Pandemic planning assumptions

Evidence summary

This document summarises evidence supporting the pandemic planning assumptions presented in: *Review of pandemic planning assumptions* (Australian Health Management Plan for Pandemic Influenza 2008/9, Department of Health and Ageing). The Australian Health Management Plan for Pandemic Influenza 2014 is based on these assumptions.

The full literature review and other supporting documents are available on the Australian Government Department of Health website at www.health.gov.au.

Note: The *Review of pandemic planning assumptions* has been drafted with reference to the *Australian Health Management Plan for Pandemic Influenza 2008/9* (AHMPPI 2008/9). Where possible the numbering system for the assumptions has been changed so they read in numerical order. However where numbering has been referenced directly from AHMPPI 2008/9 existing numbering has been retained.

Contents

Introduction

In 2007 a review of data from past pandemics was undertaken. From this review a set of planning assumptions was developed, which would be appropriate to the management of an outbreak modelled on the pandemic which occurred in 1918 (*Review of pandemic planning assumptions*, Australian Health Management Plan for Pandemic Influenza 2008/), Department of Health and Ageing).

To accompany each assumption identified, this review documented the key current scientific evidence and the main associated planning and response implications. This was not a complete literature review, rather an identification of key evidence that would impact on planning and response decisions. After the incorporation of input from relevant health sector advisory bodies, these assumptions were used to underpin the Australian Health Management Plan for Pandemic Influenza 2008.

Following the 2009 influenza pandemic, the available evidence was once again reviewed and the assumptions and planning and response implications updated. This update included the consolidation of assumptions 5 (Respiratory Protection Zone) and 6 (Survival of the virus) under the broader assumption 3 (Modes of transmission), as it was noted they were closely related. The assumptions have accordingly been renumbered.

The updated assumptions underpin the Australian Health Management Plan for Pandemic Influenza 2014.

This document summarises the findings of this review. The document in full and other supporting documents are available on the Australian Government Department of Health website at www.health.gov.au.

Assumption 1: Incubation period

Current assumption(s)[a]	The median incubation period for a novel pandemic virus can be assumed to be 2 days, with a range of 0.5–7 days, and where the majority of cases will become symptomatic within 0.5–3 days.
Planning implications	Contacts will need to be quarantined for 7 days after last exposure. Modelling for quarantine, school closure and contact tracing policy will be based on the maximum incubation period. Modelling for prophylaxis and treatment policy will be based on the minimum incubation period. Median incubation periods will be used to identify the most likely time and source of infection. The full distribution of the incubation period will be used to establish serial intervals and impact of mitigation strategies
Response implications	It is important to reassess this assumption as early as possible as it may alter recommendations about length of contact tracing quarantine timeframes and outbreak investigation. Case series studies conducted during the early stages of a pandemic should better determine the incubation period of the new virus
Scientific rationale	The incubation period for seasonal influenza viruses and the A(H1N1)pdm09 virus is short, ranging from 1–3 days.[1, 2, 3, 4] Longer incubation periods have been recorded for human infections with influenza A/H5N1.[5, 6] A precautionary approach has therefore been taken similar to other countries.[7, 8, 9]

