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Regional strategy on preparedness and response for human pandemic influenza

Experts believe that the increasing outbreaks of influenza A (H5N1) among poultry and humans have moved the world closer to a pandemic than any time since 1968. If this virus acquires the ability to spread efficiently from human to human, all of the prerequisites for an influenza pandemic will be fulfilled. The regional strategy on pandemic influenza preparedness and response aims at enhancing the capacity of countries to undertake the actions laid out in the WHO global influenza preparedness plan and in national preparedness plans. The Regional Committee is invited to endorse the regional strategy on preparedness and response for human pandemic influenza

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Executive summary

It is estimated that the next influenza pandemic is likely to result in between 2 and 7.4 million deaths worldwide, including 150 000–750 000 deaths in the Eastern Mediterranean Region. The recent outbreaks of influenza A (H5N1) among poultry and humans have moved the world closer to a pandemic than at any time since 1968. The world is currently in Phase 3 of the six-phase pandemic alert system, in which a new influenza virus subtype is causing disease in humans, but is not yet spreading efficiently and in a sustained way among humans. If this virus acquires the ability to spread efficiently from human to human, all of the prerequisites for an influenza pandemic will be fulfilled. The anticipated pandemic may cause massive social, economic and political disruption. The impact of the pandemic is likely to be the greatest in low-income countries, as these countries already have inadequate and strained health care resources.

The objectives of the WHO global influenza preparedness plan are to reduce opportunities for human infection, strengthen the early warning system to early detect emergence of a pandemic virus and contain or delay spread at the source. The regional strategy on pandemic influenza preparedness and response aims to complement the global preparedness plan through enhancing the capacity of countries to pre-empt an influenza pandemic, as well as to mitigate the negative effects of a full-blown pandemic. The main goal of the regional strategy is to provide adequate, appropriate and timely technical support to all countries of the Region to enable them detect and respond efficiently to an influenza pandemic.

The regional strategy emphasizes transparency, sharing of information and outbreak communication. It focuses on strengthening and building related capacities for epidemiological and laboratory surveillance of influenza both in animals and humans. Immediately following the detection of virological or epidemiological signals of a change in virus transmission patterns, local authorities, supported by national and regional resources, should apply measures aimed at reducing transmission, as outlined in the strategy. Appropriate non-pharmaceutical interventions such as avoidance of crowding and promotion of personal hygiene need to be incorporated in national preparedness plans. The Regional Office will utilize expertise within the Region to implement the strategy.

Member States are recommended to: establish committees to implement national preparedness plans; ensure full transparency and timely exchange of information related to cases of influenza A (H5N1); promote community participation in pandemic preparedness and establish mechanisms for risk communication to the public; strengthen epidemiological and laboratory surveillance systems; and ensure implementation of the International Health Regulations (2005) and relevant national regulations with regard to pandemic influenza.

1. Introduction

In the past century, the world has witnessed three pandemics of influenza that started without warning and caused illness in more than 25% of the world's population. The "Spanish" influenza pandemic occurred in 1918–1919 and resulted in an estimated 40–50 million deaths worldwide. This is considered one of the deadliest disease events in human history, resulting in more deaths than from the First World War. Subsequent pandemics were much milder; the epidemics of "Asian" influenza in 1957 and "Hong Kong" influenza in 1968 together resulted in an estimated 1–4 million deaths. The high rates of morbidity and mortality during influenza pandemics have resulted in social, economic and political disruption throughout the world.

The principal objective of this paper is to summarize the WHO global influenza preparedness plan and to outline the regional strategy for implementation of the global strategy.

Although avian influenza due to A/(H5N1), a highly pathogenic influenza virus subtype, is primarily a disease of birds that rarely infects humans, the virus is entrenched in many areas of the world. Wild migratory birds have played a role in further spread of the virus. Fatal laboratory-confirmed human cases of avian influenza have been documented and attributed to exposure of humans to infected birds during home slaughter, defeathering, butchering, preparation for consumption or exposure to manure containing poultry faeces.

Experience has shown that detailed preparedness plans are very useful in reducing human suffering during natural disasters and major outbreaks of communicable disease. In the event of a pandemic, the rapid spread of the influenza virus would leave little or no time to prepare. The regional strategy aims to ensure that plans are in place to reduce opportunities for the influenza virus to develop into a form that is readily transmissible among humans and to mitigate the potential for high levels of morbidity and mortality and social and economic disruption should pandemic influenza occur.

