemic include: reviewing the practice's infection control measures; ensuring all at-risk patients are immunised against seasonal influenza and pneumococcus; routinely advising all patients with viral upper respiratory tract infections on infection control techniques; connecting the practice to broadband Internet to aid communication; employing a practice nurse; and appointing a practice pandemic coordinator. General practices should start their preparations now.

What will the role of general practice be in the management of pandemic influenza in Australia? Like so many things in medicine, the answer is 'It depends'. It depends on some unpredictable variables such as the virulence and infectivity of the virus and the effectiveness of preventive and curative interventions. It also depends on variables we can shape and influence, such as the readiness, responsiveness and capacity of Australia's border protection and health systems. If there is good coordination and quick and appropriate responses from the agencies that protect our borders, from the public health system, and from general practice, we may be able to attenuate a future influenza pandemic in Australia, even if a pandemic were to strike other countries in our region.

Many of the guidelines for general practice are still in evolution and many of the plans will vary between the jurisdictions and between metropolitan and rural locations; nonetheless we can still picture what the role of general practice might be and what general practices can do to prepare for the possible pandemic phases. And even if a pandemic never eventuates, most of the preparations for a pandemic are still useful things to do. This article describes the role of general practice through the various phases of a pandemic and provides a framework to assist general practices to prepare.

## THE ROLE OF GENERAL PRACTICE IN SURVEILLANCE

Effective disease surveillance systems help to protect Australia from the spread of evolving viruses. These systems give early warning about disease outbreaks and allow an early and rapid response. Some general practices already play a role in influenza surveillance in NSW by

contributing reports of influenza-like illness to either the NSW Sentinel General Practice Scheme or the Australian Sentinel Practice Research Network. The role of general practice in the surveillance of pandemic influenza will be clarified as surveillance guidelines are reviewed.

## THE CONTAINMENT PHASE

Surveillance of travelers entering Australia will not necessarily prevent the entry of evolving influenza viruses into Australia, particularly as people infected with influenza can shed the virus in the 24 hours before they become symptomatic. Should a pandemic influenza strain enter Australia, the initial goal will be to contain it. Recent modelling commissioned by the Commonwealth Department of Health and Ageing suggests that if a containment strategy is vigorously pursued the virus could be contained until a vaccine is available.<sup>1</sup>

NSW Health will inform all NSW general practices and divisions of general practice by fax immediately when the containment phase begins. In this phase, the role of general practice will be to rapidly screen potential presenting cases and refer them without delay to the public health system for diagnosis, treatment and contact tracing. In NSW, general practitioners already work closely with their local public health units. Management of pandemic influenza patients and their contacts will include antiviral medication (either as treatment or post-exposure prophylaxis) and home quarantine. Area health services will arrange antiviral medication for patients and contacts and will work within emergency management systems to provide home support to people in home quarantine. General practice workers who are exposed to a case of pandemic influenza will be provided with post exposure prophylaxis. Updates and additional information will be made available on the NSW Health website.

At the same time, NSW Health hospitals will be activated to screen and assess potentially infected people who present in influenza assessment areas.<sup>2</sup> These areas will initially be located at NSW Health emergency departments and multipurpose services; however, more locations will be made available should the pandemic progress. Where these assessment areas are in place, potentially infected people will be able to bypass general practice, allowing practices to concentrate on their essential work of providing care for the broader burden of disease. This arrangement will minimize the risk of exposure for general practitioners, general practice staff and their non-influenza patients.

In rural and remote areas where local influenza assessment areas are not planned, existing primary care services will be advised to split their practice location into two areas—influenza and non-influenza—or to pool resources with a neighbouring practice and have separate influenza

and non-influenza practices. General practices should consult with their local area health service to find out if this applies to them.

### **Immunisation**

Estimates vary as to the length of time required to develop a vaccine to a newly evolved influenza virus. Australian Government contracts are currently in place with the domestic vaccine manufacturer CSL Limited and with the French manufacturer Sanofi Pasteur. The logistics of a national immunisation program are still to be described and, depending on local arrangements, general practice may or may not have a role in what will be a very rapid population-based immunisation program. In NSW, however, the program will be organised within the public health system.

### **THE MAINTENANCE OF SOCIAL FUNCTIONING PHASE**

Should a pandemic influenza strain escape containment the goal will be to minimise the transmission rate and the disruption to the community.

In most areas of Australia just under two per cent of the population presents to general practice on any one day. At the peak of a full-blown pandemic, up to one per cent of the population in an area could become ill on any one day. In order to maintain normal general practice services, in NSW general practices will be able to direct most of these additional patients to NSW Health influenza assessment areas. General practices will need good lines of communication with their local area health services and divisions of general practice to keep up to date on locations of these, and on the case descriptions and referral criteria (if any) required for patients to attend them.

### **PREPARING FOR AN INFLUENZA PANDEMIC**

The list below provides a framework through which general practices may approach planning for a pandemic. A number of useful references that provide greater detail are also listed in this article.

#### **Get organised**

Appoint a practice pandemic coordinator to approach the preparation and planning in your practice in an organised way.

#### **Public health measures**

Regularly and comprehensively vaccinate all your practice's older and at risk patients against both seasonal influenza and pneumococcus. Impress on all patients with viral upper respiratory tract infections the need for cough etiquette and social distancing and the need to wash their hands.

#### **Establish your practice's communication lines**

Get connected to broadband Internet. In a pandemic, case descriptions, treatment protocols and logistics may vary from day to day and you will need to be aware of these

changes. Mail services may be unreliable in periods of high absenteeism. Get used to reporting notifiable diseases to your local public health unit as a matter of course. Use the forms built into your prescribing package, download the forms from the NSW Health website ([www.health.nsw.gov.au/public-health/forms](http://www.health.nsw.gov.au/public-health/forms)) or ring and notify your local public health unit over the phone. Keep up to date—read your local division of general practice newsletter and talk to them about the preparations being made in your community.

#### **Plan for business continuity**

At the peak of a pandemic, absentee rates in the general community could be as high as 30 per cent. Among health care professionals, absentee rates may be even higher. Absenteeism occurs not only through personal illness but also through the need to care for sick relatives and, when schools are closed, to care for children. There is also likely to be voluntary absenteeism to enable voluntary social distancing, and some general practice staff may be rostered to work at influenza assessment areas—so plan now for how your practice would operate in a time of reduced staffing. Talk to neighbouring practices about pooling resources. If you are thinking of employing a practice nurse (or two) for your practice, do it now. Practice nurses enhance the quantity and quality of care for your patients, and should a pandemic eventuate they will be a very useful resource.

#### **Plan your practice infection control measures**

Make sure all your staff know how to fit and remove personal protective equipment, including a gown, mask, protective eyewear and gloves, correctly, and in the correct order. Although most potentially infected patients in NSW will be advised to bypass general practice, some will still present. In a pandemic, hand washing facilities, masks and other personal protective equipment will need to be available for both staff (P2 mask) and patients (surgical mask). Facilities must also be available to disinfect surfaces contacted by potentially infected patients. Comprehensive infection control guidelines are available on the web; see [www.health.gov.au/internet/wcms/publishing.nsf/Content/phd-pandemic-resources.htm](http://www.health.gov.au/internet/wcms/publishing.nsf/Content/phd-pandemic-resources.htm) and [www.health.gov.au/internet/wcms/publishing.nsf/content/pubhlth-pandemic-gp.htm](http://www.health.gov.au/internet/wcms/publishing.nsf/content/pubhlth-pandemic-gp.htm)

#### **Work out your supply chains for essential materials**

Your local area health service will coordinate distribution of personal protective equipment and prophylactic antivirals for staff (when required) to general practices in affected areas. Find out from your division of general practice or area health service how this will be managed in your area.

#### **Stay up to date**

*The Medical Journal of Australia* released a special influenza pandemic preparedness issue in November 2006 (see: ([www.mja.com.au/public/issues/185\\_10\\_201106/suppl\\_contents\\_201106.html](http://www.mja.com.au/public/issues/185_10_201106/suppl_contents_201106.html))). Early in 2007 the *Australian Management Plan for Pandemic Influenza* will have what

promises to be a very comprehensive updated primary care annex, (see [www.health.gov.au/internet/wcms/publishing.nsf/Content/phd-pandemic-plan.htm](http://www.health.gov.au/internet/wcms/publishing.nsf/Content/phd-pandemic-plan.htm)). Make sure you, or your practice pandemic coordinator, review these resources.

## CONCLUSION

Many of the guidelines and plans for an influenza pandemic are still evolving and plans for general practice vary between jurisdictions. Nonetheless, we can picture the role of general practice and what general practices can do to prepare for the possible pandemic phases. Remember,

most of the preparations for a pandemic are useful things to do even if a pandemic never eventuates.

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# BUSINESS CONTINUITY MANAGEMENT AND PANDEMIC INFLUENZA

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## ABSTRACT

Pandemic influenza planning presents challenges for both government and businesses. Effective cooperation and communication before and during a pandemic will help mitigate the major threats to societal function. The major challenges for government include communicating a realistic estimate of pandemic risk, managing community anxiety, communicating the need for rationing of vaccines and antiviral medications, setting standards for preparedness, and gaining the trust of essential service workers. For businesses the challenges are tailoring generic planning guides to local use, and making links with local and regional partners in pandemic planning.

Business continuity management, as defined by Standards Australia<sup>1</sup>, 'provides the availability of processes and resources in order to ensure the continued achievement of critical objectives'. Until now, its most recent applications have been in information technology—the Y2K bug is an example—or in relation to the failure of physical infrastructure as a result of fire, flood, or earthquake. Throughout 2005, international and Australian health agencies warned of worst-case scenarios for pandemic influenza, with mass absenteeism that could cripple business and critical infrastructure and disrupt local and global supply chains. This paper focuses on the challenges faced by governments and the most essential private and public sector organisations in ensuring that appropriate business continuity management is implemented in our society during an influenza pandemic.

