

Avian Influenza and Pandemic Influenza Preparedness in Hong Kong

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Abstract

Avian influenza A H5N1 continues to be a major threat to global public health as it is a likely candidate for the next influenza pandemic. To protect public health and avert potential disruption to the economy, the Hong Kong Special Administrative Region Government has committed substantial effort in preparedness for avian and pandemic influenza. Public health infrastructures for emerging infectious diseases have been developed to enhance command, control and coordination of emergency response. Strategies against avian and pandemic influenza are formulated to reduce opportunities for human infection, detect pandemic influenza timely, and enhance emergency preparedness and response capacity. Key components of the pandemic response include strengthening disease surveillance systems, updating legislation on infectious disease prevention and control, enhancing traveller health measures, building surge capacity, maintaining adequate pharmaceutical stockpiles, and ensuring business continuity during crisis. Challenges from avian and pandemic influenza are not to be underestimated. Implementing quarantine and social distancing measures to contain or mitigate the spread of pandemic influenza is problematic in a highly urbanised city like Hong Kong as they involved complex operational and ethical issues. Sustaining effective risk communication campaigns during inter-pandemic times is another challenge. Being a member of the global village, Hong Kong is committed to contributing its share of efforts and collaborating with health authorities internationally in combating our common public health enemy.

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Introduction

In 1997, Hong Kong became reputed by identifying the first instance of human infection with avian influenza H5N1. A total of 18 cases occurred that year resulted in 6 deaths.¹⁻⁶ The outbreak was completely terminated after the culling of over 1.5 million chickens. In 2003, two H5N1 human cases were again detected, and subsequent epidemiological investigations showed they had acquired the infection outside Hong Kong.⁷ Since 2004, while the virus appears from time to time in the wild bird population, Hong Kong has remained free from H5N1 outbreaks in humans and live poultry.⁸

Meanwhile, since 2003, outbreaks of avian influenza H5N1 among poultry and humans have been reported in an increasing number of countries. In view of the epizootic and epidemiological situation, the World Health Organization (WHO) concluded that among all highly pathogenic avian influenza viruses, H5N1 is probably the

most threatening for human health and is a likely candidate for causing the next pandemic.⁹

Pandemic Planning Framework

Since 2005, the Hong Kong Special Administrative Region Government (HKSARG) has developed an updated pandemic preparedness plan with specific reference to avian influenza. The plan is underpinned by several strategic principles, namely reducing the risk of human infection, detecting pandemic influenza in a timely manner, and enhancing emergency preparedness and response.¹⁰ The plan sets out a three-tier response system (Alert Response Level, Serious Response Level and Emergency Response Level), which provides the command, control and coordination framework for emergency response.^{11,12} These levels are based on different risk-graded epidemiological scenarios relevant to Hong Kong (Table 1), and each of them prescribes a corresponding set of public health actions. Reference is made with regard to strategies

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Table 1. Three-tier Response Levels in Pandemic Preparedness of Hong Kong SAR

Three-tier response levels	Public health objectives
Alert	
(a) Highly pathogenic avian influenza (HPAI) detected in poultry population outside Hong Kong (HK) OR inside HK in imported birds, wild birds in gardens/parks, pet shops or natural environment	- To obtain timely and accurate information from other places with a view to prevent introduction of the disease into HK and to detect local cases as early as possible.
(b) Avian influenza human cases detected outside HK	
Serious	
(a) HPAI detected in poultry in local retail, wholesale markets or farms	- To contain the disease as soon as possible, identify foci of infection, prevent local transmission and exportation of disease to other places.
(b) Avian influenza human cases detected in HK, but without evidence of efficient human to human transmission	
Emergency Response Level	
(a) When efficient human to human transmission occurred outside or inside HK	- To contain the disease as soon as possible, identify foci of infection, prevent large outbreak from occurring, interrupt and stop chain of local transmission and prevent exportation of disease to other places.
(b) Influenza pandemic declared by WHO	- To slow down progression of the epidemic and minimise loss of human lives in order to buy time for the production of an effective vaccine against the novel /pandemic influenza strain.