The WHO Regional Office for the Eastern Mediterranean is expected to play a leading role in containment of outbreaks of avian influenza and during the expected pandemic influenza.

2. Current assessment of pandemic threat

2.1 Global situation

Risk of pandemic influenza

There are three prerequisites for the start of an influenza pandemic: 1) emergence of a novel virus to which there is no immunity; 2) ability of the virus to replicate in humans and cause disease; and 3) efficient spread of the virus from human to human. The first two prerequisites have been met by the current influenza A (H5N1) outbreaks. Every human case of H5N1 infection increases the odds that a deadlier strain will emerge—one with a genetic composition that is better suited to human hosts and that will trigger efficient human-to-human transmission.

During the past few years, the world has faced several threats with pandemic potential, making the next one just a matter of time. The H5N1 strain first infected humans in Hong Kong in 1997, resulting in 18 cases, including 6 deaths. Since mid 2003, this virus has caused the largest and most severe outbreaks in poultry on record. Since January 2004, events affecting both human and animal health have greatly increased the probability for emergence of a human influenza pandemic. As of 6 June 2006, the cumulative number of confirmed human cases of influenza A (H5N1) reported to WHO has increased significantly, from 3 cases in 2003 to 46 in 2004, 95 in 2005 and 81 in the first half of 2006 (Table 1). The risk of additional human cases persists, as do opportunities for a human pandemic strain of the virus to emerge.

Outbreaks have recurred despite aggressive control measures, including the culling of more than 140 million poultry as of September 2005. Experts at WHO and elsewhere believe that the increasing outbreaks of influenza A (H5N1) among poultry and humans have moved the world closer to a pandemic than any time since 1968.

Table 1. Cumulative number of confirmed human cases of avian influenza A/(H5N1) reported to WHO (updated 6 June 2006)

Country	2003		2004		2005		2006		Total	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Azerbaijan	0	0	0	0	0	0	8	5	8	5
Cambodia	0	0	0	0	4	4	2	2	6	6
China	0	0	0	0	8	5	10	7	18	12
Djibouti	0	0	0	0	0	0	1	0	1	0
Egypt	0	0	0	0	0	0	14	6	14	6
Indonesia	0	0	0	0	17	11	32	26	49	37
Iraq	0	0	0	0	0	0	2	2	2	2
Thailand	0	0	17	12	5	2	0	0	22	14
Turkey	0	0	0	0	0	0	12	4	12	4
Viet Nam	3	3	29	20	61	19	0	0	93	42
Total	3	3	46	32	95	41	81	52	225	128

Total number of cases includes number of deaths.
WHO reports only laboratory-confirmed cases.

Projections of morbidity and mortality associated with pandemic influenza

Should a pandemic strain of the influenza virus emerge, global spread of the disease is considered inevitable and all countries will be affected. The pandemics of the previous century encircled the globe in 6 to 9 months, even when most international travel was by ship. Given the speed and volume of international air travel today, the virus would spread more rapidly, possibly reaching all continents in less than 3 months. The effect of influenza on individual communities will be relatively prolonged when compared with other natural disasters, as it is expected that outbreaks will recur. Widespread illness may result in sudden and potentially significant shortages of personnel to provide essential community services.

Experts estimate that the next influenza pandemic may cause more than 1 billion cases worldwide. Although health care has improved in the past decades, epidemiological models project that the pandemic would likely result in 2 to 7.4 million deaths globally. Medical facilities will be overwhelmed. Vaccines, antiviral agents and antibiotics used to treat secondary infections will be in short supply and will be unequally distributed. It will take several months before any vaccine becomes available. Inadequate supplies of vaccines are of particular concern, as vaccines are considered the first line of defence for protecting populations. If current trends continue, many developing countries will have no access to vaccines throughout the duration of a pandemic.

Current level of pandemic threat

WHO uses a six-phase pandemic alert system for informing the world of the level of pandemic threat and of the need to launch progressively more intense preparedness activities (Table 2). The designation of phases, including decisions on when to move from one phase to another, is made by the Director-General of WHO. At present the world is in Phase 3, the first level of the Pandemic Alert Period, in which a new influenza virus subtype is causing disease in humans, but is not yet spreading efficiently and sustainably among humans.

