



**MINISTRY OF HEALTH
SINGAPORE**

**INFLUENZA PANDEMIC READINESS AND
RESPONSE PLAN**

DRAFT

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INFLUENZA PANDEMIC READINESS AND RESPONSE PLAN

SCOPE

1. This document covers the **medical and public health** responses and measures to prevent the import of the influenza pandemic into Singapore and in the event of an outbreak, to manage the infected cases and break the chain of transmission.

INTRODUCTION

Background

2. Influenza causes seasonal epidemics of disease resulting in an average of 14.8 deaths per 100 000 or 600 deaths in Singapore each year (USA-19.6, Hong Kong-16.4). A pandemic occurs when there is a major change in the influenza virus such that most or all of the world's population has never been exposed previously and is thus vulnerable to the virus. An influenza pandemic has a greater potential to cause rapid increases in death and illnesses than virtually any other natural health threat.

3. In Jan 04, health authorities in Vietnam and Thailand reported their first human cases of infection with avian influenza caused by an H5N1 strain. The cases in humans are directly linked to outbreaks of highly pathogenic H5N1 avian influenza in poultry initially reported in Korea in mid-December 2003 and subsequently confirmed in an additional seven Asian countries (Vietnam, Japan, Thailand, Cambodia, China, Laos and Indonesia). As at end 04, no country other than Vietnam and Thailand had reported human cases. In Sep 04, Thailand reported a probable case of inefficient human-to-human transmission in a family cluster. A resurgence of poultry outbreaks and human cases has also been reported in Vietnam since December 2004. In February 2005, Cambodia reported its first human case of avian influenza. As of April 05, there have been 89 reported human cases resulting in 52 deaths. Based on these figures, the fatality rate is 60% with Vietnam and Cambodia continuing to report new cases.

4. The World Health Organization (WHO), in a report released at its 115th Executive Board Meeting on 20 Jan 05, expressed concern over the possibility of the avian influenza in Asia evolving into an influenza pandemic. WHO highlighted that the events in 2004, supported by epidemiological and virological surveillance, have given the world an unprecedented warning that a pandemic may be imminent. WHO warned that although the changing nature of influenza viruses prevented precise predictions of the occurrence of pandemics, the conditions favouring the emergence of a pandemic had been met save one: efficient human-to-human transmission. Hence, WHO urged all countries to undertake or intensify preparedness activities as a matter of urgency.

Public Health Threat Assessment

5. Pandemics are preceded by the introduction of a new Influenza A subtype as humans have no immunity to it. Human infections due to new subtypes of influenza A that have occurred in recent years are H5N1, H7N7 and H9N2. The most virulent is H5N1 which has caused high case fatality rates. Fortunately, human-to-human transmission of H5N1 is still rare and inefficient. However, H5N1 outbreaks continue to occur in poultry in Cambodia, Indonesia, Thailand and Vietnam. It will take a long time for the authorities there to eradicate H5N1 among the poultry, especially now that domestic ducks appear to continue to shed a high load of H5N1 without becoming symptomatic. Probable human-to-human transmission of influenza A/ H5N1 also occurred in Thailand in 2004. Each case of human infection presents another opportunity for the virus to acquire the ability to transmit efficiently from human to human, thereby increasing the likelihood of an influenza pandemic.

6. According to WHO and CDC-Atlanta, the influenza pandemic threat is real and imminent and the risk to public health severe as:

a. We are dealing with a new sub-type of the influenza A virus, the H5N1 virus, to which humans have no immunity.

b. Human cases experienced severe illness with a very high mortality rate. Human cases of the H5N1 show that both adults and children are susceptible to the infection.

c. Avian flu outbreaks continue to spread in Vietnam and Thailand. Likelihood of eradicating avian flu in this region is bleak. As long as avian flu outbreaks among poultry continue, human infections will occur. With time, the H5N1 virus will mutate and acquire the ability to spread from person to person.

CLINICAL FEATURES

Symptoms

7. Uncomplicated influenza illness is characterized by the abrupt onset of constitutional and respiratory signs and symptoms (e.g. fever, myalgia, headache, malaise, nonproductive cough, sore throat, and rhinitis). Among children, otitis media, nausea, and vomiting are also commonly reported with influenza illness. Influenza illness typically resolves after a limited number of days for the majority of persons, although cough and malaise can persist for more than 2 weeks. Among certain persons, influenza can exacerbate underlying medical conditions (e.g. pulmonary or cardiac disease), lead to secondary bacterial pneumonia or primary influenza viral pneumonia, or occur as part of a co-infection with other viral or bacterial pathogens. Young children with influenza infection can have initial symptoms mimicking bacterial sepsis with high fevers, and $\leq 20\%$ of children hospitalized with influenza can have

febrile seizures. Influenza infection has also been associated with encephalopathy, transverse myelitis, Reye syndrome, myositis, myocarditis, and pericarditis.

Laboratory Features

8. Diagnostic tests available for influenza include viral culture, serology, rapid antigen testing, polymerase chain reaction (PCR) and immunofluorescence. Sensitivity and specificity of any test for influenza might vary by the laboratory that performs the test, the type of test used, and the type of specimen tested. Among respiratory specimens for viral isolation or rapid detection, nasopharyngeal specimens are typically more effective than throat swab specimens. As with any diagnostic test, results should be evaluated in the context of other clinical information available to health-care providers.

9. Commercial rapid diagnostic tests are available that can be used by in outpatient settings to detect influenza viruses within 30 minutes. These rapid tests differ in the types of influenza viruses they can detect and whether they can distinguish between influenza types.