A range of estimates for staff absenteeism has been published in government pandemic plans to assist business preparation. These estimates are based upon 25 per cent of staff being absent at some time during the pandemic, but not for the entire pandemic period. The UK Influenza Contingency Plan<sup>2</sup> uses modeling to predict that 25 per cent of employees will take between five and eight days off in three to four months of a pandemic. At least five to seven per cent would be absent in the peak week of impact, with the proportion rising to 15 per cent if the attack rate were to increase from 25 to 50 per cent. The Australian Health Management Plan for Pandemic Influenza predicts peak absenteeism rates of up to 50 per cent.<sup>3</sup> Reasons for staff absence in a pandemic would include illness from the pandemic influenza strain; exclusion from work while suffering another respiratory tract infection mistaken for or treated on a cautionary basis as influenza; caring for ill children and relatives; caring for children if day-care and

schools are closed by authorities; and fear of contracting pandemic influenza at work or while traveling to work.

Government agencies will not, on their own, be able to control the spread of pandemic influenza and maintain essential services. Measures that maintain societal function and reduce transmission of influenza in the community and at the workplace will reduce the peak incidence of the pandemic and help the health system to cope with the patient load.

## CHALLENGES FOR GOVERNMENT

During a pandemic, government must play a leadership and coordinating role. While health departments are the lead agency for responding to pandemic influenza, there are many interagency committees active in planning at the state and national level. The lead agency supporting business continuity at the national level is the Australian Government Department of Industry, Tourism and Resources, and for NSW it is the Premiers Department. Both of these departments have published documents to support business continuity planning.<sup>4,5</sup> The role of local government has not been extensively articulated; however, its links with emergency management networks and its role in maintaining routine services such as waste management and water supply will be important.

### Getting continuity managers' attention and keeping it

The Australian Minister of Health has provided a proactive example of awareness raising for a pandemic that has achieved international recognition.<sup>6</sup> A major challenge will be balancing a sense of urgency with the acknowledgement that many organisations will take years to develop plans and will need to maintain them in perpetuity.

Black and Armstrong, in the first special issue of the *Bulletin* on avian and pandemic influenza, address the risk of a pandemic occurring and the attendant uncertainties of the timing and severity of its occurrence.<sup>7</sup> To guard against the development of cynicism in non-health planning portfolios, short term predictions for the arrival of pandemic influenza should be avoided because planners and media commentators will become increasingly cynical, or even derisive, as 12-month or even five-year prediction intervals pass. Indeed, analyses of the genetic diversity of the H5N1 virus suggest it has been circulating in birds in China for almost 10 years without mutating to a pandemic virus.<sup>8</sup>

It is too late in the evolution of the debate to describe the risk of pandemic influenza as 'imminent'. Planners need to use standard risk matrices to gain senior executive support for prioritizing pandemic influenza by using a once-in-30-year risk for a 'milder' (1957 or 1968-like) pandemic scenario and a conservative once-in-100 year risk for a 'severe' (1918-like) pandemic scenario, while acknowledging that an event with an average recurrence level of 100 years has a

10 per cent and 22 per cent probability of occurring in a 10 year and 25 year interval, respectively.<sup>9</sup> Such risk estimates need to be qualified and reviewed as new information becomes available from epidemiological analyses, in vivo recombination experiments, and viral genetic analysis on H5N1 influenza virus (or future avian influenza strains).

### **Preventing panic**

The second major challenge for government will be that of managing risk communication during a pandemic. Models of the economic impact of a pandemic find that the economic impact is not as sensitive to the mortality rate of the pandemic as it is to the behaviour of the community during a pandemic. An Australian Treasury paper predicts the decrease in shopping, leisure activities, travel and tourism will likely be mediated by the perceived risk of the pandemic rather than by the actual mortality rate.<sup>10</sup> Decreases in demand for goods and services, and absenteeism, will combine to cause a slowing of the economy. It is possible that the next pandemic could have no greater excess mortality than our usual national seasonal influenza toll (about 3000 deaths per year for influenza and pneumonia combined)<sup>11</sup>, but if distorted depictions emerge in the media with the announcement of the next pandemic, a SARS-like panic could develop, with significant societal impacts.

### **Who will get the antivirals and vaccines?**

Many planning documents in Australia and overseas have flagged that 'essential service' or 'critical infrastructure' workers may be prioritised for antiviral medications or pandemic specific vaccines. A wide range of workers consider that they provide or support essential services and have an expectation that they should receive protective antiviral medication or vaccines. There is potential for unions and work group organisations to withdraw services during a pandemic pending receipt of antiviral medications. So far the Commonwealth Government has given no guarantee of supply to any group other than health care workers. There is an urgent need for government to clarify the reasons for prioritising front line health care workers for antiviral medications during a pandemic and to test the validity of this decision against the perceptions held among industry groups, business, workers and unions prior to a pandemic.

Health care workers should remain a priority because of the significant societal panic that will occur if influenza clinics and hospitals are abandoned in a pandemic and for the assumed society-wide benefits of preventing spread of pandemic influenza from health care workers into the wider community.

A post-exposure prophylaxis option, which requires that essential workers receive antiviral medication only after a suspected influenza exposure, may offer the health system greater flexibility in implementing prophylaxis while still providing reassurance to essential workers.

### **Developing standards for business continuity plans**

While business, critical infrastructure and even health care organisations have been advised or directed to develop pandemic plans, the content, coverage and level of plans has rarely been specified or standardised and no independent standards exist for validating the readiness of organisations. Such standards would be useful not only in providing assurance to government and the community in general, but also in assisting businesses seeking to assess their supply chain threats in a pandemic.

## **CHALLENGES FOR BUSINESS AND CRITICAL INFRASTRUCTURE**

Detailed frameworks and resources for business continuity management are available.<sup>1,12</sup> Widespread absenteeism may result in both downstream and upstream supply chain failures and the situation may be complicated by increased demand for essential goods. The hospitality sector, on the other hand, may be affected by decreased demand during a pandemic. The following section focuses on some of the challenges faced by businesses in developing their plans.

### **The legacy of a physical infrastructure and IT approach to continuity planning**

Many service sectors have a history of comprehensive business continuity planning for physical infrastructure or information technology failure. Businesses are very good at identifying their core business functions and identifying alternative service delivery options. To cite one example from the United States, FEDEX has five empty jets roaming the night skies waiting to be diverted to airports where scheduled flights are overbooked.<sup>13</sup> Some businesses that rely heavily on information technology have well developed back-up networks that can operate from an alternative site or even a different continent.

While an information technology perspective provides a thorough grounding in business continuity management principles, the uncertainties associated with infectious diseases such as influenza pandemics may be overlooked. The standard advice from business continuity management plans, such as 'cross-training', telecommuting and infection control (including respiratory and cough hygiene), may be superficially reassuring in pandemic planning guides, but they are not a guarantee of appropriate readiness. There is a need to consolidate pandemic preparedness through effective internal communication and links with external partners, and to use risk assessment to adapt generic pandemic planning guides for local use.

### **Communication and consultation with staff**

The fear and uncertainty that is associated with pandemic influenza make it vital that business organisations consult staff and unions about what infection control interventions will be implemented in the workplace. This consultation will need to include staff education, and also negotiation of infection control practices and protection measures to

ensure maximum staff trust and satisfaction, and minimum absenteeism.

### **Recognising that the risk of transmission in the workplace varies**

Many plans treat the workplace as a zone of homogenous risk; however, risk varies depending on crowding and travel and on the duration, frequency and closeness of contact with the public and other workers. Physically mapping risk areas may assist in planning and prioritising infection control interventions. Segregating groups of staff to decrease mixing could be more fully developed in some plans but special care must be used to ensure that groups at higher risk of infection are not stigmatised within an organisation. Few organisations have considered the protection of staff and their families as a package.

### **Pandemic response as a local issue**

Many Australian corporate plans reviewed by the author see the World Health Organization and Australian Department of Health and Ageing as their primary source of information. Few have identified the website of their local health department as an information source, yet these sites will provide information such as whether the pandemic has been detected in their area; where their local influenza clinics are; what services are being offered by local hospitals, influenza clinics, general practitioners and other health workers; and if and when, and where, vaccines and antiviral medications will be available.

Businesses and government need to engage with local partners in different industrial and sector services to assess

#### **BOX 1**

##### **THE FOOD SUPPLY—A SPECIAL CASE**

When considering core societal functions the provision of health care, power, water, transport and food dominate. Of all of these, the food industry is the one with least government control and a special vulnerability that cannot be ignored. The production and delivery of food to supermarket shelves is a highly complex logistics-driven enterprise and only a few days supply is held at most supermarkets. Absenteeism at each link in the chain of food delivery from port services, heavy transport, warehousing, logistics, and supermarket stocking and sales threaten basic food supplies. Panic buying could empty shelves and looting could further delay resumption of services. Governments can recommend stockpiling of food and water to develop resilience in the community, but the greater challenge is to educate the community on how to effectively build and use a stockpile, and to provide basic food supplies across the country to ensure supply to the poor and immobile, and to people quarantined or ill.

the feasibility of their planning assumptions where they interface with other sectors. A United States biotechnology company that published its pandemic plan in January 2006 advised that before visiting a shop for essential items workers should 'phone first to confirm availability of required items if possible'.<sup>14</sup> A supermarket with pandemic-related absenteeism is unlikely to cope with or endorse this recommendation. Rather than assuming supermarkets will provide a telephone enquiry service, it is far better to ask local supermarkets what their pandemic plans hold. Will there be curbside sale of essential items as flagged by one Florida-based supermarket?<sup>15</sup> To minimise unrealistic recommendations, organisations should test their planning assumptions through cross-sectoral planning and scenario exploration with local mutual aid and emergency planning groups.