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 2: Attack rates

Current assumption(s)[a]	2.1 The infection attack rate (IAR) for a novel pandemic virus can be assumed to be between 11–60%, and the clinical attack rate (CAR) at 7–35%. 2.2 The CAR could be halved if all measures outlined in the Australian Health Management Plan for Pandemic Influenza can be applied as planned and are as effective as current estimates indicate. 2.3 The IAR in children will be higher than in adults. 2.4 The IAR and CAR may be higher in some population groups, such as Indigenous people, healthcare workers and people living in closed environments, but it is difficult to predict which groups prior to the start of the pandemic
Planning implications	2.1 An unmitigated pandemic would result in an unmanageable number of cases. Pandemic planning is required and mitigation strategies are warranted. 2.2 Interventions to reduce transmission are potentially very worthwhile. They would reduce case numbers, even in the event of a pandemic as severe as in 1918–19. 2.3 Interventions to reduce transmission in children may have a greater impact on reducing overall transmission rates than interventions targeting any other group. Transmission reduction strategies that target children should therefore be planned for (in conjunction with other broader population-based strategies, as appropriate). 2.4 There is a need to prepare capacity to assess attack rates in different population groups, including Indigenous people and healthcare workers, to inform decision making and mitigation strategies. Planning should encompass strategies to target specific population groups who may have higher than average attack rates
Response implications	2.1–2.2 It will be important to model the likely impact of interventions on the attack rate so as to estimate the likely healthcare demand in a mitigated pandemic. It will be important to assess the impact of interventions on the attack rate continually in order to assess overall effectiveness. 2.3 Early in the pandemic, it will be important to establish the differences in the rate of accumulation of cases in adults compared with children to assess the likely effectiveness. After the first pandemic wave, robust estimates of age-specific attack rates may be useful in supporting decision making with regards to use of initial doses of vaccine. 2.4 It will be important to collect data on attack rates in different population groups to allow tailoring of public health interventions. This should be done through serologic cohort studies sampled pre- and post-pandemic waves
Scientific rationale	2.1 The IAR for previous pandemics ranged from 11–60%; the CAR ranged from 7–35%.[9, 10, 11] 2.2 Modelling studies show that even with a 1918-severity pandemic, combinations of mitigation strategies can reduce the CAR by 50%.[9] 2.3 Previous studies show that in the 1957 and 2009 pandemic, children had the highest IAR and CAR.[10, 12, 13] 2.4 Studies conducted during previous pandemics showed that some population subgroups had higher IAR. In past pandemics, this included Indigenous people, children in boarding schools, healthcare workers and military personnel,[14, 15, 16, 17, 18] however, risk groups in a future pandemic will not be known until the early stages of the pandemic

[a] Australian Health Management Plan for Pandemic Influenza 2014.

Assumption 3: Modes of transmission*

Current assumption(s)[a]	3.1 Contact, droplet and aerosol transmission will be the major modes of transmission during a pandemic, but the relative likelihood and dominance of each mode will depend on the presenting host, pathogen and environmental factors. 3.2 Specific procedures within the healthcare setting may increase the risk of aerosol transmission. 3.3 Vertical transmission of influenza virus is possible. 3.4 Faecal–oral and bloodborne transmission of influenza virus seem unlikely but are conceivable
Planning implications	3.1 Infection control in the community should focus on droplet, aerosol and contact precautions. Contact transmission will likely to be the easiest to interrupt through simple nonpharmaceutical interventions such as cleaning, increasing ventilation and social distancing. 3.2 Health service planning should account for both aerosol and droplet transmission. 3.3 Plans for preventive measures, treatment and infection control should assume that vertical transmission is possible and that pregnant women are at increased risk of complications from influenza infection. 3.4 Standard precautions to protect against bloodborne viruses and faecal–oral transmission should be maintained at all times in relevant settings such as healthcare facilities.
Response implications	3.1–3.2 The relative dominance of each mode of transmission for the pandemic virus should be assessed. If one mode emerges as dominant, preventive measures should be amended. 3.3 Preparations should be made to collect data to assess vertical transmission early in the pandemic as well as the safety/efficacy of pandemic vaccine in pregnant women. 3.4 Studies should assess if bloodborne and faecal–oral transmission are significant for the spread of the pandemic strain. If found to play a role in transmission, infection control and transmission reduction interventions may need to be modified significantly
Scientific rationale	3.1 Droplet, aerosol and contact transmission have been demonstrated as the major routes of transmission for influenza, and dominate depending on the presenting host, pathogen and environment combination.[9, 19] 3.2 Certain procedures performed in healthcare settings, such as but not limited to bronchoscopy, intubation, and nebuliser treatment, can generate small particles containing virus that can be respired by exposed individuals.[20] 3.3 Very few studies document vertical transmission of influenza viruses[21, 22] but the increased risk of complications in pregnant women due to influenza infection is well documented.[23, 24, 25, 26] 3.4 Faecal–oral and bloodborne transmission of seasonal or pandemic influenza have not been documented.[9, 27] Avian influenza A/H5N1 is predominately a faecal–oral disease in birds/animals, and may result in human infection through exposure to contaminated waterways.