Differential Diagnosis

10. Influenza can be difficult to diagnose based on clinical symptoms alone because the initial symptoms of influenza can be similar those caused by other infectious agents including, but not limited to, *Mycoplasma pneumoniae*, adenovirus, respiratory syncytial virus, rhinovirus, parainfluenza viruses, and *Legionella* spp. Reported sensitivities and specificities of clinical definitions for influenza-like illness in studies primarily among adults that include fever and cough have ranged from 63% to 78% and 55% to 71%, respectively, compared with viral culture.

Mortality

11. Influenza-related deaths can result from pneumonia as well as from exacerbations of cardiopulmonary conditions and other chronic diseases. Older adults account for $\geq 90\%$ of deaths attributed to pneumonia and influenza. Estimated rates of influenza-associated pulmonary and circulatory deaths per 100,000 persons were 0.4–0.6 among persons aged 0–49 years, 7.5 among persons aged 50–64 years, and 98.3 among persons aged ≥ 65 years. Deaths from influenza are uncommon among children with and without high-risk conditions, but they do occur. However, in an influenza pandemic, the mortality rates among the different population groups could be vastly different from that in seasonal influenza cases.

Epidemiology

12. As human influenza viruses were responsible for influenza pandemics and seasonal epidemics in the past, we assume that the epidemiological features of the next pandemic strain will be consistent with those of human

influenza viruses, as outlined below. However, these features should not be interpreted as being definitive of a novel pandemic virus. In the event of a pandemic, active and enhanced surveillance will be required in the early stages of the outbreak to determine the true nature of the pandemic virus.

13. **Incubation period.** The incubation period is typically 2 days, with a range of 1 - 4 days.

14. **Transmission.** There are 3 modes of transmission:

- a. Large droplet spread, which is the main route of transmission;
- b. Contact, either direct or indirect, with respiratory secretions.
- c. Transmission through droplet nuclei, i.e. airborne spread, is possible, although less evidence is available on this mode of spread. Sneezing, coughing and even talking can produce droplets of wide variety of particle sizes that can facilitate droplet or droplet nuclei infection.

15. **Infectious period**

- a. Infected persons can be contagious one day before the onset of symptoms. Infected persons with minimal symptoms may still shed the virus and be infectious. Primary infection in young children is usually symptomatic although up to 50% may be asymptomatic.
- b. Viral shedding occurs for approximately 3-5 days in adults, up to 3 weeks for young children, and viral shedding for more than 3 weeks is possible in severely immunocompromised persons. The amount of viral shedding correlates with the severity of illness and temperature elevation.
- c. Pre-existing antibodies against related influenza strains are partially protective, i.e. a higher infective inoculum is required with a lower likelihood of clinical illness.

16. **Organism survival in different environments.** Survival of the influenza virus outside the body varies with temperature and humidity. It generally survives 24-48 hours on hard, non-porous surfaces, 8-12 hours on cloth/paper/tissue, and 5 minutes on hands. Survival of the virus is enhanced under conditions of low humidity and in the cold.

Case Definition

17. The case definition of influenza is sub-categorized into probable and confirmed cases. In view of the time required for laboratory confirmation of pandemic influenza infection, the probable case definition will be the working definition for operational considerations and the contact definition has been developed in relation to this.

a. **Probable case.** Persons are considered probable pandemic influenza cases when the following conditions are fulfilled:

- (1) Abrupt onset of fever more than or equal to 38 degrees Celsius (except in persons aged 60 years and above); and
- (2) Non-productive cough; and either
 - (a) a positive epidemiological link (travel to country with pandemic influenza or contact history with an infected person); or
 - (b) a positive rapid test¹ kit result, if available.
- (3) Fever may often be absent in persons aged 60 years and above. Therefore, in the absence of fever, any of the following symptoms, in addition to non-productive cough, should raise a high index of suspicion for persons in this age group:
 - (a) malaise;
 - (b) chills;
 - (c) headache;
 - (d) myalgia.

b. **Confirmed case.** Persons are considered confirmed pandemic influenza cases when there is laboratory confirmation of infection with pandemic influenza.

PLANNING ASSUMPTIONS

18. The response plan is based on the following planning assumptions:

- a. The first local human case is more likely to be imported from affected countries rather than developing from within Singapore through direct animal to human transmission.
- b. The warning period will be relatively short should a novel flu virus emerge that is capable of efficient human transmission.
- c. It may take several days to confirm that this is a new flu strain.

¹ The use and type of rapid test kits to be used will be determined in the event of an influenza pandemic.

d. The virus is likely to spread quickly and associated with a high morbidity and/or mortality. Although the human flu is transmitted mainly through droplets, it is much more infectious than SARS.

e. The infection could be present in Singapore through imported human cases within days to weeks after it emerges in another part of the world. It is unlikely that we will be able to prevent import of the pandemic or contain the spread of the disease in the community. However, the spread can be delayed.

f. The length of each wave is six weeks. A pandemic usually spreads in two or more waves, either in the same year or in successive influenza seasons. A second wave may occur within 3 to 9 months of the initial outbreak and may cause more serious illnesses and deaths than the first. Based on published data from temperate countries, the length of each wave is estimated to be up to 6 weeks.

g. There will not be any vaccine initially. The development of vaccine will take at least 4 to 6 months. When vaccines are eventually developed, the supply would be limited initially.

h. Currently, there are two classes of medications that are indicated for both the prophylaxis and treatment of infected cases. They are M2 inhibitors and the neuraminidase inhibitors. The current H5N1 strain appears to be resistant to M2 inhibitors and hence a novel human flu strain arising from human and avian flu viral recombination is likely to be also resistant to this class of drugs. We will have to rely on neuraminidase inhibitors such as Oseltamivir which is in high demand worldwide and availability is low.

i. The control measures used for SARS will be adapted for use to mitigate the spread of influenza, this includes infection control measures instituted at healthcare institutions, border health and community-wide measures and quarantine measures.