Table 2. Influenza pandemic: phases and strategic actions

Period	Phases	Transmission	Objectives	Strategic actions
Inter-pandemic (planning and preparedness)	1	Influenza virus subtype in animals only (risk to humans low)	Strengthen pandemic preparedness at all levels	Prepare pandemic preparedness plan Establish surveillance in animals Establish human surveillance Establish collaboration between human and animal sectors
	2	Influenza virus subtype in animals only (risk to humans substantial)	Minimize the risk of transmission to humans Detect and report rapidly, if it occurs	Enhance animal surveillance and aggressive response to animal outbreaks Strengthen human surveillance Stockpile antivirals, personal protective equipment, etc. Strengthen collaboration between different sectors and WHO/OIE/FAO Develop and implement risk communication strategy Prepare health and essential service contingency plan
Pandemic Alert (emergency and pre- emptive response)	3	Human infection (transmission in close contacts only)	Ensure rapid characterization of new virus Detect, notify and respond to additional cases	Enhance animal surveillance and aggressive animal outbreak containment Enhance human surveillance and aggressive outbreak management
	4	Limited human to human spread; small clusters <25 cases lasting <2 weeks	Contain the virus or delay its spread	Early strategic use of antivirals Encourage social distancing Implement risk communication strategy Issue alert for quick implementation of health and essential service contingency plan
	5	Localized human to human spread; Large clusters 25– 50 cases over 2–4 weeks	Maximize efforts to contain or delay the spread	
Pandemic (minimizing impact)	6	Widespread in general population	Minimize the impact of the pandemic	Implement health and essential services contingency plan Risk communication; Treat cases and contacts with antivirals, if available, Enforce social distancing: close schools, ban gatherings

In May 2006, a cluster of human cases of A/(H5N1) infection appeared in an extended family in North Sumatra province, Indonesia, indicating multiple opportunities for the H5N1 virus to spread from human to human, particularly to other family members, and to health care workers. The cluster involved an initial case and seven subsequent laboratory-confirmed cases. All cases were among members of an extended family of siblings and their children. The family members resided in four households, three of which were adjacent to each other. The fourth household was located about 10 kilometres away.

All confirmed cases in the cluster had close and prolonged exposure to a patient during a phase of severe illness. Although human-to-human transmission has not been ruled out, other possible sources of exposure are being explored. Full genetic sequencing of two viruses isolated from cases in the cluster was undertaken by WHO H5N1 reference laboratories in Hong Kong and the United States of America. Sequencing of all eight gene segments found no evidence of genetic reassortment with human or pig influenza viruses and no evidence of significant mutation. The viruses showed no mutation associated with resistance to the neuraminidase inhibitors, including oseltamivir. The human

viruses from this cluster are genetically similar to viruses isolated from poultry in North Sumatra during a previous outbreak.

2.2 Regional situation

Outbreaks of avian influenza in the Region

In the Eastern Mediterranean Region, the H5N1 virus has been reported in wild and migratory birds in the Islamic Republic of Iran and Kuwait, and among domestic poultry in Afghanistan, Djibouti, Egypt, Iraq, Jordan, Palestine and Sudan. Influenza A (H5N1) has also been reported in humans in Iraq (3 cases), Egypt (14 cases), Jordan (one imported case from Egypt) and Djibouti (one case).

Estimated regional morbidity and mortality in the event of pandemic influenza

The Regional Office estimates that in the event of pandemic influenza (attack rate of 35%), more than 180 million people in the Region would fall ill, 96–168 million would require medical care, 6.4–28.1 million would need hospitalization and 150 000–750 000 would die. These estimates were calculated using FluAid Analysis, a CDC software program for estimating morbidity and mortality resulting from influenza. *World Health Statistics 2005* was used as the source for the number of doctors, nurses and hospital beds per 10 000 population, assuming an age distribution as follows: less than 18 years of age, 50% of the total population; 19–64 years, 45%; and more than 65 years, 5%, across all countries in the Region.