### **CONCLUSION**

Challenges exist for government and business, but close cooperation is essential before and in a pandemic. Since many businesses can cope with a high level of absenteeism for a number of weeks or even months if they focus on their core functions, the major threats to societal function may be the flow-on effects of panic and uncorroborated planning assumptions. A comprehensive public communication strategy with pre-tested messages will be vital to minimising this threat to business and the community during an influenza pandemic.

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## THE EFFECTIVE USE OF THE MEDIA DURING AN INFECTIOUS DISEASE EMERGENCY

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During an infectious disease emergency such as a pandemic of influenza, the media will play a critical role in disseminating public health information. Timely and accurate information can help facilitate coordination and cooperation within the community, reduce speculation and fear and maintain public confidence in the health system. The media can also actively assist public health responses by providing the public with advice on how to remain well and by telling people what they can do if they suspect they have the disease or have been in close contact with others who have it. In recognition of the important role of the media and other forms of communication during infectious disease emergencies, NSW Health is developing a communication strategy for infectious disease emergencies, based on recommendations from the 2004 NSW Taskforce on Severe Acute Respiratory Syndrome (chaired by Professor Ron Penny).<sup>1</sup> With respect to public communication, the strategy will aim to ensure a constant flow of accurate information to the media, as an absence of information is likely to quickly result in speculation and misinformation.

While the strategy is still being developed, key features of the media component include:

- providing clear and simple messages based on advice from NSW Health and other appropriate agencies (for example, the Australian Government Department of Health and Ageing or, during the recovery phase of a pandemic, the NSW Department of Community Services)
- using a constant media face and identifying alternative spokespersons to engage the media when public health experts are not available. The chosen spokesperson(s)

should be knowledgeable and authoritative and should provide consistent messages and facts

- providing media groups with telephone numbers for media information services so that they do not flood emergency services lines
- providing media statements, fact sheets and interviews as soon as possible after an outbreak is notified and then on a regular basis, each day
- utilising pre-existing resources and structures (for example, pre-existing websites and fact sheets) for the dissemination of public health information, and developing new resources where appropriate
- establishing a 1800 information line where recorded news releases are available and updated regularly
- establishing a dedicated website that provides timely information about the emergency
- using varied forms of media in addition to mainstream media (media releases and interviews)—for example, web-based information on the intranet and Internet
- encouraging the media to appropriately balance their responsibility for reporting news and events versus their role as providers of information during what will be a complex emergency
- recognising that media plans should cover different stages of an infectious disease emergency—recognising, for example, that media information is vital not only during the height of a pandemic, but also during the longer-term recovery phase when it can help ensure that patients and their families or relatives receive all available assistance and that people resume their normal lives as soon as possible after the outbreak.

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# CHALLENGES FOR THE LABORATORY BEFORE AND DURING AN INFLUENZA PANDEMIC

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## ABSTRACT

Laboratory tests that reliably confirm infection with a novel influenza strain are a major component of pandemic planning. Combined nose and throat swabs are the most practical respiratory tract sample to safely obtain from patients. As nucleic acid tests are sensitive, specific and rapid, they will be the diagnostic test of choice during a pandemic. Virus isolation (in laboratories with Physical Containment level 3 facilities) is required for characterisation of the pandemic strain and vaccine development. Antiviral resistance testing may be required if antiviral drugs are used extensively to help control a pandemic. Diagnostic strategies will vary throughout the various pandemic phases.

Laboratories, like all parts of the health sector, are currently formulating plans to provide appropriate services during an influenza pandemic. These services revolve around the provision of timely laboratory results to guide patient management and public health responses. They include the specific detection of the pandemic influenza virus in clinical samples, be it the currently circulating (but not yet detected in Australia) influenza A/H5N1 strain or a future novel strain. They also include differentiation of the pandemic strain from the other human influenza strains (influenza A/H3N2 and A/H1N1, and influenza B) or other infectious causes of influenza-like illnesses. Laboratories will also need to support the clinical management of individuals already infected with influenza virus, for example by identifying and providing antibiotic sensitivity information for secondary bacterial infections. At the same time they will need to continue providing the usual pathology services for non-influenza related conditions.

The level of laboratory service will vary between different centres. Specialist virology laboratories will undertake a full range of influenza virus testing, including the rapid detection, culture and typing of isolates for potential use in vaccines, and the detection of antiviral drug resistance. Other laboratories may undertake a more limited range of services depending on their location (for example, in rural areas), their population (for example, in public or private hospitals) and access to specialised laboratories. The identification of the earliest cases of a novel influenza strain will require co-operation and communication between public health practitioners, treating clinicians

and both public and private laboratories. These issues are discussed in the technical annexes of the Australian Health Management Plan for Pandemic Influenza and in the World Health Organization (WHO) and Centers for Disease Control (USA) pandemic plans.<sup>1-3</sup>

## LABORATORY DIAGNOSIS OF INFLUENZA

### Collection of samples

The key to successful laboratory diagnosis of influenza is the collection of the appropriate respiratory tract samples. This poses the challenge of ensuring that enough people are trained in safe and reliable specimen collection techniques prior to a pandemic. A swab from each nostril and a swab from the throat are recommended for adults (the specimens are combined in the laboratory, hence the name 'combined' nose and throat swab); nasopharyngeal aspirates may be collected in children less than three years of age. In severely ill hospitalised patients, lower respiratory tract samples such as bronchoalveolar lavage fluid are especially useful. Samples should be collected in the first three to four days following the onset of symptoms (as this is when the viral load is highest), and transported to the laboratory as quickly as possible. Early experience of human infection with influenza A/H5N1 infections suggests that the virus is more readily detectable in lower respiratory tract samples, although blood, faeces and cerebrospinal fluid may also contain virus.<sup>4,5</sup>

### Diagnostic methods

Table 1 lists the advantages, disadvantages and turnaround times of various laboratory methods for confirming influenza virus infection. The traditional or 'gold standard' method—isolation of influenza virus from the specimen—requires tissue culture facilities and particular expertise. With pandemic influenza, isolation will require a Physical Containment level 3 (PC3) laboratory<sup>1-3</sup>, where viruses can be then be typed as influenza A/H3N2, A/H1N1, A/H5N1 or B and later further evaluated to ensure that appropriate strains are used in vaccine preparation. Vaccine strain evaluation is undertaken through the WHO global influenza network. Australia is well-served by this network, with a WHO Collaborating Centre in Melbourne and WHO National Influenza Centres in Sydney (Institute of Clinical Pathology and Medical Research, Westmead), Melbourne (Victorian Infectious Diseases Reference Laboratory) and Perth (PathWest).<sup>6</sup>

Nucleic acid testing (NAT) is highly sensitive and specific for the detection of influenza and other respiratory virus genomes.<sup>7</sup> Pandemic strain-specific NAT (for example, as developed for influenza A/H5N1) will be the diagnostic test of choice in a pandemic.<sup>1-3</sup> It can be used on a range of clinical specimens and can be performed reasonably quickly, depending on the laboratory's testing platform. NAT can be directed against highly conserved regions of the influenza

**TABLE 1**

**LABORATORY DIAGNOSTIC METHODS FOR CONFIRMING INFLUENZA VIRUS INFECTION\***

Test	Sensitivity	Turnaround time	Advantages	Disadvantages
Conventional cell culture	~100% (though less than RT-PCR)	At least 4–5 days	<ul style="list-style-type: none"> <li>Highly sensitive/specific</li> <li>Yields isolate for antigenic characterisation</li> <li>Recovers novel/divergent strains</li> <li>Recovers other respiratory viruses</li> </ul>	<ul style="list-style-type: none"> <li>Dependent on specimen quality/transport</li> <li>Slow TAT</li> <li>Labour intensive</li> <li>Requires technical expertise</li> <li>Requires specialised equipment</li> </ul>
Rapid cell culture (shell vial with immunofluorescence)	56–100% (generally 70–90%)	1–4 days	<ul style="list-style-type: none"> <li>Quicker TAT than conventional cell culture</li> <li>Relatively inexpensive</li> </ul>	<ul style="list-style-type: none"> <li>Dependent on specimen quality/transport</li> <li>Less sensitive than conventional cell culture</li> <li>May miss divergent strains</li> </ul>
Immunofluorescence (direct antigen detection)	60–100% (generally 70–90%)	2–4 hours	<ul style="list-style-type: none"> <li>Rapid TAT</li> <li>Provides assessment of specimen quality</li> </ul>	<ul style="list-style-type: none"> <li>Labour intensive</li> <li>Requires interpretative skill (subjective)</li> <li>Requires fluorescence microscopy</li> <li>No isolate for antigenic characterisation</li> </ul>
Nucleic acid testing	~100% (greater than cell culture)	<1–2 days	<ul style="list-style-type: none"> <li>Highly sensitive/specific</li> <li>Less dependent on specimen quality/transport</li> <li>Typing/subtyping possible</li> <li>Enables molecular analysis (sequencing)</li> <li>Detects other respiratory viruses (multiplex assays)</li> <li>More rapid TAT with real time PCR assays</li> </ul>	<ul style="list-style-type: none"> <li>Expensive</li> <li>Labour intensive (depending on assay)</li> <li>Requires technical skill and specialised equipment</li> <li>Potential for cross-contamination/false-positives</li> <li>No isolate for antigenic characterisation</li> <li>May miss divergent strains</li> </ul>
Rapid antigen (point-of-care) tests	59-93% (generally ~70%)	15–30 minutes	<ul style="list-style-type: none"> <li>Rapid TAT</li> <li>No technical skill required</li> <li>Specimen transportation not required</li> </ul>	<ul style="list-style-type: none"> <li>Expensive</li> <li>Lower sensitivity</li> <li>False-positive results (misinterpreting faint bands)</li> <li>No isolate for antigenic characterisation</li> </ul>
Serology (CFT, HAI, IF, neutralisation, EIA)	Up to 100%	1–3 weeks	<ul style="list-style-type: none"> <li>Useful where specimens are unobtainable or laboratory facilities limited</li> </ul>	<ul style="list-style-type: none"> <li>Delayed diagnosis</li> <li>Requires paired serum specimens</li> <li>Variable sensitivity and specificity</li> <li>Labour intensive and requires technical skill</li> <li>No isolate for antigenic characterisation</li> </ul>