Estimating the Impact

19. In order to estimate the impact of an influenza pandemic occurring in Singapore in terms of deaths, hospitalizations and outpatient visits, a software programme, FluAid, developed by US CDC was used to study the trends based on various attack rate assumptions (estimate of how a pandemic strain might behave). The results and modeling details are as shown in the table below.

Table 1: Estimated numbers of deaths, hospitalizations and outpatient visits due to a pandemic strain of influenza at gross attack rates of 15%, 25% and 35%

Impact/Scenario	Attack rate = 15%	Attack rate = 25%	Attack rate = 35%
<i>Deaths</i>			
Most likely	1 123	1 872	2 622
Minimum	536	894	1 250
Maximum	1 947	3 245	4 543
<i>Hospitalisations</i>			
Most likely	6 744	11 240	15 737
Minimum	1 845	3 075	4 304
Maximum	8 222	13 702	19 183
<i>Outpatient visits</i>			
Most likely	332 454	554 090	775 726
Minimum	248 517	414 196	579 875
Maximum	464 995	774 992	1 084 989

20. Assuming an attack rate of 25%, the projected estimated number requiring outpatient treatment is 550 000 and those requiring hospitalization is 11,240. However, when there is intervention with anti-virals, using a conservative estimate of its efficacy, the estimated number of hospitalized cases is expected to be halved².

NATIONAL STRATEGY

21. The national strategy is to establish an effective surveillance system to detect the importation of a novel influenza virus, mitigate the consequences when the first pandemic wave hits and then race to achieve national immunity when a vaccine becomes available. During an outbreak, we will have to sustain the nation through the first pandemic wave by minimizing mortality and morbidity through effective infection control, healthcare management, chemoprophylaxis and measures to increase social distances while ensuring preparedness for vaccination of the entire population when a vaccine becomes available. Our response aims at achieving the following 3 outcomes:

- a. **Maintain essential services in Singapore to limit social and economic disruptions.** In an influenza pandemic, it is important to limit the impact on essential services. Most work units would probably be able to maintain staff availability at above 80%. This can be further improved if there is an established business continuity plan to ensure that proper health control measures for both individual and community within the organization are in place. However, certain segments of the

² As treatment, use of anti-virals will result in 50-70% fewer influenza induced complications, 50-80% fewer hospitalisations and deaths and earlier return to normal activities by 1-3 days.

essential services will need the added protection to ensure full operational capacity in order to continue to provide Singaporeans with uninterrupted services. These work units will be provided anti-viral prophylaxis.

b. **Reduce morbidity and mortality through treatment of all influenza-like cases.** Due to the difficulty of confirming influenza patients, in practice, all persons presenting with the abrupt onset of constitutional and respiratory signs and symptoms (e.g. fever, myalgia, headache, severe malaise, nonproductive cough, sore throat, and rhinitis) will be treated. Hence all patients 1 year and older with influenza-like symptoms will be treated with anti-virals preferably within 48 hours of the onset of symptoms and continued for 5 days.

c. **Slow and limit the spread of influenza to reduce the surge on healthcare system.** When an influenza pandemic is declared, the estimated number of cases requiring medical attention could easily overwhelm our healthcare system. Hence additional measures will be taken to slow down the spread and reduce the surge requirements on our healthcare system. These include:

(1) **Border Health Control Measures.** Policies with regard to border control and cross border case management will be activated to prevent import. If necessary, travel restrictions or advisories would be issued to restrict travel to and from the infected countries. By and large, the border health control measures for SARS will be adopted, though some of the measures may not be as effective for pandemic.

(2) **Healthcare Institutions.** The healthcare institutions are key to fighting the disease. They will be protected through infection control measures and personal protection practices developed during the SARS crisis. In addition, front-line healthcare workers (HCWs) working at the restructured hospitals and polyclinics will be given anti-viral prophylaxis for the duration of the pandemic.

(3) **Community-Wide Measures.** It is unlikely that we will be able to contain the infection. However, measures can still be taken to delay the spread of the disease throughout the community, in order not to overwhelm essential services or resources. A key drive is in educating the public and securing their co-operation with our efforts in infection control. The key message to the public will be the importance of each individual's responsibility in detecting and preventing the spread of flu through personal hygiene and being socially responsible in their behaviour. As influenza is highly virulent and it spreads easily from person to person in confined spaces, it may be necessary to implement the temporary closure of schools and childcare

centres as well as limit public events to prevent people from congregating at public places.

DISEASE OUTBREAK RESPONSE SYSTEM (DORS)

22. DORS (Disease Outbreak Response System) is a generic framework which enables MOH to respond immediately to any outbreaks and serves as the nucleus to ramp up for a higher level of response. DORS has three main thrusts: Case Management; Infection Control in Healthcare Institutions; and Public Health Measures.