*Note: Assumption 5- 'Respiratory protection zone' and Assumption 6- 'Survival of the virus' from the AHMPPI 2008/9 have been incorporated into assumption 3.

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 4: Period of communicability

Current assumption(s)[a]	4.1 Cases of all age groups are likely to be infectious from 1 day (24 hours) before the onset of symptoms. 4.2 Peak virus shedding occurs in the first 2 days of illness, and cases are most infectious at this stage. 4.3 Infectiousness in healthy adults will decline rapidly after 5 days of illness. 4.4 Children, the elderly and immunocompromised individuals will shed greater amount of virus, and may shed for longer. Infectiousness will likely decline after 1 week of symptoms. 4.5 Asymptomatic individuals may shed virus and be infectious in the first 2 days of infection, but they are unlikely to play a major role in disease spread. 4.6 Antivirals reduce respiratory viral shedding, but it is unclear whether vertical transmission (if it occurs) would be reduced by the use of antivirals
Planning implications	4.1–4.5 Quarantining of contacts even if asymptomatic will be required as it is assumed that the onset of the period of communicability will pre-date the onset of symptoms by up to 24 hours. 4.1–4.5 The standard period for isolation is 7 days or until the resolution of fever (if that period is longer). 4.6 Antivirals should be used to reduce virus shedding and should be administered early in the course of infection to reduce disease transmission. Antivirals should be prioritised for groups that are likely to shed more virus for longer (such as children, the elderly and immunocompromised)
Response implications	4.1–4.5 Virus shedding patterns and the associated period of communicability for the new pandemic virus need to be rapidly reassessed since different strains have different infection patterns. 4.6 The impact of antivirals on virus shedding need to be reassessed during the pandemic, and policy recommendations updated if observations are different from the assumptions made.
Scientific rationale	4.1 Studies suggest that virus shedding (thus infectiousness) precedes onset of symptoms by 1 day.[28, 29] 4.2 Based on virus shedding data, peak shedding occurs within 1–2 days after onset of symptoms.[30, 31, 32] 4.3 Data for both influenza A and B infections suggest that virus shedding in healthy adults declines after day 5 of symptoms.[30, 33] 4.4 Research on virus shedding patterns in children and the immunocompromised suggest that they shed virus for longer than other groups.[34, 35, 36] There are no data to suggest that the elderly are likely to have longer periods of communicability of the virus, but since cytotoxic T-lymphocyte activity declines with age, it is likely that longer time is taken to clear virus and recover from infection.[29] 4.5 Data on whether individuals with asymptomatic influenza infections are infectious are very limited.[37] However, the literature suggests that asymptomatic infections are unlikely to play a major role in disease spread.[30] 4.6 Antivirals reduce length of illness and virus shedding[38, 39]

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 5: Serial interval

Current assumption(s)[a]	The current assumption is that the serial interval will be 2–4 days. Serial interval in this context is defined as the average length of time between the primary case developing symptoms and the secondary case developing symptoms
Planning implications	Early in the pandemic, short serial intervals will necessitate rapid contact tracing to be effective in reducing transmission. Long serial intervals will increase the reproduction number, which may necessitate more stringent pharmaceutical and nonpharmaceutical measures to reduce transmission
Response implications	Serial interval estimate, along with attack rate, will be required to be able to model the likely impact and to adjust control measures to reduce transmission.
Scientific rationale	Studies have shown that both seasonal influenza and the 2009 pandemic influenza had mean serial intervals of 2–4 days.[40, 41, 42] The World Health Organization currently estimates that the serial interval for influenza at 2–4 days[43]