\* Based on information provided in Playford and Dwyer 2002<sup>7</sup> and Dwyer et al 2006<sup>13</sup>

RT-PCR = reverse transcriptase polymerase chain reaction

TAT = turnaround time

CFT= complement fixation test

HAI= haemagglutination inhibition

EIA = enzyme immunoassay

genome so that all human and avian influenza strains are detected, or it can be directed against specific regions of the influenza genome (for example, haemagglutinin or neuraminidase) to allow differentiation between influenza subtypes. Other molecular investigations such as sequencing influenza genes can be useful for detecting neuraminidase inhibitor drug resistance mutations<sup>8</sup>, or detecting relatedness between viral strains (for example in an outbreak setting).<sup>9,10</sup> Although not routinely available, quantitative NAT can be used to measure the viral load in clinical samples, allowing a better understanding of disease pathogenesis, transmission and antiviral drug efficacy.<sup>11</sup>

Virus antigen and nucleic acid testing methods have a quicker turnaround time than virus isolation, and are performed in more laboratories. Influenza antigens can be detected by immunofluorescence, using monoclonal antibodies that distinguish between influenza A or B, or between H3 or H1 subtypes.<sup>7</sup> Other rapid antigen detection systems include enzyme immunoassays and 'point of care' tests. The point of care tests, generally based on immunochromatographic platforms using monoclonal antibodies specific to conserved regions of influenza A or B, are simple to perform and can be used in laboratories (especially if virology resources are limited), or elsewhere,

such as in doctor's surgeries, accident and emergency departments or influenza clinics. In general terms, their specificity is good (making them useful in investigating outbreaks or in surveillance) and their rapidity makes them useful for commencing antiviral therapy quickly.<sup>12</sup> The sensitivity and specificity of the rapid antigen detection tests against influenza A/H5N1 strains are still uncertain.

Influenza-specific antibodies can be detected by various methods such as complement fixation, immunofluorescence, enzyme immunoassays, haemagglutinin inhibition and neutralisation, tests that are technically complex and difficult to perform in large numbers. Serological testing usually requires both acute and convalescent (collected four to six weeks after disease onset) samples, and has a role in detecting atypical infections and making retrospective diagnoses, and in epidemiological studies.

### Reliability of testing

A challenge for Australian laboratories is ensuring that their testing is reliable for viruses not yet circulating in Australia, such as the current influenza A/H5N1 strains. Genetic variation in the viruses over time may particularly affect the reliability of NAT<sup>9</sup>, and the lack of clinical samples in Australia from influenza A/H5N1-infected individuals makes local assessment of the various methods uncertain.

**TABLE 2**

**ROLE AND FEATURES OF LABORATORY DIAGNOSTIC METHODS USED IN AN INFLUENZA PANDEMIC**

Laboratory Method	Role	Features
<b>Methods specific to the diagnosis and typing of the pandemic virus strain</b>		
Nucleic acid testing	Test of choice to diagnose pandemic influenza	Pandemic strain-specific primers will be required (eg H5). Quantitation (of viral load) will not routinely be available. May also be applied to non-respiratory tract samples, eg serum, faeces, cerebrospinal fluid.
Virus isolation	Vaccine strain determination and genotyping	Will be limited to laboratories with Physical Containment level 3 facilities and virus culture expertise.
<b>Other laboratory tests used in a pandemic</b>		
Nucleic acid testing	To detect all influenza A H subtypes, including seasonal human influenza	Uses nucleoprotein or matrix primers, or primers specific for influenza A/H3N2, A/H1N1 and influenza B. It picks all H types, but doesn't separate H5 from the others.
	To detect other respiratory pathogens	Primers can be multiplexed to detect more than one virus.
Immunofluorescence	To detect all influenza A (or human H3 and H1) or influenza B	
Rapid antigen or point of care tests	To detect all influenza A and/or B	Generally less sensitive than nucleic acid testing.
H5-specific rapid antigen tests	When assays become available they may assist diagnosis if a pandemic has become established	Limited experience in clinical practice.
Serology	To detect recent influenza A or B infection	H5-specific assays are not yet routinely available.
Antiviral drug resistance testing	To detect mutations associated with neuraminidase inhibitor resistance	Genotype and phenotype assays currently limited to reference or research laboratories.

Developing reliable tests for the pandemic strain, including quality assurance, laboratory training and use of specialised confirmatory tests (such as virus isolation), is an expensive process and not covered by current pathology funding mechanisms. Recent 'urgent research' funding through the National Health and Medical Research Council has allowed the assessment and quality assurance of various influenza A/H5N1-specific tests.

## DIAGNOSTIC STRATEGIES DURING A PANDEMIC

A major challenge will be determining diagnostic strategies during the different pandemic phases. These will vary between laboratories according to their virology expertise, capacity, patient populations, and availability of various assays, and the stage of the pandemic. Table 2 lists the possible diagnostic testing approaches during a pandemic.

In the very early phases, where containment is paramount, testing will have to be rapid to identify the first arrival(s) and clusters of disease. Highly sensitive tests such as pandemic strain-specific nucleic acid testing using polymerase chain reaction or related technologies are required. However, should the pandemic be widespread in Australia (phases 6a–d, as defined in the Australian Health Management Plan for Pandemic Influenza<sup>1</sup>), testing strategies may change. One could argue that at this phase in the pandemic, clinical identification will suffice (as is often the case during the usual seasonal influenza outbreaks) and laboratory testing should be limited to patients requiring hospital admission or for particular outbreaks. Rapid or point of care tests, although less sensitive and less specific for the pandemic strain, may be a useful addition in these stages of the pandemic. Antiviral resistance testing, although yet not routinely available in Australia, will be important if antiviral drugs are used extensively.<sup>1,8</sup>

## LABORATORY WORKPLACE ISSUES DURING A PANDEMIC

A particular challenge for laboratories will be coping with the surge of work during the early phases of the pandemic when the implications of 'positive' results are particularly high, and at a time when normal laboratory services will continue. There will be heightened community (and media) anxiety about influenza, and healthcare workers will have to deal with their own concerns about the pandemic. Issues of absenteeism, access to antiviral prophylaxis, and maintaining non-pandemic related laboratory medicine services will need consideration. Laboratory workers are generally well trained in biosafety and related infection control issues (current guidelines provide advice about laboratory precautions<sup>1–3</sup>), so there should be no additional work-related safety issues specific to managing specimens during a pandemic. Interactions between the public and private laboratories will need to be strengthened, given that influenza often presents to general practitioners.

## CONCLUSION

There are a range of laboratory tests that detect seasonal influenza (influenza A/H3N2 and A/H1N1, influenza B), with their availability dependent on local laboratory practices and resources. Should a pandemic strain emerge, for example from the current avian influenza A/H5N1 virus, then pandemic-virus-specific tests will be needed. In this situation, specific nucleic acid testing will be the test of choice, with virus isolation also needed for evaluation of vaccine strains and genetic drift. The success of laboratory diagnosis is very much dependent on good quality specimen collection and early communication with the laboratory.

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# PLANNING FOR PANDEMIC INFLUENZA SURVEILLANCE IN NSW

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## 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 spread<sup>1</sup> 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.<sup>2</sup> 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 deaths<sup>3</sup>, 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.<sup>4</sup>

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.<sup>5</sup> 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.<sup>6</sup>

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.<sup>6</sup>

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.<sup>6</sup>

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.<sup>6</sup>

### 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.<sup>7</sup> 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.<sup>7,8</sup> The United Kingdom conducts syndromic surveillance for respiratory infections using its National Health Service telephone help-line.<sup>9</sup> 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.<sup>10,11</sup> 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.<sup>12</sup>

## THE AUSTRALIAN CONTEXT

The recently released Australian Health Management Plan for Pandemic Influenza<sup>13</sup> 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](http://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*.<sup>14</sup> The plan is structured according to the NSW emergency management framework of prevention and preparedness, response and recovery.<sup>15</sup> 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><b>Inter-pandemic</b> 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"> <li>Disseminate national and international influenza situation reports.</li> <li>Conduct year-round syndromic surveillance of influenza-like illness and continue seasonal enhanced laboratory-based surveillance.</li> <li>Develop effective communication protocols for the exchange of surveillance information among clinicians, laboratories, hospitals and the community.</li> <li>Develop effective local case finding, communication, data collection and management tools and plans.</li> <li>Identify and train personnel that could provide surge capacity for surveillance activities if the risk of a pandemic increases.</li> <li>Test surveillance systems within broader pandemic exercises</li> </ul>
<p><b>Early containment</b> 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"> <li>Area health services with international entry points to conduct international border (entry) passenger screening.</li> <li>Implement area health service processes for:               <ul style="list-style-type: none"> <li>case finding by active surveillance and screening for suspected cases at emergency departments and influenza clinics</li> <li>timely transportation of clinical specimens for laboratory testing</li> <li>timely collection, collation, analysis and reporting of data obtained from case finding and tracing of contacts of cases.</li> </ul> </li> <li>Maintain and deploy personnel with the necessary skills to provide surveillance surge capacity.</li> </ul>
<p><b>Later containment</b> 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"> <li>Area health services with international entry points to conduct international border (entry and exit) passenger screening.</li> <li>Continue to support area health service processes for:               <ul style="list-style-type: none"> <li>case finding by active surveillance and screening for suspected cases at emergency departments and influenza clinics</li> <li>timely transportation of clinical specimens for laboratory testing</li> <li>timely collection, collation, analysis and reporting of data obtained from case finding and tracing of contacts of cases.</li> </ul> </li> <li>Maintain and deploy personnel with the necessary skills to provide surveillance surge capacity.</li> <li>Conduct health care worker influenza-like illness surveillance and monitor absenteeism in health-care workers.</li> </ul>
<p><b>Maintenance</b> 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"> <li>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.</li> <li>Analyse information from influenza clinics to monitor transmission and describe the epidemiological characteristics of the virus, and inform public health action and service provision.</li> </ul>
<p><b>Inter-pandemic or inter-wave</b> 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"> <li>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).</li> <li>Analyse information from influenza clinics to monitor transmission and describe the epidemiological characteristics of the virus, monitor service provision, and inform public health actions.</li> </ul>

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 visits<sup>16</sup>, 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.<sup>17</sup> 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.<sup>18</sup>

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.