23. **Definition of DORSCON-FLU Alert levels.** The triggers for implementing the influenza pandemic response are defined as follows:

a. **Alert GREEN Level 0.** This is a situation where the public health threat to Singapore is low because there are no novel influenza virus outbreaks anywhere in the world.

b. **Alert GREEN Level 1.** At this level of alert, there should be global concern including the WHO about the possible emergence of a novel virus resulting from the outbreak of HPAI in animals. In this case, there may be isolated external or local cases of animal to human case, but the threat of human to human infection remains low. Hence in Alert GREEN, the disease, if any, is basically limited to animals.

c. **Alert YELLOW.** This refers to a situation where there are inefficient human-to-human transmissions of influenza caused by a novel virus outside Singapore. The potential for a global influenza pandemic is high, though not inevitable as it would still be possible to contain the outbreak through aggressive measures by the affected country. The risk of import into Singapore is elevated. Where there are isolated imported cases, such cases have not resulted in sustained transmission locally.

d. **Alert ORANGE.** This is when a pandemic is underway and the infection has evolved to become a human disease. WHO has confirmed that the novel virus is causing several outbreaks in one country and this has spread to other countries with consistent disease patterns indicating serious morbidity and mortality is likely in at least one segment of the affected population. Locally, there is a confirmation of novel virus infection case(s) and evidence of more than one transmission, but the outbreak has not reached the community level. However, given the infectivity of the virus, further outbreaks of the disease are expected.

e. **Alert RED.** This is a situation where there is a pronounced risk of acquiring the disease from the community. There is an increasing trend of mortality and morbidity rates among affected cases. The healthcare system is likely to be overwhelmed.

f. **Alert BLACK.** Alert BLACK is sounded when the morbidity and mortality rates are exceedingly high, and emergency measures are needed to bring the situation under control. The healthcare and other social support systems are overwhelmed by the pandemic. Economic activities are severely disrupted, as panic sweeps through the community.

24. The activities of the influenza pandemic response plan can be elaborated and broken down to three phases, in line with the DORS framework, as follows:

a. **Phase 1 - Pre-Outbreak (DORSCON GREEN).** Surveillance of the local and international influenza situation is the key activity. Surveillance will provide early indication of an outbreak and assess the threat situation for response to prevent importation or onset of disease in humans. While maintaining the preparedness for the key response systems, this phase may also see the management of isolated animal to human cases.

b. **Phase 2 – Outbreak (DORSCON YELLOW to BLACK).** While the surveillance confirms and characterizes the outbreak, the major activities are the coordination and control of public health responses and managing the impact to Singapore including public confidence.

c. **Phase 3 – Post-Outbreak (DORSCON GREEN).** Surveillance continues to be on high capacity to detect resurgence, while steps are taken to step-down measures that have been instituted in the fight against the disease.

25. The DORSCON-FLU alert levels provide a guide for response planning and execution in the event of an influenza pandemic. However if the progression of the disease is very fast, it may not be operationally feasible to have a clear, sequentially graduated response.

DORSCON-FLU RESPONSES

26. **Alert GREEN Level 0.** The strategy is to maintain situation awareness through general surveillance.

a. **Surveillance.** Monitor the influenza situation and ensure an integrated surveillance system that is well prepared to detect first case or unusual clusters of influenza in animals or humans.

b. **Infection Control Measures.**

(1) Triage and isolation of febrile patients at emergency departments and ensure the use of appropriate personal

protective equipment at high risk areas³ at healthcare institutions.

(2) Encourage seasonal flu vaccination for HCWs, high risk groups.

c. **Anti-virals.** Maintain anti-viral stockpile and ensure preparedness for the anti-viral distribution system.

d. **Communication.** Provide general information on seasonal influenza (including appropriate hygiene practices to prevent infection, advisory for vaccination) as well as the national response plan for both public and targeted groups respectively. Keep connected with the medical community on the influenza situation and developments through Med Alerts, circulars and directives. Maintain the MOH Hotline for public enquiries.

e. **Readiness Measures.** Ensure the readiness of pre-existing response systems such as home quarantine, 993 ambulance service, contact tracing etc. Regular audits of healthcare institutions' infection control measures, isolation procedures etc.

27. **Alert GREEN Level 1.** The strategy is to step up vigilance and preparedness to meet the potential threat.

a. **Surveillance.** Enhance internal surveillance by monitoring closely the local influenza situation, stepping up surveillance of high-risk groups and enhancing laboratory capabilities. Liaise with WHO and affected country for information on the virus and situation.

b. **Infection Control Measures.** Full PPE (personal protection equipment) for HCWs attending to suspect cases, all suspect⁴ cases to be isolated in Tan Tock Seng Hospital (TTSH)/ Communicable Disease Centre (CDC) and discharge of cases only when immunofluorescence show they are no longer shedding the virus. No phone surveillance required for cases after discharge since they are no longer infectious. Close contacts of cases will be placed on Phone Surveillance⁵ and observed for flu-like symptoms. Additional precautions to be taken in managing remains of suspect cases according to the clinical assessment.

c. **Anti-virals**

(1) All patients who meet the case definition will be provided with anti-viral treatment for 5 days.

³ High-risk areas : Emergency Departments, staff clinics, Intensive Care Units, isolation rooms, influenza wards, virology labs.

⁴ Medical practitioners will be kept informed of global situation and alerted to send suspicious cases to TTSH/CDC through Med Alerts.

⁵ One incubation period or 5 days.

(2) Close contacts of cases will be provided with anti-viral prophylaxis⁶ including unprotected HCWs attending to the cases.