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 6: Presenting symptoms

Current assumption(s)[a]	The predominant presenting symptoms during a pandemic will be fever and respiratory symptoms such as cough and sore throat. These will usually be accompanied by systemic symptoms such as myalgia and fatigue. Fever may not be present in the elderly and children. Atypical presentations may be more common at the extremes of age
Planning implications	Screening programs, surveillance and clinical case definitions should be based around fever and respiratory symptoms
Response implications	It will be a high priority to understand the spectrum of presenting symptoms to allow modifications to case definitions (surveillance and clinical) as early as possible to ensure the appropriate levels of sensitivity and specificity. It will be important early in a pandemic to establish the frequency of atypical presentations as amendments, particularly to the clinical case definitions, may be required
Scientific rationale	Extensive studies of seasonal influenza and previous pandemics indicate that influenza is predominately a respiratory disease.[33, 44, 45, 46] However, atypical presentations of seasonal influenza can occur particularly in those at the extremes of age and in patients with unusual influenza viruses such as influenza A/H5N1.[29] It is therefore possible that pandemic influenza could present with high frequency of atypical symptoms

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 7: Health impact

Current assumption(s)[a]	7.1 The clinical case fatality rate will range between 1% and 2.5%. 7.2 With appropriate medical care (early antiviral and antibiotic therapy as needed and supportive care for those with more severe illness), the death rate could be halved. 7.3 A W-shaped mortality distribution, similar to that seen in the 1918 pandemic, has been assumed for planning purposes with three mortality rate peaks—under-5-year-olds, over-65-year-olds and 20-to-35-year-olds. 7.4 A similar range of complications would be encountered as currently experienced with seasonal influenza, namely, predominately respiratory complications including secondary bacterial infections for all age groups, a rise in cardiovascular events in adults and the elderly, and a small proportion of children presenting with neurological complications. The frequency of all complications would be greater in a pandemic than with seasonal influenza. 7.5 Maternal mortality and fetal loss are likely to be significant. 7.6 The immunosuppressed and those with underlying serious medical conditions would experience higher complications than those without underlying health problems. 7.7 Psychosocial and mental health needs are likely to be high and demand for these services may extend into and even beyond the recovery period
Planning implications	7.1–7.2 Planning should ensure that the stockpiling and use of antivirals, antibiotics and appropriate supportive health care during a pandemic could be optimised. 7.3 Paediatric and elderly care health services will be in demand and planning should ensure that these services could be readily optimised. The possibility of a high health impact in the young working-age group needs to be incorporated into business continuity and social service planning arrangements. 7.4 Respiratory and cardiovascular services will likely be in high demand and planning should ensure that these services could be optimised. 7.5 Obstetric and neonatal services should be included in health service planning. 7.6–7.7 Certain specialist healthcare services may be required to ensure that the specific needs of these groups can be best met. Social support and community resilience will also be important and should be included in whole of government planning
Response implications	7.1–7.7 Data on health service usage and case fatality rates need to be closely monitored throughout the pandemic and services optimised as required
Scientific rationale	7.1–7.3 are based on data from the 1918 pandemic[45] and are aligned with pandemic planning assumptions in other countries.[8, 9] 7.4 Hospitalisation data during seasonal influenza outbreaks in Australia and during the 2009 pandemic indicated that the range of complications are similar.[37, 47, 48] 7.5–7.6 This is based on data from seasonal influenza and previous pandemics.[33, 44, 48, 49] 7.7 This is based on data from natural disasters and mass casualty events

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 8: Treatment with neuraminidase inhibitor antivirals