promulgated by the WHO.^{13,14}

Reducing Risk of Human Infection

Control of Live Poultry

The risk that a pandemic virus will emerge depends on opportunities for human exposure to infections.¹⁵ Because of H5N1's ability to cross the species barrier to infect humans leading to severe disease, control of H5N1 infection in live poultry is the most important line of defense to reduce opportunities for human infection.¹⁶⁻¹⁸ In Hong Kong, a number of measures have been introduced to achieve this aim.

First of all, H5 vaccination of live poultry is made mandatory at all local poultry farms. H5 vaccine has been shown to produce significant reduction of virus excretion in vaccinated chickens, and confer protective antibody response in flocks.^{19,20} Poultry vaccination is coupled with intensive H5 virus surveillance at local poultry farms, including the use of sentinel flocks. Stringent biosecurity measures (including bird-proof facilities, restriction of movement of people/ equipment/ vehicles, etc.) are also imposed.⁸ Only those farms meeting all the requirements by the veterinary authority are allowed to sell their birds in live poultry markets.

The second level of control concerns the importation of live poultry and their products. All live chickens imported into Hong Kong from the Mainland must come from registered farms and the birds must be vaccinated against H5 avian influenza. On entry across the border, they must be accompanied by a valid health certificate documenting their source and vaccination details. The exporting registered farms in the Mainland are regularly inspected and tested, as agreed between Hong Kong and the Mainland authorities.

Furthermore, to comply with international recommendations for avian influenza vaccination of poultry, a DIVA (differentiating infected from vaccinated animals) strategy is put in place along with the vaccination programme in Hong Kong and the exporting farms.²¹

Third, at the wholesale and retail markets, stringent hygiene requirements are enforced as licensing conditions. They include thorough cleansing and disinfection of cages and vehicles, as well as preventing overcrowding of live chickens in the cages. Wholesale and retail markets implement two regular "Rest Days" per month (on the 10th and 25th) to break any virus cycle establishing in the markets.²²

Fourth, the number of live poultry farms, wholesale establishments and retail outlets is gradually reduced via a voluntary surrender scheme. The scheme encourages live poultry farmers, wholesalers, retailers and transporters to surrender their licenses or tenancies and cease operation voluntarily on a permanent basis in return for ex-gratia payment or loans. In addition, HKSARG amended legislation to ban domestic poultry keeping in 2006.²³

In all, the above measures appeared to have protected local farms and live poultry markets from avian influenza outbreaks since 2003. Finally, to eliminate completely opportunities for human exposure from live poultry, HKSARG has announced the planning and development of a central poultry slaughtering facility. When the facility comes into operation, live poultry will no longer be sold at the wet markets of Hong Kong.

Traveller and Port Health Measures

As an international travel hub, Hong Kong is vulnerable to importation of human cases of avian influenza.

Nonetheless, due care must be exercised in choice of port health measures. For example, screening and quarantine of incoming travellers at international borders did not substantially delay virus introduction in past pandemics, except in some island countries.²⁴ Also, travel restrictions are shown to have limited benefits in delaying spread of influenza unless combined with interventions to reduce local transmission.^{25–27} The WHO recommends providing information to international travellers and possibly screening travellers departing from countries with transmissible human infections.²⁴

In line with WHO recommendations, the key measures to prevent and delay entry of avian influenza involve health announcements on-board flights coming from avian influenza affected areas, and distribution of health education pamphlets to outgoing travellers to avian influenza affected areas. Meanwhile, Hong Kong maintains temperature screening for incoming travellers at immigration control points. The Tourist Commission and tourist industry operators turn out to be extremely helpful partners to disseminate updates on avian influenza to travellers.