(3) Review the stockpile plan and ramp up readiness for delivery of anti-viral drugs according to contingency plan.

d. **Vaccination.** Encourage high risk groups and HCWs to vaccinate against seasonal flu to reduce the incidence of acute respiratory infections due to seasonal influenza viruses.

e. **Communications**

(1) Advise public and HCWs to take heed of advisories and updates issued by MOH.

(2) Update HCWs on the virus; provide guidelines for detecting and managing possible cases as well as the global situation.

(3) Public education on good hygiene practices and responsible social behaviour to prevent getting flu especially if there is an ongoing flu epidemic.

(4) Issue advice on health precautions to take when visiting countries affected by flu outbreaks. Advise public to be vaccinated if traveling to affected areas. MOH Hotline manning hours extended as appropriate.

f. **Readiness Measures.**

(1) Step up infection control audits of healthcare institutions (when there is a local case of novel virus infection in humans).

(2) Standby to activate response systems such as home quarantine, 993 ambulance service, contact tracing, etc.

(3) Actively engage the potential suppliers and laboratories on the development of a vaccine.

28. **Alert YELLOW.** The strategy is to prevent further import of cases, protect targeted essential services and break the disease transmission by providing treatment of all cases and anti-viral prophylaxis/"ring-fence" to contacts including attending healthcare workers.

⁶ 10 days of anti-viral prophylaxis. WHO recommends individual anti-viral prophylaxis of 1 week following exposure to pandemic influenza.

- a. **Surveillance.** Enhanced community surveillance will include the utilisation of rapid detection methods and increase in respiratory samples for virological surveillance. Hospitals will report atypical pneumonias, review case definitions and monitor hospital staff illness. Laboratory readiness will be stepped up.
- b. **Infection Control Measures.** As in Alert GREEN Level 1 plus:
- (1) Infection control at hospitals, polyclinics, GPs and step-down healthcare facilities will be enhanced to include full PPE in all high risk areas or if necessary all areas, temperature screening and restriction on visitors.
 - (2) Restrict inter-hospital movement of patients and HCWs except in emergencies. Zoning of restructured hospitals (RHs) with specific nursing homes (NHs) may be necessary.
 - (3) Impose home quarantine⁷ for close contacts of cases to limit the spread of disease in Singapore.
 - (4) All HCWs are to carry out twice daily temperature monitoring.
- c. **Anti-virals.** Private healthcare institutions will be advised to increase their stock of anti-virals and anti-bacterials.
- d. **Vaccination.** All HCWs and high risk group will be vaccinated against seasonal flu.
- e. **Communications.** As in Alert GREEN Level 1. The public will be educated on the virus, health measures, inculcate social responsibility and use of 993 dedicated ambulance service.
- f. **Community Measures**
- (1) Recent travellers from affected countries will be given Health Alert Notices (HANs) and will need to monitor their temperature daily for 1 incubation period.
 - (2) Temperature screening for passengers arriving from affected countries at all border control checkpoints.
- g. **Readiness Measures.** As in Alert GREEN Level 1 plus
- (1) Activate emergency purchase of additional antiviral and anti-bacterial drugs if necessary.

⁷ One incubation period or 5 days.

- (2) TTSH/ CDC and hospitals will prepare for surge in demand.
- (3) Prepare for decanting operations and provision of alternate housing when required.

29. **Alert ORANGE.** The strategy is to contain the spread and suppress the speed of transmission, while preserving essential services and resources. All the measures taken in Alert YELLOW will continue where operationally feasible.

a. **Surveillance**

- (1) ARI surveillance stepped up to daily monitoring and reporting from polyclinics and hospitals
- (2) Hospitals to continue to report atypical pneumonia, prolonged unexplained fever, sudden death or unusual health event especially in cases with travel history to affected countries
- (3) Fever and respiratory illness clusters among healthcare staff and/or patients in healthcare facilities including nursing homes and step-down care facilities will be monitored closely and reported to MOH.

b. **Infection Control Measures**

- (1) Implement “No visitor” rule at all hospitals.
- (2) Stop all inter-hospital movement of patients or healthcare workers.
- (3) Set up Flu Clinics at the 18 Polyclinics for assessment and anti-viral treatment of flu-like patients.

c. **Anti-virals**

- (1) Commence anti-viral prophylaxis of identified essential services.
- (2) Stop “ring-fencing” or anti-viral prophylaxis for close contacts as the number of infected is likely to be very large.

d. **Vaccination.** Vaccinate priority groups when pandemic vaccine is available.

e. **Communications**

- (1) Public education to prevent the rush for drugs and hence overwhelming the healthcare system unnecessarily.

(2) Advise public on the Flu Clinics, locations and opening hours, symptoms of infection and to seek assessment as soon as possible. Encourage public to seek outpatient assessment at designated Flu Clinics to prevent overcrowding at restructured hospitals' Emergency Departments.

(3) Continue to emphasize the importance of good social behaviours and discourage mass social events to limit the spread of the disease as well as provide regular updates on the influenza pandemic virus.

f. **Community Measures**

(1) Encourage temperature taking at schools and all non-healthcare workplaces, markets, places of mass gatherings etc.

(2) Carry out temperature screening for in-bound and outbound passengers at all air, sea and land border checkpoints.

(3) Consider closing of schools and suspension of public gathering and events.