Current assumption(s)[a]	8.1 Timing—The optimal effect of neuraminidase inhibitor (NI) antiviral treatment is seen if started within 48 hours of symptom onset. Effectiveness decreases after 48 hours, with limited therapeutic benefit likely to be seen when treatment is started later than 5 days post-onset of systemic symptoms (myalgia +/– fever). 8.2 Dosage—Current recommended doses and contraindications should be used for planning. There is currently no evidence to support the use of combination therapy. 8.3 Effect on mortality—Early NI antiviral treatment (within 48 hours of symptom onset) may have some impact on reducing mortality. A scarcity of evidence makes it difficult to differentiate the effect on early versus late mortality. It is possible that late mortality may be reduced through a reduction in antibiotic use (assumption 10.4). 8.4 Effect on morbidity—Early use of NIs (within 48 hours of symptom onset) is anticipated to result in a reduction in: • duration of symptoms (0.5–1.5 days) and time to return to normal activity (0.5–2.5 days) • antibiotic use of 23–74% in adults (oseltamivir and zanamivir) and 50–95% children (zanamivir) • pneumonia in at-risk adults, healthy adults, and children, and otitis media in children. (Note: the evidence supports a reduction but is inadequate to provide reasonably reliable estimates of the size.) 8.5 Antiviral treatment (early) of pregnant women is likely to be important in reducing maternal mortality and negative neonatal outcomes; however, the size of this potential impact is impossible to predict at this stage. Early surveillance and clinical data will be needed. 8.6 The precise clinical indications and population groups that would benefit most from treatment are difficult to predict prior to the onset of a pandemic. It is reasonable to assume that those most at risk of severe outcomes will benefit the most from treatment—for these groups refer to planning assumption 9. 8.7 Effect on transmission—Early antiviral treatment of cases (within 24–48 hours of symptom onset) may reduce transmission of virus within households, and may reduce secondary cases by up to 50%. 8.8 Resistance—Sensitivity of the pandemic virus to NI antivirals is high, and will be monitored
Planning implications	Antivirals are most effective if administered within 48 hours of onset of symptoms—this will guide the development of case definitions, diagnostic criteria, availability and dispensing, prepositioning of the antiviral medications, and risk-communication messaging. Antiviral and antibiotic stockpile requirements will be informed by these assumptions. They can be used to model the likely health capacity needs and health impact of a future pandemic, assuming application of alternative antiviral policies (from risk groups only to all patients), as well as the impact of varying degrees of resistance to NI antivirals
Response implications	The policy on the use of antivirals for treatment should be reviewed during the pandemic in light of the severity of the pandemic, at-risk groups, attack rates, transmission patterns and health sector capacity. Virological surveillance and resistance testing is important to monitor as resistance will reduce the effectiveness of antivirals and increase reliance on alternative mitigation strategies

[a] Australian Health Management Plan for Pandemic Influenza 2014

Scientific rationale	Treatment is most effective when initiated within 48 hours of symptom onset, with earlier initiation associated with greater benefit.[50, 51, 52] Randomised trial data demonstrate NI antiviral treatment is associated with a reduction in median symptom duration and reduction in time to return to normal activity.[53] Observational studies (including H1N1 pandemic data) suggest NI antivirals may reduce the incidence of influenza-related complications (pneumonia, other respiratory conditions, otitis media), reduce antibiotic requirements and hospitalisations.[54, 55] There is limited randomised trial data to support this, with the most consistent and strongest finding being a reduction in antibiotic use.[53, 56, 57] Observational studies (including H1N1 pandemic data) suggest NI antivirals may reduce mortality, however there is no randomised data.[58, 59] The prevalence of resistance to NI in circulating human influenza viruses is currently low, however this may change.[60] Small observation studies suggest NI antiviral treatment may reduce viral load and duration of viral shedding, and household studies suggest that treatment may reduce transmission of the virus to contacts[61, 62]