Early Detection of Pandemic Influenza

Early warning of the emergence of a pandemic influenza virus is essential in mobilising all necessary efforts to contain its spread.^{15,28} Animal and human health sectors should coordinate their approaches to epidemiological, virological and clinical surveillance across specialties.²⁹ Over the past decade, Hong Kong has strengthened both animal and human influenza surveillance systems, achieving a high degree of sensitivity and capable of monitoring genetic reassortment.³⁰

As an illustration, a territory-wide surveillance programme is in place to conduct avian influenza tests from a wide range of wild and domestic birds. These include debilitated or dead wild birds, live wild bird fecal samples from nature reserves, fecal samples from cages of recreation parks and other locations with captive birds (e.g. pet shops), and illegally imported birds that are intercepted. Moreover, at wholesale and retail markets, fecal tray samples and dead poultry are also monitored for avian influenza.

On the front of human influenza surveillance, all doctors are required by law to notify the Department of Health of any suspected or confirmed cases of influenza A(H5, H7, H9). A sentinel surveillance network comprising over 100 private general practitioners and public general out-patient clinics monitors influenza-like illness in the community on a weekly basis (Fig. 1). More recently, similar sentinel networks have been extended to child care centres, elderly homes, and traditional Chinese medicine practitioners. These institutions also report respiratory disease outbreaks to the Department of Health. When a local human case of

avian influenza is detected, surveillance will be stepped up immediately in public and private hospitals. Also, the Hospital Authority will activate e-FLU, a designated clinical information system for influenza, which transfers data electronically from public hospitals to the Department of Health to facilitate contact tracing and other public health control actions.

In the realm of laboratory testing, the Department of Health's Public Health Laboratory Centre (PHLC) is a WHO-accredited National Influenza Centre providing diagnostic capacity required for pandemic influenza.³¹ Apart from providing free confirmatory tests for influenza to both public and private healthcare sectors, PHLC has established mechanisms to transfer new rapid test technologies to hospital laboratories, and to coordinate with public and private laboratories on testing arrangements and testing strategy.

Pandemic Preparedness and Response

Once a novel influenza virus with pandemic potential is detected in humans, containment measures should be applied to arrest its development into pandemic influenza.^{25,27} Containment measures may comprise antiviral treatment and prophylaxis, non-pharmaceutical interventions such as infection control, isolation and quarantine, contact tracing, social distancing and mass education campaigns.^{32,33} The WHO and scientists recommend setting up containment and buffer zones to implement containment measures, provided it is technically, operationally and politically feasible.^{33–35} For Hong Kong, while the application of containment measures against pandemic influenza poses considerable logistical challenge, we find the experience gained during the severe acute respiratory syndrome (SARS) epidemic in 2003 particularly relevant.

When the virus breaks through the containment threshold and a pandemic gets under way, a primary objective is to delay the spread of the epidemic and reduce morbidity and mortality before an effective vaccine comes along.³³ Lo et al³⁶ suggested that during the 2003 SARS outbreak in Hong Kong, community hygienic and social distancing measures could have significantly reduced the incidence of various respiratory viral infections. Encouragingly, modelling research from Hong Kong suggests that household-based interventions (i.e., combination of household-based quarantine, isolation of cases outside the household, and targeted prophylactic use of antivirals) could be useful to reduce transmission across a range of plausible transmission scenarios even when expected levels of compliance are only moderate.³⁷

WHO recommends that measures to increase social distance may include closing schools and workplaces or discouraging mass gatherings, depending upon transmission