30. **Alert RED.** The strategy is to regain control of the situation by implementing more stringent measures in the community including closing of school and stop selected events to prevent congregation of large groups of people. All measures taken in Alert ORANGE will continue to be applied.

a. **Surveillance.** As in Alert ORANGE. However, surveillance reporting designed to detect first cases and clusters will cease because the healthcare system will be overwhelmed.

b. **Infection Control Measures**

(1) Refer confirmed or probable cases who require in-patient treatment to all restructured hospitals or as designated (TTSH/ CDC will be overwhelmed) with the same discharge criteria as in GREEN Level 1 if operationally feasible.

(2) Discontinue home quarantine of contacts and contact tracing as the numbers infected will be too large for this to be operationally feasible. However, flu-like cases will be advised to stay home.

(3) Lift restriction to inter-hospital movement of patients or healthcare workers and zoning of restructured hospitals with specific nursing homes because this would not be operationally feasible to sustain.

(4) Discontinue dedicated ambulance service 993.

e. **Communications.** Same as in Alert ORANGE plus advisories on precautions to take to limit transmission e.g wearing of masks if sick and avoiding crowded areas.

31. **Alert BLACK.** The strategy here is that medical & public health measures take precedence over social & economic considerations. We have to accept that the focus for the nation is just to contain the “damage” and regain control of the situation, and other sectors such as economy, social etc may be less emphasized. Drastic measures like stopping all social events may be implemented. The majority of measures are as in Alert RED except for:

a. **Community Measures**

(1) Suspend all public gatherings, school and Institutes of Higher Learning (IHL) closures.

(2) Advisory to public to stay home or even consider imposing Curfew.

32. **Annex A** provides a Summary of the Key Control Measures in an Influenza Pandemic.

COMMAND AND CONTROL

33. **National Command And Control Structure**

a. **Homefront Crisis Ministerial Committee (HCMC).** In an Influenza Pandemic, the Homefront Crisis Management System (HCMS) will be activated to coordinate and manage the national response to overcome the crisis. Strategic and political guidance is provided by the Homefront Crisis Ministerial Committee for influenza (HCMC-FLU) which is chaired by Minister for Home Affairs. Members include ministers and chiefs of the various ministries and agencies involved in responding to the disease outbreak.

b. **Homefront Crisis Executive Committee (HCEG).** HCEG (FLU), chaired by Permanent Secretary (Home Affairs), endorses policies and coordinates the response measures across the various ministries and agencies involved in the responses.

c. **Crisis Management Groups (CMGs).** The roles of the various subgroups under HCEG or CMGs for the Influenza Pandemic are as follows:

(1) CMG (Medical) led by the Ministry of Health (MOH) - To manage all medical related issues during an influenza pandemic including provision of emergency medical services, formulate response plans to deal with the medical crisis such as disease

outbreak and provide policy guidance and advice to other responding agencies.

(2) CMG (Safety & Security) led by the Ministry of Home Affairs (MHA) - To manage all civil defence and civil security type of incidents, including terrorism related threats and civil emergencies.

(3) CMG (Public Communications) led by the Ministry of Information, Communications & the Arts (MICA) - To formulate public communications policies and plans to manage and maintain Singapore's image in the public arena, both locally and internationally.

(4) CMG (Environment) led by the Ministry of the Environment & Water Resources (MEWR) – To manage impact on environmental and public health issues and advise other responding agencies.

(5) CMG (Housing & Social Support) led by the Ministry of National Development (MND) – To formulate plans for mass re-housing of the population and provision of social support services during an influenza pandemic.

(6) CMG (Transport) led by the Ministry of Transport (MOT) - To formulate plans to ensure availability and continuity of air, land and sea transportation services critical to the economy of Singapore.

(7) CMG (Economic Sustainability) led by the Ministry of Trade & Industry (MTI) - To maintain public confidence in the economy so that economic activities and normal life would go on. To provide policy guidance and advice to the public and private sectors as well as industrial and commercial entities on appropriate measures to mitigate the impact of flu pandemic.

(8) CMG (Education) led by the Ministry of Education (MOE) - To direct the conceptualisation and implementation of plans to minimise impact of flu to schools, post-secondary educational institutions and other educational institutions.

(9) CMG (Diplomatic Support) led by the Ministry of Foreign Affairs (MFA) – To provide diplomatic support and manage diplomatic fallout arising from measures taken by Singapore to fight the influenza pandemic.

34. Lead Agency for Influenza Pandemic. As the pandemic is essentially an infectious disease outbreak, MOH as CMG (Medical) is the lead agency to coordinate the national response to manage the crisis. The CMG (Medical) is led by Permanent Secretary (Health) with the Director of Medical

Services as the Crisis Manager. The key elements managing the outbreak are:

- a. **Inter-Ministry Operations Committee (IMOC).** This forum comprises representatives from the other CMGs and relevant agencies involved in responding to the outbreak. IMOC is the main platform to co-ordinate inter-ministry actions for a multi-agency response to deal with the outbreak.
- b. **Task Force.** The Task Force focuses on medical and disease control issues that need to be implemented to limit the spread of infection, to treat and manage the cases.
- c. **MOH Ops Coordination Committee (MOHCC).** MOHOCC plans and co-ordinates the medical and public health responses to respond to the outbreak. It works directly with the healthcare institutions and facilitates inter-agency integration.

SURVEILLANCE

35. Surveillance for influenza requires internal and external monitoring for virus strains and disease activity. Early identification of circulating or novel strains through an integrated surveillance system is essential for pandemic detection and vaccine preparation.