Assumption 9: Prophylaxis with neuraminidase inhibitor antivirals

Current assumption(s)[a]	9.1 Dosage—The current recommended dosage and instructions for use for prophylaxis is assumed to be effective against the pandemic strain. 9.2 Pre-exposure prophylaxis: • Oseltamivir and zanamivir are 50–75% effective at preventing influenza in healthy and at-risk adult groups. • Pre-exposure prophylaxis should preferably begin 2 hours before exposure. The maximum recommended length for continuous prophylaxis should be 6 weeks for oseltamivir and 4 weeks for zanamivir until further data become available. People on continuous pre-exposure prophylaxis need a periodic break from taking the drug. 9.3 Postexposure prophylaxis: • Oseltamivir and zanamivir are effective at reducing the risk of influenza in household contacts of laboratory-confirmed influenza by between 50% and 90%, with a best estimate of 80%. • This effect is dependent on antiviral prophylaxis being initiated as early as possible—definitely within 48 hours of exposure. It is unlikely to have any significant impact if started more than 48 hours post exposure
Planning implications	Antiviral interventions have a role in mitigating the effects of a pandemic, especially in the early phases when a pandemic vaccine is not available. They complement other strategies to reduce disease transmission and disease burden, such as hygiene interventions, risk communication, isolation and quarantine. In planning policy for use of antivirals for prophylaxis, the following should be considered: (a) availability of antivirals including their prepositioning and dispensation protocols, (b) likely uptake and adherence by those targeted for prophylaxis, and (c) the phase of the pandemic during which the policy is applied and the objective sought (such as containment of initial clusters or minimising the peak transmission period)
Response implications	Flexibility in the antiviral use policy is recommended, so that during a pandemic, it can be reviewed as information becomes available on the severity of the pandemic, at-risk groups, attack rates and transmission patterns, health sector capacity and antiviral stockpile amounts
Scientific rationale	Systematic reviews have concluded that oseltamivir and zanamivir are effective in preventing seasonal influenza (pre-exposure prophylaxis).[63, 64] Randomised controlled trials have demonstrated a protective effect when NI antivirals are used for postexposure prophylaxis in households, if started within 48 hours of initial contact.[64] Observational findings from the H1N1 pandemic are supportive of this effect [65, 66]

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 10: Immunity following natural infection

Current assumption(s)[a]	10.1 For planning purposes, it should be assumed that all individuals, regardless of age, would be vulnerable to pandemic influenza; that is, no natural prior immunity will be present in any age groups. 10.2 It is assumed that individuals who have recovered from natural infection will have a reasonably high degree of protection from a second infection within the same pandemic, should a second distinct wave occur. However, as subsequent waves may be due to a drifted virus, it cannot be assumed that an individual who experienced pandemic influenza in an initial wave would be fully protected in any subsequent waves
Planning implications	10.1 Planning should be based on the assumptions that no natural prior immunity will exist; hence, protection may be required by all members of the population. 10.2 Planning for the first wave response can assume that natural infection will confer a high degree of protection during that wave. However, planning for second and subsequent waves (based on the assumption that the virus will drift) should be based on the assumption that immunity developed in the community as a result of infection during previous waves may not be fully protective against subsequent waves
Response implications	10.1 As the first wave progresses, immunity post infection should be assessed. If immunity is high, then, in certain circumstances, protective measures for recoverees could be reduced. 10.2 If subsequent waves progress, data should be collected to see if previous infection is conferring protection against the second/subsequent wave pandemic virus. If immunity is high, then, in certain circumstances, protective measures for recoverees could be reduced. The level of protection in second waves following natural infection will be assessed at the time as a priority
Scientific rationale	10.1 By definition, an influenza pandemic occurs when a new influenza virus emerges and spreads around the world, and most people do not have immunity [67]. Research has shown that attack rates and severity of previous pandemics has been lower in the elderly likely as a result of previous exposure to antigenically related influenza viruses.[45, 68, 69] However, pre-existing levels of immunity to future pandemic viruses will depend on the extent of its relatedness to viruses that circulated previously.[70] 10.2 For seasonal influenza, individuals recovered from infection have been shown to have a high degree of protection from a second infection with the same virus.[68, 71] Based on data from previous pandemics, rates of cross-protection against second infection or a drifted virus during a second wave vary[72, 73, 74]