3. WHO global influenza preparedness plan

Avian influenza and human pandemic influenza differ in their epidemiology, ability to cause large outbreaks or pandemics, primary host and availability of vaccine. Accordingly, approaches to contain these two types of influenza differ. Global efforts to contain avian influenza are regarded as a pre-emptive strike to avoid pandemic influenza. The global plan aims at risk reduction by avoiding emergence of a new form of the virus that is transmissible among humans. Activities focus on elimination of animal reservoirs through close collaboration with other international organizations, in particular the Food and Agriculture Organization of the United Nations (FAO) and the International Organization for Animal Health (OIE). A strengthened surveillance system for animal health can detect infection in poultry quickly, and should be followed rapid and safe culling, slaughter or vaccination of infected and exposed poultry as appropriate. The surveillance system for poultry should be accompanied by an active surveillance system to ensure detection and timely response to human cases. The plan highlights the importance of protection and immunization of individuals at risk (e.g. cullers).

Efforts are needed to ensure continuous improvement of national and international preparedness plans for pandemic influenza, development of A/(H5N1) vaccine and access to antiviral drugs. Global commitment to prevent an influenza pandemic is reflected in the 2005 Health Assembly resolution on strengthening pandemic-influenza preparedness (WHA58.5) that articulates the need for global action and strengthening of national preparedness to respond to pandemic influenza.

Each phase of alert in WHO's six-phase pandemic alert system coincides with a series of recommended activities to be undertaken by WHO, the international community, governments and industry. Transition from one phase to another is triggered by several factors, which include the epidemiological behaviour of the disease and the characteristics of circulating viruses. These factors constitute a set of epidemiological and virological signals.

Epidemiological signals are likely to be the most sensitive and reliable indicators of a transition from inefficient, non-sustained human-to-human transmission of the virus to efficient and sustained transmission. The detection of clusters of human cases closely related in time and place would indicate a transition in the behaviour of the virus, with the virus moving towards improved transmissibility. A thorough epidemiological investigation should be initiated in cases of three or more persons with unexplained moderate-to-severe acute respiratory illness (or who died of an unexplained acute respiratory illness), with onset of illness within 7 to 10 days of each other and a history strongly suggesting potential exposure to the H5N1 virus, including:

- ? travel to or residence in an area affected by avian influenza outbreaks in birds or other animals;
- ? direct contact with dead or diseased birds or other animals in an affected area;
- ? close contact with an H5N1 patient (living or deceased) or a person with unexplained moderate-to-severe acute respiratory illness;
- ? a possible occupational exposure, including employment as an animal culler, veterinarian, laboratory worker or health care worker.

While epidemiological signals are likely to be the most reliable indicator of a change in transmission patterns, comparative studies of virus isolates can also yield useful clues. Such studies of H5N1 viruses, isolated from both humans and animals, are currently being conducted by the WHO network of H5 reference laboratories as part of routine investigation of H5N1 outbreaks. Although the exact mutations that would result in efficient and sustained human-to-human transmission are not precisely understood, two types of virological change would be considered cause for concern: detection of a virus with new genetic and antigenic features (such as a “reassortant” virus containing both human and avian genetic material); and isolation of a virus from a human case showing a number of mutations not seen in avian isolates.

4. Regional strategy on preparedness and response for human pandemic influenza

4.1 Overview

The regional strategy on pandemic influenza preparedness and response aims to complement the global preparedness plan through enhancing the capacity of countries to pre-empt an influenza pandemic, as well as to mitigate the negative effects of a full-blown pandemic.

The strategy focuses on responding in a timely manner to outbreaks of H5N1 infection among humans through strengthening national and international capacity for surveillance, epidemiological investigation and treatment of human cases; enhancing information management, risk assessment and exchange of epidemiological data and specimens; and strengthening support for specimen collection, laboratory diagnosis and virological analysis of influenza A (H5N1).

The objectives for the avian influenza response are to:

- ? reduce opportunities for human infection;
- ? strengthen the early warning system to early detect emergence of a pandemic virus; and
- ? increase preparedness for pandemic influenza.

With regard to pandemic influenza, the main goal of the strategy is to provide adequate, appropriate and timely technical support to all countries of the Region to enable them to respond efficiently to an influenza pandemic and minimize impact on health and societal structures. The recommended control measures correspond to the principal opportunities to intervene. The objectives with regard to pandemic influenza preparedness and response are to:

- ? reduce opportunities for human infection;
- ? strengthen the early warning system to early detect emergence of a pandemic virus;
- ? contain or delay spread at the source in the event a pandemic is declared;
- ? reduce morbidity, mortality and social disruption;
- ? conduct research during the pandemic.