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## WEBSITES AND RESOURCES FOR AVIAN AND PANDEMIC INFLUENZA

### WEBSITES

#### **Animal Health Australia**

[www.animalhealthaustralia.com.au/programs/eadp/ausvetplan\\_home.cfm](http://www.animalhealthaustralia.com.au/programs/eadp/ausvetplan_home.cfm) contains the Australian Veterinary Emergency Plan (AUSVETPLAN), which is a series of technical response plans that describe the proposed Australian approach to the occurrence of an exotic disease. It includes a link to the Australian disease strategy for avian influenza.

#### **Australian Government Department of Health and Ageing**

[www.health.gov.au/](http://www.health.gov.au/) provides an extensive range of links to Australian Government resources and plans for national health emergencies. It includes links for pandemic preparedness, avian influenza, the Australian Health Management Plan for Pandemic Influenza, and Exercise Cumpston 06.

#### **Australian Government Department of Tourism, Industry and Resources**

[www.industry.gov.au/pandemicbusinesscontinuity/](http://www.industry.gov.au/pandemicbusinesscontinuity/) contains a range of tools to assist small businesses to prepare for a human influenza pandemic in Australia

#### **Australian Government Travel Advisory and Consular Assistance Service**

[www.smarttraveller.gov.au/](http://www.smarttraveller.gov.au/) contains travel advisories and bulletins to assist Australians to travel overseas safely.

#### **emergencyNSW**

[www.emergency.nsw.gov.au/](http://www.emergency.nsw.gov.au/) is the public emergency information website of the NSW Government. It provides information about how to prepare for, deal with and recover from an emergency situation.

#### **NSW Department of Health**

[www.health.nsw.gov.au/pandemic/](http://www.health.nsw.gov.au/pandemic/) provides regular updates about pandemic influenza preparedness, the current H5N1 avian influenza outbreak in birds, and information and resources for pandemic influenza planning, particularly for NSW.

[www.health.nsw.gov.au/pandemic/docs/nswplan.pdf](http://www.health.nsw.gov.au/pandemic/docs/nswplan.pdf) contains the whole-of-government NSW Human Influenza Pandemic Plan.

#### **NSW Department of Primary Industries**

[www.agric.nsw.gov.au/reader/avian-influenza](http://www.agric.nsw.gov.au/reader/avian-influenza) contains information and resources about avian influenza.

#### **United States Department of Health and Human Services**

[www.pandemicflu.gov/index.html](http://www.pandemicflu.gov/index.html) provides information and updates about avian and pandemic influenza from the United States Government.

#### **World Health Organization**

[www.who.int/csr/disease/avian\\_influenza/en/index.html](http://www.who.int/csr/disease/avian_influenza/en/index.html) tracks the evolving situation with human cases of H5N1 avian influenza and provides access to both technical guidelines and information useful for the general public. It also has links to pandemic influenza pages.

[www.who.int/ethics/influenza\\_project/en/index.html](http://www.who.int/ethics/influenza_project/en/index.html) contains discussion papers that examine a wide range of ethical issues raised by a potential influenza pandemic, as well as some key documents from other international ethics centres.

### JOURNALS

#### **Medical Journal of Australia**

Supplement — Preparing for an influenza pandemic. Vol. 185, No. 10, 20 November 2006.  
[www.mja.com.au/public/issues/185\\_10\\_201106/suppl\\_contents\\_201106.html](http://www.mja.com.au/public/issues/185_10_201106/suppl_contents_201106.html)

#### **Emerging Infectious Diseases**

Special issue: Influenza. Vol. 12, No. 1, January 2006.  
[www.cdc.gov/ncidod/eid/vol12no01/contents\\_v12n01.htm](http://www.cdc.gov/ncidod/eid/vol12no01/contents_v12n01.htm)

## PANDEMIC INFLUENZA PREPAREDNESS

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An influenza pandemic occurs when a new influenza virus emerges which is markedly different from recently circulating seasonal influenza viruses and is able to:

- infect people and cause disease (rather than, or in addition to, infecting other mammals or birds)
- spread readily from person to person
- spread widely among the population (because most people will have little or no immunity to it).

Because so many people may be affected, pandemics of influenza have historically had devastating consequences. It is essential that the community, businesses and all levels of government undertake planning and preparatory action beyond health and emergency planning to protect the community and minimise the impact of any pandemic.

The highly pathogenic avian influenza virus known as H5N1, currently circulating in domestic and wild bird populations around the world, is a public health concern because of its potential to transform into a pandemic strain. As long as the virus continues to circulate in birds and other animals, there will be opportunities for this virus to change and adapt to humans.

Recent planning developments in NSW and Australia include the Council of Australian Government's *National Action Plan for Human Influenza Pandemic*, the release of a revised *Australian Health Management Plan for Pandemic Influenza* and the development of the *NSW Human Influenza Pandemic Plan*.

### CONTAINMENT

In the revised *Australian Health Management Plan for Pandemic Influenza* there is an increased emphasis on containing the influenza pandemic by preventing or minimising transmission and spread of the virus. Proposed

strategies include border control measures, widespread adoption of good hygiene and infection control practices, isolation of the sick, quarantine of contacts, and the use of antivirals for those exposed. Successful containment should attenuate the burden on the health system and buy time for a vaccine to be developed and distributed.

Within NSW, early containment activities will include border control activities at Sydney airport and the early activation of pandemic influenza screening in Emergency Departments. Home quarantine will be imposed for contacts of cases and a whole-of-government planning group is considering arrangements for the implementation of this measure. The public health response will need to be extensive and efficient so that potential cases are identified quickly and their contacts traced and offered prophylaxis.

### THE CLINICIAN'S PERSPECTIVE

For the clinician faced with an impending influenza pandemic, flexibility, good communication skills, the ability to deal with a high flow of information, and good observation and collaboration abilities (especially in the context of research) will be paramount. Early in the pandemic (at the containment stage) the clinician will need to deal with challenging diagnoses, control panic (in other staff and the public), treat presumptively, and negotiate competing system needs.

Later in the pandemic (at the maintenance stage), the clinician will need to adapt to the change in circumstances. This will involve reserving diagnostic capacity for atypical cases, reviewing treatment strategies, examining the best use of resources in a time of shortage, operating with a shortage or lack of trained staff due to sickness or social distancing measures, and coping with the personal prospect of illness. The clinician's use of continuous antiviral prophylaxis may also be causing side effects.

In the tail of the pandemic (during the recovery stage), there may be a second wave of infections. Those affected by the virus may require rehabilitation. Regular services disrupted by the pandemic will need to be reinstated. There is a strong likelihood that staff fatigue and mental health issues will come to the fore.

Throughout the pandemic there will need to be a breaking down of barriers between occupational groups, a willingness to work differently, and a strong commitment to infection control. By planning co-operatively prior to the pandemic occurring, some of the adverse effects may be mitigated. ☒

\*Bug Breakfast is the name given to a monthly series of hour-long breakfast seminars on communicable diseases delivered by the NSW Department of Health's Division of Population Health.

## PANDEMIC INFLUENZA

### WHAT IS AVIAN INFLUENZA (BIRD FLU)?

Avian influenza is an infectious disease of birds, caused by a number of different strains of avian influenza virus. Usually the virus circulates in wild bird populations causing no disease or only mild disease. Infection of domestic poultry, such as chickens, can cause severe disease in these birds. There are a number of different strains of avian influenza, only a few of which can cause disease in humans.

A new type of avian influenza, called influenza A H5N1, was first recognised in 1997 in Hong Kong. This strain reappeared in late 2003 and has rapidly spread to many Asian, Middle-Eastern, European and African countries, causing severe infection in wild birds and domestic poultry flocks. There is no evidence that avian influenza is currently infecting birds or humans in Australia.

### WHAT IS PANDEMIC INFLUENZA?

A large-scale, worldwide human influenza epidemic is called a pandemic. Pandemics occur when a new virus emerges to which people have little or no immunity. Previous influenza pandemics occurred in 1918-19, 1957-58 and 1968-69. In the 1918-19 pandemic, between 20 and 40 million people died. Many scientists are concerned that the recent H5N1 outbreak in birds could mutate to produce a new strain of influenza virus that spreads easily between people, resulting in a pandemic.

### WHAT ARE THE SYMPTOMS?

A pandemic strain of influenza does not currently exist anywhere in the world. The symptoms of the next pandemic are difficult to predict, as different strains of influenza can lead to different symptoms in people. However, influenza strains usually cause symptoms typical of normal seasonal human influenza (fever, cough, tiredness, muscle aches, sore throat, shortness of breath, runny nose, headache). In some cases, influenza can result in a severe pneumonia and, in a small number of cases, encephalitis (inflammation of the brain) or diarrhoea. Symptoms of influenza generally appear between two to four days following exposure.