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 11: Vaccine use

Current assumption(s)[a]	11.1 The objectives of vaccination are to protect the vulnerable and to reduce transmission. Since vaccine protects the person immunised and also has a multiplier effect, vaccinating a sufficient proportion of the population will achieve herd immunity and will reduce transmission. 11.2 Quantities of pandemic customised vaccine sufficient for the Australian target population (40% of total population) will only be available within 6 months of the pandemic or by the second epidemic wave. 11.3 Efficacy of the prepandemic candidate and pandemic customised vaccine will be comparable to current seasonal influenza vaccines. Efficacy will vary depending on demographic factors, where vaccine will be most efficacious in healthy older teenagers and young adults. Vaccine will be less efficacious among the elderly, young children and those with underlying chronic illnesses. 11.4 The safety of prepandemic candidate vaccines and pandemic customised vaccine will be comparable to current seasonal influenza vaccines. Vaccine will be relatively safe for all populations, except for those in whom it is contraindicated. 11.5 Population acceptability and willingness to be vaccinated will be high. 11.6 If utilised, the virus strain in the prepandemic candidate vaccine will be closely related to the pandemic strain, and a priming level of protection will be achieved after two doses. 11.7 Two doses of pandemic customised vaccine will be required to achieve immunity, where doses will need to be received 3 weeks apart and immunity will be achieved 7 days after the second dose. 11.8 For individuals who receive two doses of the prepandemic candidate vaccine, one pandemic customised vaccine booster dose will be required for protective antibody levels. Immunity will be achieved 7 days after the booster dose
Planning implications	11.1–11.2 Vaccination target population will impact the volume of vaccine doses ordered and risk-communication messaging to maximise uptake. 11.3–11.4 At-risk groups for whom vaccine is known to be less efficacious or safe will be targeted with other mitigation strategies, such as antiviral use and nonpharmaceutical interventions. 11.5 Methods to enhance vaccine uptake by target groups will be explored during the planning process. 11.6 Prepandemic candidate vaccines will not be applied until further advice from the World Health Organization. However, the list of target groups for this vaccine during the prepandemic phase will include frontline healthcare workers. 11.7–11.8 Various models for vaccine delivery to target population groups will be developed for different pandemic severity scenarios
Response implications	11.1–11.2 A rapid assessment of pandemic severity and high-risk groups (for infection and for complications) will be conducted early in the first pandemic wave to inform vaccination strategy. 11.3–11.4 Vaccine efficacy, effectiveness and safety studies will be conducted and adjustments made to the vaccine if necessary. 11.5 Vaccine uptake will be monitored in all jurisdictions to determine if risk-communication strategies need revision. 11.6–11.8 The level of cross-protection achieved from the prepandemic candidate vaccine, seasonal influenza vaccine and pre-existing immunity for the pandemic strain will be assessed to determine if vaccination policy needs to be revised
Scientific rationale	11.1–11.2 Delays in the availability of a customised pandemic vaccine are likely. In 2009 first doses were available at 4 months post pandemic declaration in Australia and within the second epidemic wave in the UK.[9] The UK and NZ's updated pandemic plans have assumptions of up to six months' delay.[8, 9]