4.2 Main features of the regional strategy

Transparency

The strategy underscores the importance of transparency and information sharing. All countries are encouraged demonstrate full transparency and prompt sharing of information and appropriate outbreak communication related to avian and pandemic influenza.

Risk communication and social mobilization

The strategy emphasizes the role of public awareness in reducing morbidity and mortality during pandemic influenza and in avoiding unnecessary panic.

The Regional Office will prepare and deliver culturally appropriate information, education, and communication materials to communities, and work jointly with other relevant international organizations to produce and widely distribute culturally acceptable, but technically sound, guidelines and educational materials to support interventions at the animal-human interface, especially for protection of identified risk groups such as cullers, health care and laboratory workers. The Regional Office will assist in disseminating information by providing a 24-hour on-call system for reporting of potential pandemic influenza signals. The objectives of these communications are to:

- ? instil and maintain the public's trust in the global and national public health system and convey realistic expectations about its ability to respond to and manage the initial outbreak of an efficient transmission of a pandemic virus;
- ? provide accurate, timely, consistent and comprehensive information about containment activities;
- ? identify and address rumours, inaccuracies and misperceptions quickly and prevent stigmatization of affected groups;
- ? promote compliance within the containment zone, rapidly identify barriers to compliance, and react with new approaches to increase compliance through a policy of transparent communication.

Capacity-building

The Regional Office will strive to strengthen and build appropriate capacities, at regional and national levels, in the fields of epidemiological and laboratory surveillance and response to influenza. The Regional Office will work towards creation of a regional network for influenza surveillance.

Implementation of rapid response and containment activities requires the availability of a pool of highly trained and qualified staff who have been pre-identified and trained by WHO and who can quickly mobilize into teams. A roster of carefully selected consultants within the Region will be identified and the consultants will be trained to serve as a regional response team that can be on standby for rapid deployment. The international response teams will be drawn from a multidisciplinary pool of experts in alert and response operations representing national and international organizations.

The Regional Office will develop and implement a set of training modules and activities in rapid detection, response and containment of pandemic influenza. The Regional Office will use a "training of trainers" approach to provide training to national staff. The Regional Office will further strengthen mechanisms for collection and transportation of clinical specimens for rapid testing.

Should pandemic influenza emerge in any country of the Region, the Regional Office will, at the request of the concerned country, expediently deploy an international field team to the affected country to assist in the initial assessment of pandemic signals. Based on recent experience, teams may require expertise in laboratory diagnostics, epidemiology, clinical management, infection control, veterinary medicine, medical anthropology, logistics, communications and database management.

The Regional Office will hasten initiation and support activities related to routine control measures aimed at reducing opportunities for further transmission of the disease as soon as clusters of cases are detected in any country within the Region. Immediately following signal detection, local authorities, supported by national resources if needed, should apply measures aimed at reducing transmission, as outlined below.

- ? Isolation of clinical cases of moderate-to-severe respiratory disease and other patients under investigation in respiratory isolation rooms or single rooms
- ? Identification and voluntary home quarantine of asymptomatic close contacts and daily monitoring for symptom onset

- ? Administration of antiviral drugs for the treatment of cases and, if domestic supplies permit, for the targeted prophylaxis of close contacts
- ? Strict infection control and the use of personal protective equipment in health care facilities caring for cases during the delivery of health care
- ? Intensive promotion of hand and cough hygiene and of domestic cleaning, using household cleaning products, to reduce transmission via fomites (infectious respiratory secretions on surfaces)

National preparedness plans

The Regional Office will provide technical support to Member States in developing, revising and updating their preparedness plans. As preparedness for pandemic influenza involves many disciplines, all potential stakeholders and resources within the countries and across borders at regional and international levels should be mobilized and involved in development of preparedness plans and their implementation. The Regional Office will support mobilization of all regional resources and potential stakeholders. Special consideration will be made for countries where mass gatherings could occur, such as in countries receiving large numbers of religious visitors or tourists.

Countries are also expected to mobilize national staff, including those focused on health care, local and national social mobilization, health promotion, risk communication, and mental health and social welfare of people, and response staff in the containment zone and to provide “surge” capacity for critical positions. National teams will receive training in influenza, rapid response and containment goals, concepts and activities, and team roles and responsibilities.