### WHO IS AT RISK?

People at risk of becoming infected with a pandemic influenza strain are those that have been in close contact (usually within 1 metre) of a person infected with the new influenza strain. People who live in the same house as someone with pandemic influenza, and people that look after someone while they are ill, are most at risk of becoming infected.

### HOW IS IT PREVENTED?

As a pandemic influenza strain has not yet developed, a human vaccine for pandemic influenza is not available. Existing vaccines for normal human influenza will not provide protection against pandemic influenza. Scientists worldwide are currently working to develop a suitable human vaccine against H5N1 avian influenza, in the hope that will be protective against a future pandemic virus resulting from a mutated H5N1 strain. Until a vaccine becomes available, the best method of prevention will be to ensure that everyone washes their hands regularly and thoroughly, and that they cough or sneeze into tissues, and not into other people's faces. After coughing or sneezing, people should dispose of their tissues immediately, and wash their hands with soap and water.

People who may have pandemic influenza should stay at home until they are completely better. People with pandemic influenza should wear a mask to help to prevent spreading the infection to other people in the house. People looking after other people who are sick should wear full personal protective equipment, including goggles, gloves, masks and protective clothing, and, if necessary, should take anti-influenza medication.

### HOW IS IT DIAGNOSED?

Pandemic influenza virus infection can be diagnosed using specimens of blood, or from swabs of the nose and throat. Testing is done at a specialised laboratory.

### HOW IS IT TREATED?

Specific anti-influenza drugs are likely to be effective against pandemic influenza in humans. If you become unwell and suspect that you may have pandemic influenza, you should go to your nearest hospital emergency department or influenza clinic for assessment and treatment.

### WHAT IS THE PUBLIC HEALTH RESPONSE?

Outbreaks of different strains of pandemic influenza have occurred previously in Australia. However, there have been no recent reports of pandemic influenza anywhere in the world. There is surveillance for people infected with pandemic influenza at all Australian borders.

Human infection with pandemic influenza must be notified to the local public health unit. Should suspected human cases occur in NSW, the local public health unit would work with the patient, the treating doctors, and the laboratory to confirm the diagnosis. Suspected cases would be isolated

from others to prevent further infections. Close contacts of these cases who may have been exposed to the virus will be given information about the risk of infection. Should these people also develop symptoms, they would also be isolated and tested for pandemic influenza.

### **TRAVEL ADVICE**

Australians should not travel to areas affected by pandemic influenza. Australian should reduce their risk of infection with avian influenza by avoiding poultry farms and live bird markets in areas affected by avian influenza. They should also ensure that they wash their hands thoroughly after coming into contact with sick people, or after handling uncooked poultry products such as eggs. You should wash your hands before eating, and always ensure that poultry is cooked thoroughly before eating.

### **FOR MORE INFORMATION**

Australian Government Department of Health and Ageing information hotline 1800 004 599. 

# COMMUNICABLE DISEASES REPORT, NEW SOUTH WALES, FOR JULY AND AUGUST 2006

For updated information, including data and facts on specific diseases, visit [www.health.nsw.gov.au](http://www.health.nsw.gov.au) and click on **Infectious Diseases**.

## TRENDS

Tables 1 and 2 show reports of communicable diseases received for July and August 2006 in NSW; we are pleased to report that no **measles** cases were reported during this period. Figure 1 shows reports of selected communicable diseases, by month of onset, from January 2001 to August 2006.

## LYMPHOGRANULOMA VENEREUM EMERGES IN NSW

Four cases of lymphogranuloma venereum (LGV) were notified to NSW Health in June 2006. The cases were identified after a batch of rectal swabs was tested using newly developed PCR and gene sequencing tests at St Vincent's Hospital. All four cases were homosexually active men who had presented with proctitis between October 2004 and March 2006 and initially tested positive for chlamydia. Public health units initiated an investigation into each case, but no direct links among the cases could be identified. These cases are the first cases of LGV notified in NSW. They follow an outbreak of LGV among gay men that was first identified in the Netherlands in late 2003<sup>1</sup> and that has subsequently spread to other European countries and North America.<sup>2</sup>

LGV can cause proctitis in homosexually active men who are thought to acquire the infection following unprotected anal intercourse. It is caused by an especially aggressive form of chlamydia that invades lymph nodes and destroys the surrounding tissues. Symptoms usually develop about two months following infection and include an anal discharge, diarrhoea or constipation, abdominal pain and fever.<sup>3</sup> Other sexually transmitted infections including HIV and hepatitis C have been associated with LGV infection.<sup>4</sup>

In October 2005 the Sexually Transmitted Infections in Gay Men Action Group (STIGMA) wrote to doctors in inner Sydney who care for gay men with information about LGV and how the infection can be diagnosed and treated.

In July 2006, NSW Health convened an expert panel to review the public health implications of LGV in NSW, and further recommendations will follow. The risk of LGV can be reduced through practicing safe sex. Homosexually active men should talk to their doctor about having regular sexual health checks, especially if they or a partner have symptoms. Specific intervention for infected patients include antibiotic therapy to both cure the infection and prevent further transmission, and partner notification and assessment.

## References

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2. Blank S, Schillinger JA, Harbatkin D. Lymphogranuloma venereum in the industrialised world. *Lancet North Am Ed* 2005; 365: 1607–8.
3. Williams D, Churchill D. Ulcerative proctitis in men who have sex with men: an emerging outbreak. *BMJ* 2006; 332: 99–100.
4. Van der Bij AK, Spaargaren J, Morr  SA, et al. Diagnostic and clinical implications of anorectal lymphogranuloma venereum in men who have sex with men: A retrospective case-control study. *Clin Infect Dis* 2006; 42: 186–94.

## MENINGOCOCCAL DISEASE

Winter and spring are the peak periods for meningococcal disease in NSW. Until recently 200 to 250 cases of the disease were notified annually in the state. Of these, about half were due to serogroup B meningococcus and about a third were due to serogroup C meningococcus. However, the introduction of a vaccine against meningococcus C and a nationwide school-based immunisation program in 2003 and 2004 has led to a dramatic decline in serogroup C disease.

In 2005, 136 cases of meningococcal disease were reported in NSW, of which 73 (54%) were due to serogroup B and 15 (11%) to serogroup C meningococcus. To the end of August 2006, 68 cases had been reported, including 37 (54%) due to meningococcus B and 7 (10%) due to meningococcus C.

For further information, see <http://www.health.nsw.gov.au/infect/diseases.html>.

## ENTERIC DISEASES

Several viral gastroenteritis outbreaks in institutions were reported throughout July 2006 (Figure 1). In April 2006 an increase in the number of people attending emergency departments with gastroenteritis was detected through NSW Health's Public Health Real-time Emergency Department Surveillance System (PHREDSS). An increased number of notifications of outbreaks of viral gastroenteritis in institutional settings were also received in April, and outbreaks have been commonly reported since. By July, 216 outbreaks affecting more than 5000 people had been reported in 2006 across NSW, compared with 30 outbreaks affecting 300 people in the same period in 2005. The 2006 outbreaks were mainly reported from aged care facilities (141), hospitals (41) and childcare centres (30). The cause of the outbreaks was not confirmed for 74%, but epidemiologically these outbreaks were typical of a viral infection. Norovirus was confirmed as the cause in 23% of outbreaks and rotavirus in 2%.

Norovirus is a common cause of vomiting and diarrhoea, especially in the winter months. Norovirus is very contagious and is spread easily between people. Rotavirus is the most common cause of viral gastroenteritis in children. Viral gastroenteritis is prevented by thorough hand washing with soap and water after using the toilet, and before preparing food or eating and drinking. For more information, see the Fact Sheet at: [http://www.health.nsw.gov.au/infect/pdf/viral\\_gastro.pdf](http://www.health.nsw.gov.au/infect/pdf/viral_gastro.pdf). Guidelines have been developed for the management of outbreaks in institutional settings (see: [http://www.health.nsw.gov.au/pubs/2004/gastroctrl\\_fs.html](http://www.health.nsw.gov.au/pubs/2004/gastroctrl_fs.html)).

### **A CLUSTER OF HEPATITIS A IN TRAVELLERS TO FIJI**

In August, Sydney South West Public Health Unit (SSWPHU) was notified of a person (Case 1) who had been diagnosed with hepatitis A. Approximately four weeks earlier, Case 1 had travelled to Fiji to attend a meeting, and after further investigation it was considered that Fiji was the likely source of the infection. Fifteen other Australians attended the meeting.

Hepatitis A is a viral infection of the liver. Symptoms include feeling unwell, aches and pains, fever, nausea, lack of appetite, abdominal discomfort and darkening of the urine, which is followed in a few days by jaundice. In some instances no symptoms are experienced at all. The incubation period is usually four weeks but can range from two to seven weeks. A positive serological test for hepatitis A is required to confirm the diagnosis. Passive immunisation with normal human immunoglobulin (NHIG), which contains antibodies derived from the pooled plasma of blood donors, is effective in preventing hepatitis A if given within two weeks of the person being exposed to the virus.

Soon after Case 1 had been notified to SSWPHU, a further case of hepatitis A in another person who attended the same meeting was notified. Public health unit staff obtained a list of names and contact details of participants from the organiser of the meeting. Attempts were made to contact each of the attendees by telephone to ascertain if they had become unwell with symptoms of hepatitis A. Contact was made with 10 (out of 14) participants by telephone, and it was discovered that hepatitis A had been diagnosed in a third participant, a resident of Queensland. The remaining nine participants who were contacted denied any symptoms of hepatitis A. Four of the meeting participants had received hepatitis A vaccine prior to travelling to Fiji, and one reported immunity to hepatitis A due to previous illness. An information letter was mailed or sent electronically to

all participants advising them of their risk of hepatitis A infection and the symptoms of the illness.