36. An integrated surveillance system is in place that can detect the first few cases or unusual clusters of influenza in animals or humans and the timely identification of a novel influenza virus. Influenza surveillance comprises five main components: community surveillance, laboratory surveillance, hospital surveillance, veterinary surveillance through the Agri-Food and Veterinary Authority (AVA), and external surveillance.

- a. **Community Surveillance.** Community-wide surveillance of acute respiratory infections (ARI) has been well established in Singapore. Weekly reports are compiled from the public-sector hospitals and polyclinics.
- b. **Laboratory Surveillance.** Virological surveillance of influenza viruses is routinely carried out by the National Influenza Centre on respiratory samples from hospitals and polyclinics.
- c. **Hospital Surveillance.** Hospitals continue to support the post-SARS epidemic surveillance system. Patients fulfilling the surveillance criteria are reported to MOH.
- d. **Veterinary Surveillance.** The Agri-Food and Veterinary Authority (AVA) carries out surveillance on poultry, based on the assumption that poultry infection and deaths will precede human infection.

e. **External surveillance.** MOH performs continuous monitoring of infectious disease situations in the region and globally, via various sources, to identify external health risks and threats. Where incidents of concern emerge in a given country, clarification is sought directly through international contacts.

37. **Annex B** provides the details of the surveillance plan.

MANAGEMENT OF CASES

38. TTSH/ CDC is the designated treatment facility for any case of potentially infectious disease. During an outbreak, TTSH/ CDC will be the designated hospital for in-patient treatment of influenza and the Emergency Department will be the triage point for all influenza referrals to TTSH/ CDC from Alert GREEN Level 1 to ORANGE. Paediatric and obstetric services will be set up at TTSH/ CDC by KKH when activated by MOH. All persons including children and pregnant patients who fulfill the probable case definition will be transferred to TTSH/ CDC for treatment. Anyone who refuses to be admitted will be compelled to do so under Section 8(1) of the Infectious Diseases Act. However when TTSH/ CDC approaches full capacity, other restructured hospitals will also have to manage in-patient influenza cases.

39. There will be a dedicated ambulance service (993) for transportation of suspect and probable cases to TTSH/ CDC till Alert ORANGE (or as long as operationally feasible).

40. **Annex C** elaborates on the management of cases.

INFECTION CONTROL MEASURES IN HEALTHCARE SETTINGS

41. Most exposures to influenza occur in hospitals or other healthcare setting from influenza infected patients. Influenza-infected HCWs, patients and visitors can spread infection within and outside healthcare facilities. Transmission risks are primarily from unprotected exposures to unrecognized cases in inpatient and outpatient settings. It can also occur through large respiratory droplets and close contact with infected patients. Also, exposure during aerosol – generating procedures may increase exposure risks. Strict adherence to appropriate infection control practices, including the use of PPE, helps prevent transmission.

42. The infection control measures with respect of a SARS outbreak are relevant and will be put in practice. Please refer to **Annex D** for more on control measures in healthcare settings.

MANAGEMENT OF CONTACTS

43. During the initial period of outbreak, the aim is to break the disease transmission. Hence all contacts, including unprotected HCWs, of suspected influenza pandemic cases will be identified and “ring-fenced”. In Alert GREEN level 1 they will be on phone surveillance and provided 10 days of

anti-viral prophylaxis. At Alert YELLOW, they will be placed on 5 days HQO with 10 days of anti-viral prophylaxis. However, from Alert ORANGE and beyond, when a pandemic is declared, there will already be large numbers of infected cases; “ring-fencing” of contacts will discontinue as it would not be operationally feasible.

44. **Annex E** provides details of the management of contacts.

QUARANTINE

45. The quarantine process follows the SARS measures except that recovered pandemic cases will not require quarantine. The Director of Medical Services will chair the Epidemiological Meeting and Quarantine Board to define the contacts and issue the home quarantine orders. The Home Quarantine Order process will then take place. Alternative accommodation arrangements will be provided similar to those for SARS.

46. **Annex F** provides the details for quarantine operations.

USE OF ANTI-VIRALS

47. Research has shown that anti-virals are effective for both the prevention (prophylaxis) and early treatment of influenza if administered within 48 hours following the onset of illness. Their use can reduce the duration of uncomplicated disease and the likelihood of complications requiring antibiotic treatment and possibly hospitalization. Less certain, due to lack of studies, is their ability to reduce serious complications and mortality in groups at highest risk including the elderly and persons with underlying disease. Anti-virals will likely be the only virus-specific intervention during the initial pandemic response.

48. The anti-viral drug to be used for prophylaxis and treatment in the event of an influenza pandemic is Oseltamivir. Each course comprises ten 75 mg capsules. Treatment should be initiated within 48 hrs of onset of symptoms and consist of one 75 mg capsule twice a day for 5 days. Prophylaxis consists of one 75mg capsule once per day for up to 6 weeks. Protection stops when prophylaxis is terminated.

49. **Anti-Viral Prophylaxis for Essential Services.** It is assumed that for most, the illness will be self-limiting. Hence, staffing at work units will probably be maintained at above 80% in most instances even without prophylaxis. Staff availability can be raised with an effective business continuity plan. Hence, anti-viral prophylaxis will only be provided to segments of essential services who have been pre-identified as working either in high risk areas or in crucial areas necessary in providing the critical services for national resources and required to function at full capability in the event of an influenza pandemic.

50. **Treatment of Cases.** As the symptoms of influenza is non-specific, all those who present with flu-like symptoms (ARIs) will be provided anti-viral

treatment based on the case definition and according to the DORSCON-FLU Response Plan over the outbreak period.