Coordination with other agencies

The Regional Office will work closely with FAO, OIE, United Nations Children’s Fund (UNICEF) and the World Food Programme (WFP), as well as other relevant international organizations and nongovernmental organizations to reduce the risk of animal-to-human transmission and the possible emergence of a pandemic strain. In this respect, the Regional Office has signed a memorandum of understanding with UNICEF and WFP. Collaborative agreements have also been made with the Centers for Disease Control and Prevention (CDC) in Atlanta and the Naval Medical Research Unit No. 3 (NAMRU-3) in Cairo.

Other strategic activities

- ? Translation of key guidelines into other languages
- ? Ensuring adequate stockpiling of antiviral drugs
- ? Promotion of use of appropriate non-pharmaceutical interventions, e.g. avoidance of crowding, promotion of personal hygiene
- ? Support for vaccine development within the Region
- ? Promotion and support for operational and epidemiological research to improve knowledge of risk factors for spread of influenza
- ? Examination of the ethical dimensions of enforced quarantine or compliance with other recommended measures

5. Challenges

Contingency planning for an event that may occur in the future is frequently difficult to justify, particularly in the face of limited resources and more urgent problems and priorities. One of the challenges that could impede the preparedness of countries is lack of adequate resources, including the financial resources needed to implement preparedness plans and to support affected countries. Moreover, there is only one regional reference laboratory for influenza, and further capacity is needed in epidemiology and laboratory surveillance. Developing adequate capacities takes many years and requires the retention of trained personnel, already an ongoing challenge in some countries. Most countries of the Region also lack adequate infection control practices in their health facilities.

Timely translation of important guidelines and other documents into Arabic is needed. It is expected that there will be a visible shortage of antiviral medicines, as their accessibility is already limited. Likewise, accessibility of new influenza vaccines is extremely limited.

In November 2005, the Regional Office held an intercountry meeting on avian influenza and preparedness for human pandemic influenza in Cairo, Egypt. The meeting emphasized the importance of leadership, transparency and timely exchange of information between national and international public health authorities dealing with animal health and other related sectors, both private and public. Participants highlighted the role of risk communication to the public in order to increase the level of awareness among the public and promote non-pharmaceutical interventions such as good personal hygiene and avoidance of overcrowding. The importance of epidemiological and laboratory surveillance systems and networks for communicable diseases, especially acute respiratory tract infections, was also emphasized.

There are two main reasons to invest in pandemic preparedness. The first is that preparation will mitigate the direct effects of a pandemic by clarifying the role of each partner, identifying gaps in the ability to respond and ensuring that existing legal authorities are adequate to implement the plan when the time comes. Preparing for the next influenza pandemic will also result in strengthening of functional epidemiological and laboratory systems. Improvements in infrastructure can have immediate and lasting benefits, and can also mitigate the effects of other epidemics or infectious disease threats.

6. Recommendations

1. Countries should establish national committees where terms of reference and lines of leadership are clearly defined for implementation of national pandemic plans by, but not limited to, establishing in each Member State:
 - ? a political body, comprising high-level representatives from concerned ministries, the main role of which will be stewardship;
 - ? a national emergency body, if not already present, comprising representatives from technical and related disciplines across different ministries;
 - ? a focal point within the Ministry of Health responsible for communication with the Regional Office.
2. Countries should ensure full transparency and timely exchange of information related to confirmed cases of avian influenza and human pandemic influenza.
3. Countries should promote community participation and empower nongovernmental agencies, scientific societies, academic institutions and the like by involving them in the preparation and implementation of national preparedness plans.
4. Countries should give serious attention to the role of risk communication to the public in increasing the level of awareness among the public and promoting appropriate interventions. Responsibility for public risk communication should be clearly laid out in national preparedness plans.
5. Epidemiological and laboratory surveillance systems for communicable diseases should be strengthened, especially with regard to acute respiratory tract infections. This should include strengthening the capacities of national public health laboratories for diagnosis of communicable and emerging diseases.
6. Countries should ensure implementation of the International Health Regulations (2005) and relevant national regulations with regard to pandemic influenza.
7. Countries with technical capacity to produce influenza vaccine should develop and support local production of influenza vaccine to meet the regional needs.

7. Further reading

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