Further follow-up of all meeting participants was attempted four weeks after the initial notification. Contact was made with seven of the 13 participants who were not cases. All these people reported that they had remained well; however, five attended their general practitioner (GP) to obtain further advice on this issue. One person received hepatitis A vaccination from the GP following the trip, but this was the second dose of vaccine of a course commenced prior to travelling.

The cluster of three cases of hepatitis A in travellers to Fiji highlights the importance of hepatitis A vaccination prior to travel to endemic countries. It is important to educate both travellers and general practitioners about the value of individually targeted travel advice (such as safe eating and drinking) and vaccinations prior to travelling to developing countries. The meeting organisers have also been advised to recommend hepatitis A vaccination in future courses.

### **HEPATITIS A PROPHYLAXIS CLINIC**

In August, a case of hepatitis A was reported to Sydney South West Public Health Unit (SSWPHU). Follow-up revealed that the case worked at a school tuckshop on 11 August whilst infectious, preparing ready-to-eat foods. Although the case did not experience any vomiting or diarrhoea while at the tuckshop, a risk assessment by the public health unit raised concerns about opportunities for transmission during the preparation of food.

A decision was made to offer NHIG to any member of the school community who may have consumed ready-to-eat foods at the tuckshop on 11 August. On Tuesday 22 August the school provided a letter to parents and students including fact sheets about hepatitis A and NHIG, and sought consent for students at risk to be passively immunised. Two clinics, with staff from Sydney West, South Eastern Sydney Illawarra, Sydney South West Area Health Services, and NSW Department of Health, were held at the school on August 23 and 24. Information and NHIG were given to 568 students, teachers and tuckshop workers. The NSW Food Authority inspected the tuckshop and provided information regarding safe food handling.

No secondary cases of hepatitis A have been identified in relation to this incident but heightened surveillance will continue until early October.

Good food safety practices are crucial in all food settings, including smaller operations staffed by volunteers such as a tuckshop. ☒

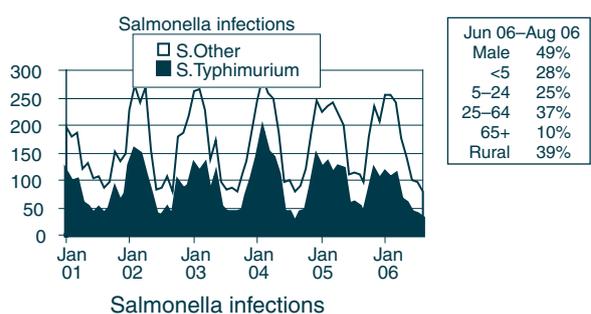
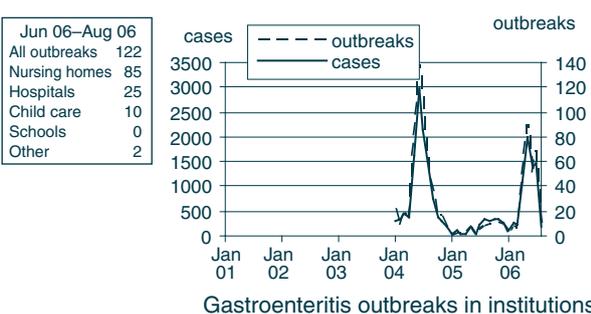
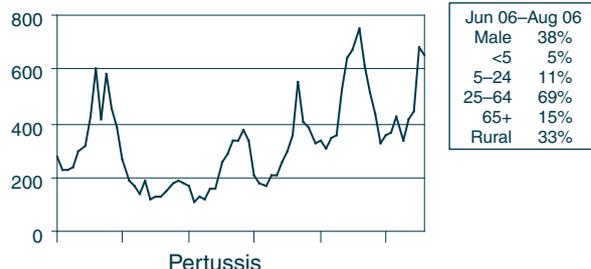
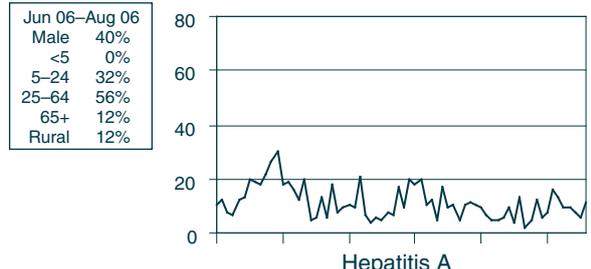
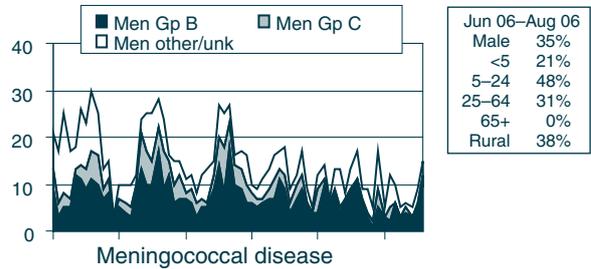
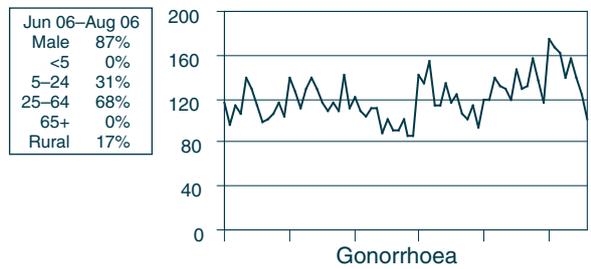
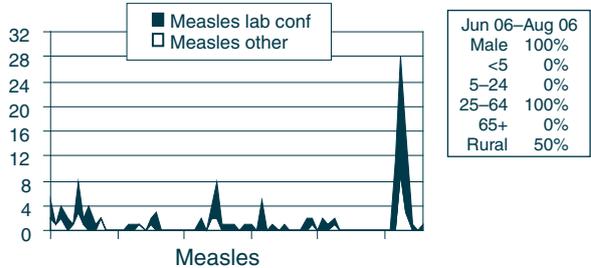
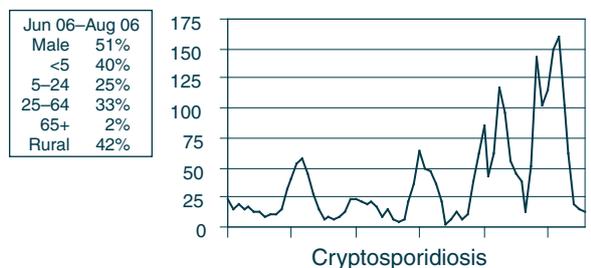
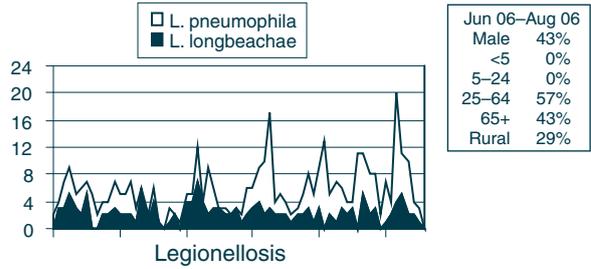
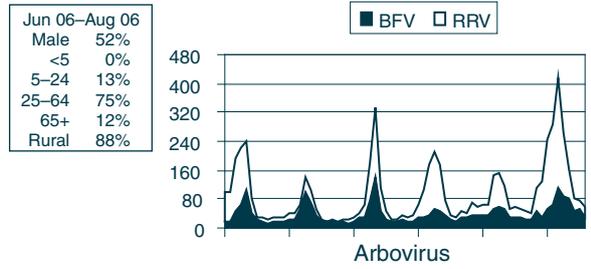
**FIGURE 1**

**REPORTS OF SELECTED COMMUNICABLE DISEASES, NSW, JAN 2001 TO AUGUST 2006, BY MONTH OF ONSET**

Preliminary data: case counts in recent months may increase because of reporting delays.  
 Laboratory-confirmed cases only, except for measles, meningococcal disease and pertussis  
 BFV = Barmah Forest virus infections, RRV = Ross River virus infections  
 Lab conf = laboratory confirmed

Men Gp C and Gp B = meningococcal disease due to serogroup C and serogroup B infection, other/unk = other or unknown serogroups.  
 NB: multiple series in graphs are stacked, except gastroenteritis outbreaks.  
 NB: Outbreaks are more likely to be reported by nursing homes and hospitals than by other institutions

NSW population	
Male	50%
<5 yrs	7%
5-24 yrs	27%
25-64 yrs	53%
65+ yrs	13%
Rural	46%