51. **Annex G** provides the details for anti-viral use.

PANDEMIC VACCINATION

52. In a pandemic, it is very likely that vaccines will only be available after 4-6 months. In the initial stages, these will be in short supply. However, vaccination is the key strategy in response to an influenza pandemic.

53. Initially, when vaccines are in short supply, vaccination will be provided to priority groups. As the vaccines become more readily available, vaccination will be expanded to include the at-risk groups, essential services and the population in general.

MANAGEMENT OF REMAINS OF PROBABLE PANDEMIC CASES

54. Influenza is more infectious than SARS. Like SARS, it is an infectious disease and there is a possibility of the virus spreading when remains handlers come into contact with the oral/nasal fluids from the bodies. To reduce the possibility of such contacts occurring, all bodies of probable influenza pandemic cases will be managed as in SARS. **Annex H** provides guidelines on the management of remains.

BORDER HEALTH CONTROL MEASURES

55. Measures implemented at the border checkpoints form our first line of defence against possible importation of Influenza case(s). To facilitate timely and effective responses for ramping up such defense measures, MOH will proceed to implement the appropriate border control measures with the concerned key border control agencies (Civil Aviation Authority of S'pore, Immigration and Checkpoint Authority & Maritime Port Authority), through the activation of the Border Health Control Work Group. The border control measures include inbound and outbound temperature screening, issue of Health Alert Notices (HANs) and filling in of Health Declaration Cards (HDCs).

56. A phased and gradual approach will be adopted to step up control measures in accordance with the changing circumstances as guided by the principle of risk management. The implementation and subsequent stepping up of the various border control measures will be aligned with the defined triggers underpinning the DORSCON-FLU alert levels, with the aim to have early detection and prevention of possible importation. **Annex I** provides the details.

PUBLIC COMMUNICATIONS

57. As demonstrated in SARS, accurate and up-to-date information, disseminated in a transparent manner, has proved to be effective to calm nerves and reduce panic. A comprehensive information management plan to provide information on the diseases and general aspects of the response plan to the public will build confidence and facilitate public health actions in the event of an influenza pandemic. MICA, as CMG (Public Communications) is the lead agency in this area and will work directly with the Corporate Communications element in each agency to coordinate the messages and media releases.

58. Public communications will aim to manage public concerns and fear of the unknown. The information needs of the public in an influenza pandemic would include:

- a. Mode of transmission of the virus
- b. Symptoms of the disease
- c. How citizens can protect themselves and their family members
- d. How preventive or containment procedures may affect their daily activities.
- e. What should be done if one suspects infection
- f. What the authorities are doing to contain the pandemic and why these may not be as effective.

59. **Annex J** provides details on the Public Communications Plan.

PRECAUTIONARY MEASURES FOR THE WORKPLACE

60. Influenza, like many viral diseases that affect the upper respiratory tract, can be transmitted through large droplet spread; contact, either direct or indirect, with respiratory secretions; through droplet nuclei, i.e. airborne spread from sneezing, coughing and even talking. Unlike SARS where a person is infectious after the onset of symptoms, influenza cases can be contagious one day before the onset of symptoms. This "silent transmission" characteristic of the influenza infection does reduce the effectiveness of some of the measures listed, nevertheless, they are still useful to screen out those who are obviously ill and will reduce the probability of infection. Additionally, some viruses can survive for 24-48 hours on nonporous surfaces.

61. In a pandemic, most organizations and workplaces should be able to maintain 80% staff availability. An effective business continuity plan and workplace infection control guidelines provided by MOH will improve this. Offices and workplaces can adopt the following measures to reduce the probability of transmission in the workplace.

- a. Individuals should practice good personal hygiene.
 - b. Staff and visitors need to be educated on the transmission mode of the disease and the steps that can be taken to prevent transmission.
 - c. Implement temperature screening for visitors and regular temperature taking for staff. Unwell staff should be directed to seek medical attention.
 - d. More frequent cleaning and disinfection of rooms and work areas.
 - e. Establish isolation rooms for febrile visitors or staff.
 - f. Ensure that a contact tracing system is in place.
62. **Annex K** provides a detailed guide on the procedures.

Ministry of Health, Singapore

This Readiness and Response Plan is based on the following:

1. US Department of Health and Human Services. Draft Pandemic Influenza Preparedness and Response Plan. August 2004. (www.dhhs.gov/nvpo/pandemics/)
2. US Department of Health and Human Services. Guidelines and Recommendations on Influenza. (www.cdc.gov/flu)
3. Penelope Ward, Ian Small, James Smith, Pia Suter, Regina Dutkowski. Oseltamivir (Tamiflu) and its potential for use in the event of an influenza pandemic. *Journal of Antimicrobial Chemotherapy* 2005; Suppl S1:15-21.
4. World Health Organisation. WHO Guidelines on the Use of Vaccines and Antivirals during Influenza Pandemic. 2004. (www.who.int/csr/disease/influenza/pandemic/en/)
5. World Health Organisation. WHO consultation on priority public health interventions before and during an influenza pandemic. 2004. (www.who.int/csr/disease/influenza/pandemic/en/)
6. Meltzer MI, Shoemaker HA, Kohnanski M, Crosby R, 2000. FluAid: A manual to aid state and local-level public health officials plan, prepare and practice for the next influenza pandemic (Beta test version). Centres for Disease Control and Prevention, US Department of Health and Human Services. (www.dhhs.gov/nvpo/pandemics/)