[a] Australian Health Management Plan for Pandemic Influenza 2013

	11.1–11.2 2009 Australian pandemic estimates were that 40% of the population needed to be vaccinated to protect those at risk of severe disease and to reduce disease transmission (7% vulnerable/at risk for complications, 33% herd immunity/transmission reduction).[75] Updated estimates will depend on the pandemic epidemiological characteristics. 11.3 Vaccine efficacy will be comparable to current seasonal influenza vaccines if current standard methods of development are used. Efficacy is highest in healthy older teenagers/young adults [76] and lowest in the elderly, children < 6 months old and immunocompromised people.[70, 76, 77, 78, 79, 80] 11.4 Safety will be comparable to current seasonal influenza vaccines if produced using currently applied technologies and methods, however an unfavourable safety profile cannot be ruled out.[9] 11.5 Vaccine acceptability and uptake is influenced by many factors including concerns over the safety, efficacy and development process[81, 82, 83, 84, 85]. Vaccine uptake during 2009 pandemic was variable (18-40%) [9,75], with a perceived low risk of infection and severity, and fear of adverse events, reported to negatively impact on willingness to be vaccinated [86]. 11.6 The public health value of a prepandemic candidate vaccine depends on whether it offers high cross-protection.[9] Studies in healthy adult populations show that two doses are needed.[87, 88] Most registered prepandemic candidate vaccines have a two-dose regimen 21 days apart.[89] 11.7 Given the assumption of very little pre-existing immunity, two doses of the pandemic customised vaccine will be required 21-days apart. If a prepandemic vaccine strategy is applied and has good cross-reactivity, only one dose of pandemic customised vaccine will be needed following two doses of the prepandemic candidate vaccine, as per the prime-boost strategy in the United Kingdom.

Assumption 12: Absenteeism

Current assumption(s)[a]	12.1 Up to 20% of the working-age population could be away from work on any given day during the peak of the pandemic. This includes absenteeism due to illness, quarantine, care for someone who is ill or due to fear of infection. 12.2 Absenteeism rates among healthcare workers may be higher during a pandemic compared to other workforce sectors due to their occupational exposure and fear of infection. 12.3 Working-age adults who develop pandemic influenza would be unable to come to work for up to 7 days after the onset of symptoms. 12.4 From the time of onset of symptoms, working-age adults who develop pandemic influenza would require 14 days till full recovery to be fit enough to return to normal activities
Planning implications	12.1–12.4 Business continuity needs to assume and plan for high and possibly fluctuating levels of absenteeism throughout the pandemic. Communication strategies need to ensure that the public are kept well informed and that fears and concerns are addressed. 12.2 Risk communication for healthcare workers should be delivered regularly prior and during a pandemic to educate and reassure them about measures taken to protect their health, thus maximising commitment to work during a pandemic. Policy on measures such as use of antiviral prophylaxis and treatment should be explored for this high-risk population
Response implications	12.1–12.4 During the pandemic, workforce absenteeism should be assessed through surveillance or specific research studies. Interventions can then be updated if absenteeism is higher or lower than assumed in business continuity plans. These studies can also be used to ascertain the pandemic's disease burden.
Scientific rationale	12.1 The cumulative absenteeism during seasonal influenza epidemics can be up to 20%.[90] For pandemic influenza, the 2009 pandemic had 13% cumulative absenteeism,[90] but daily peak absenteeism rates were low.[91] Modelling studies have suggested that absenteeism can be up to 20% during any given day in the peak of a severe pandemic.[9, 92] Different rates of growth (R_0), latent periods and period of communicability will impact both absenteeism rates and duration of peak absenteeism.[92] 12.2 Studies from severe acute respiratory syndrome and subsequent surveys relating to pandemic influenza have shown that healthcare workers may be absent from work due to both illness and fear of infection.[9] 12.3 This is based on advice given during the 2009 pandemic[93] and based on the assumptions made regarding the period of communicability. 12.4 Research has shown that even though most symptoms resolve within 1 week of onset; full recovery could take 2 weeks[9, 94, 95]

[a] Australian Health Management Plan for Pandemic Influenza 2014

Assumption 13: Duration of pandemic disruption

Current assumption(s)[a]	The pandemic in Australia will last 7–10 months. Recovery is likely to take a further 6 months to 1 year, depending on how severe the pandemic has been
Planning and response implications	Business and the community need to plan to be able to continue to function despite the disruptions for up to one year. Business continuity needs to take into account the likely fluctuating levels of disruptions and possible differences in timing of interventions across the country
Scientific rationale	Previous pandemics have demonstrated multiple waves of infection, where the interval between successive waves was many months.[96] Each pandemic wave may vary in length, with other countries assuming 8–16 weeks[7, 8, 9]

[a] Australian Health Management Plan for Pandemic Influenza 2014

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