**TABLE 1**

**REPORTS OF NOTIFIABLE CONDITIONS RECEIVED IN JULY 2006 BY AREA HEALTH SERVICES**

Condition	Area Health Service (2006)																Total for July+	To date+		
	Greater Southern		Greater Western		Hunter / New England		North Coast		Northern Syd / Central Coast		South Eastern Syd / Illawarra		Sydney South West		Sydney West					
	GMA	SA	FWA	MAC	MWA	HUN	HUN	NEA	MNC	NRA	CCA	NSA	ILL	SES	CSA	SWS	WEN	WSA	JHS	
<b>Blood-borne and sexually transmitted<sup>d</sup></b>																				
Chancroid*	43	32	15	10	15	105	27	23	23	40	41	89	47	156	39	63	26	77	4	866
Chlamydia (genital)*	-	-	2	1	1	6	2	2	2	1	2	10	3	38	14	10	3	16	-	115
Gonorrhoea*	1	1	3	1	2	5	2	-	-	3	-	26	1	43	17	91	4	49	-	251
Hepatitis B-acute viral*	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	4
Hepatitis B-other*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Hepatitis C-acute viral*	8	10	8	4	10	32	8	17	25	25	25	25	17	52	22	83	31	47	31	462
Hepatitis C-other*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10
Hepatitis D-unspecified*	-	-	-	-	-	2	1	2	1	2	5	5	1	14	4	10	2	8	-	63
Syphilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<b>Vector-borne</b>																				
Barmah Forest virus*	2	1	1	4	-	16	-	11	6	2	2	1	3	1	1	1	-	-	-	49
Ross River virus*	3	-	1	2	-	4	-	5	4	3	1	3	1	1	-	-	-	-	-	29
Arboviral infection (other)*	-	-	-	-	-	-	-	-	1	1	-	4	1	-	1	-	-	-	-	8
Malaria*	-	-	-	-	-	1	-	-	-	-	-	3	-	2	1	-	-	3	-	10
<b>Zoonoses</b>																				
Anthrax*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brucellosis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Leptospirosis*	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	1
Lysavirus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Lyssavirus*	-	-	-	-	-	4	-	-	-	-	-	-	-	1	-	-	-	-	-	8
Psittacosis*	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	62
Q fever*	2	2	-	1	-	2	7	4	-	-	-	-	1	-	-	-	-	-	-	19
<b>Respiratory and other</b>																				
Blood lead level*	2	-	-	-	-	2	-	-	-	1	-	3	-	1	-	4	-	-	-	13
Influenza*	3	2	-	2	1	-	-	2	12	1	5	5	1	7	1	10	1	9	-	97
Invasive pneumococcal infection*	2	2	1	-	4	10	-	4	1	3	5	5	5	9	3	12	4	4	-	69
<i>Legionella longbeachae</i> infection*	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	1	-	-	2
<i>Legionella pneumophila</i> infection*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	19
Legionnaires' disease (other)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
Leptosy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Meningococcal infection (invasive)*	-	-	-	-	-	1	-	-	1	2	-	-	1	-	-	1	-	2	-	1
Tuberculosis	-	-	-	-	-	-	-	-	1	-	6	6	1	5	2	6	-	3	-	24
<b>Vaccine-preventable</b>																				
Adverse event after immunisation (AEFI)**	1	1	-	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	5
<i>H. influenzae b</i> infection (invasive)*	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	2
Measles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Mumps*	-	-	-	-	-	-	-	-	-	1	-	8	-	6	3	2	5	6	-	56
Pertussis	28	12	2	11	21	50	22	4	9	14	91	26	87	6	49	70	43	117	32	658
Rubella*	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	2	-	-	-	4
Tetanus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<b>Enteric</b>																				
Botulism	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cholera*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis*	1	-	-	-	-	-	-	-	-	-	5	-	2	1	1	1	1	-	-	11
Giardiasis*	6	1	-	-	1	10	7	1	1	3	28	5	16	2	4	6	23	-	-	115
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
Hepatitis A*	-	-	-	-	-	-	-	-	1	-	2	-	1	2	-	1	-	4	-	11
Hepatitis E*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Listeriosis*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Salmonellosis*	2	5	-	-	2	18	3	2	5	1	15	4	5	8	11	4	9	-	-	95
Shigellosis*	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-	-	-	-	1
Typhoid*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
Verotoxin producing <i>E. coli</i> *	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
<b>Miscellaneous</b>																				
Creutzfeldt-Jakob disease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
Meningococcal conjunctivitis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2

\* lab-confirmed cases only + includes cases with unknown postcode \$ HIV and AIDS data are reported separately, quarterly in the NSW Public Health Bulletin.  
 \*\* AEFI notified by the school vaccination teams during the National Meningococcal C Program are not included in these figures. These notifications are reviewed regularly by a panel of experts and the results will be published quarterly in the NSW Public Health Bulletin.  
 N.B: From 1st Jan 2005, Hunter/New England AHS also comprises Great Lakes, Gloucester & Greater Taree LGAs; Sydney West also comprises Greater Lithgow LGA

GMA = Greater Murray Area    MAC = Macquarie Area    NEA = New England Area    CCA = Central Coast Area    SES = South Eastern Sydney Area    WEN = Wentworth Area  
 SA = Southern Area    MWA = Mid Western Area    MNC = North Coast Area    NSA = Northern Sydney Area    CSA = Central Sydney Area    WSA = Western Sydney Area  
 FWA = Far West Area    NRA = Northern Rivers Area    ILL = Illawarra Area    SWS = South Western Sydney Area    JHS = Justice Health Service

**TABLE 2 REPORTS OF NOTIFIABLE CONDITIONS RECEIVED IN AUGUST 2006 BY AREA HEALTH SERVICES**

Condition	Area Health Service (2006)																Total for Aug+	To date+	
	Greater Southern		Greater Western		Hunter / New England		North Coast		Northern Syd / Central Coast		South Eastern Syd / Illawarra		Sydney South West		Sydney West				
	GMA	SA	FWA	MAC	MWA	HUN	NEA	MNC	NRA	CCA	NSA	ILL	SES	CSA	SWS	WEN	WSA	JHS	
<b>Blood-borne and sexually transmitted<sup>§</sup></b>																			
Chancroid*	-	-	-	-	-	108	25	36	49	41	91	52	187	78	77	19	79	9	-
Chlamydia (genital)*	29	13	-	12	16	5	-	-	5	4	10	2	57	25	21	-	12	-	941
Gonorrhoea*	-	-	-	1	-	5	-	-	-	-	-	-	-	-	-	-	-	-	148
Hepatitis B-acute viral*	-	-	-	-	-	6	3	1	4	5	34	6	40	29	45	1	52	6	2
Hepatitis B-other*	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	235
Hepatitis C-acute viral*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
Hepatitis C-other*	14	15	-	15	19	41	18	21	27	23	28	28	53	52	64	29	23	46	520
Hepatitis D-unspecified*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	4
Lymphogranuloma venereum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Syphilis	-	1	-	3	3	5	-	-	-	1	2	3	23	16	-	2	10	3	75
<b>Vector-borne</b>																			
Barmah Forest virus*	2	-	2	1	-	11	1	9	4	2	-	2	2	3	-	-	1	-	40
Ross River virus*	-	1	-	4	1	4	4	6	2	3	1	1	1	1	-	-	-	-	29
Arboviral infection (other)*	-	1	-	-	-	-	-	1	-	-	-	-	1	1	1	-	1	-	5
Malaria*	-	1	-	-	-	2	-	-	-	-	3	-	1	1	2	-	5	-	15
<b>Zoonoses</b>																			
Anthrax*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brucellosis*	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Leptospirosis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Lyssavirus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16
Psittacosis*	-	-	-	-	-	3	3	-	-	-	-	1	1	-	1	-	-	-	-
Q fever*	-	1	-	-	2	-	6	-	-	-	-	-	-	-	-	-	-	-	71
<b>Respiratory and other</b>																			
Blood lead level <sup>§</sup>	-	-	-	-	1	1	-	-	1	-	-	1	1	1	1	-	-	-	7
Influenza*	10	1	-	-	6	17	29	-	15	1	13	3	15	2	11	2	18	-	198
Invasive pneumococcal infection*	5	2	1	3	1	8	5	4	2	4	11	5	9	1	3	2	8	-	386
<i>Legionella longbeachae</i> infection*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	401
<i>Legionella pneumophila</i> infection*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
Legionnaires' disease (other)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42
Leprosy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Meningococcal infection (invasive)*	-	-	-	-	-	2	-	1	-	2	2	1	2	1	3	1	2	-	15
Tuberculosis	1	-	-	-	-	2	1	1	-	3	3	2	10	1	3	2	6	-	32
<b>Vaccine-preventable</b>																			
Adverse event after immunisation (AEFI)**	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	2
<i>H. influenzae b</i> infection (invasive)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Measles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
Mumps*	-	-	-	-	-	-	-	-	-	-	6	-	12	7	1	-	1	-	27
Pertussis	51	19	5	24	6	80	18	6	9	23	65	25	117	53	92	42	108	743	3769
Rubella*	-	-	-	-	-	-	-	-	-	1	-	-	1	2	2	-	-	-	22
Tetanus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
<b>Enteric</b>																			
Botulism	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cholera*	1	3	-	-	-	2	11	-	-	2	3	1	1	1	1	-	3	-	18
Cryptosporidiosis*	4	4	-	1	2	11	5	-	-	8	23	7	24	1	12	12	15	-	129
Giardiasis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Hepatitis A*	1	-	-	-	-	-	-	-	-	-	4	-	-	3	1	1	1	-	6
Hepatitis E*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Listeriosis*	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2
Salmonellosis*	2	2	-	-	4	6	3	2	9	5	14	8	13	8	11	-	13	-	100
Shigellosis*	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	4
Typhoid*	-	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	1	-	4
Verotoxin producing <i>E. coli</i> **	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
<b>Miscellaneous</b>																			
Creutzfeldt-Jakob disease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meningococcal conjunctivitis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1

\* lab-confirmed cases only + includes cases with unknown postcode § HIV and AIDS data are reported separately, quarterly in the NSW Public Health Bulletin.  
 \*\* AEFI is notified by the school vaccination teams during the National Meningococcal C Program are not included in these figures. These notifications are reviewed regularly by a panel of experts and the results will be published quarterly in the NSW Public Health Bulletin.  
 N.B: From 1st Jan 2005, Hunter/New England AHS also comprises Great Lakes, Gloucester & Greater Taree LGAs; Sydney West also comprises Greater Lithgow LGA  
 GMA = Greater Murray Area MAC = Macquarie Area NEA = New England Area CCA = Central Coast Area SES = South Eastern Sydney Area WEN = Wentworth Area  
 SA = Southern Area MWA = Mid Western Area MNC = North Coast Area NSA = Northern Sydney Area CSA = Central Sydney Area WSA = Western Sydney Area  
 FWA = Far West Area HUN = Hunter Area NRA = Northern Rivers Area ILL = Illawarra Area SWS = South Western Sydney Area JHS = Justice Health Service