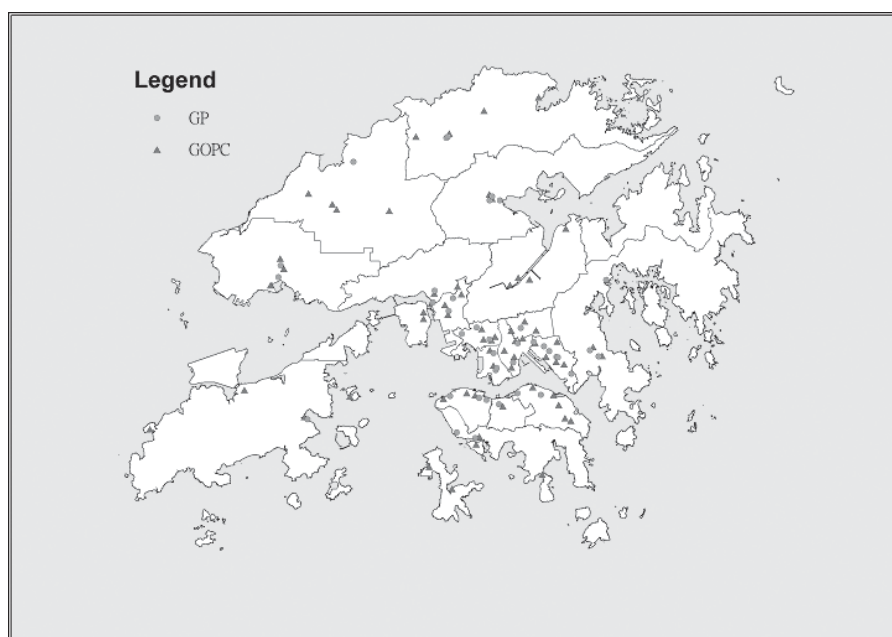


Fig. 1. Map showing geographical distribution of sentinel sites of private general practitioners (GP) and public general outpatient clinics (GOPC).

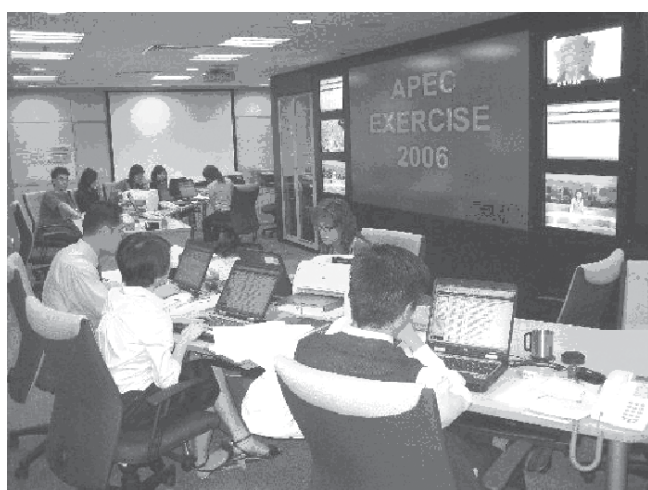


Fig. 2. HKSARG participates in APEC Pandemic Exercise 2006.

characteristics and epidemiological characteristics of the particular virus (e.g., attack rates in different age groups).³⁸ Avoiding crowded settings may reduce the peak incidence of an epidemic.³⁹ Closure of schools may be particularly effective – studies have shown that school closures are associated with significant decreases in the incidence of viral respiratory diseases and healthcare utilisation among children.^{40–42}

Taking reference from these scientific studies, Hong Kong has developed contingency arrangements for social distancing (e.g., school closure, cancellation of public gatherings, isolation and quarantine) to slow down influenza transmission. These measures may not necessarily be applied on a territory-wide basis depending on the characteristics

of the epidemic, such as the severity and mortality of the pandemic strain.⁴⁰ When in-patient care for pandemic influenza is no longer feasible, community care services will be deployed for patients who do not need hospitalisation, in accordance with WHO guidelines.⁴³

Antivirals and Vaccines

Antivirals are likely the only effective medical intervention during the first wave of pandemic when pandemic vaccines are not yet available.^{32,34,35} HKSARG is maintaining an antiviral stockpile of around 20 million doses including oseltamivir and zanamivir. This amount is estimated according to recommendations of the Scientific Committee of Emerging and Zoonotic Diseases (SCEZD).⁴⁴ The stockpile is indicated for the treatment for infected patients, pre-exposure prophylaxis for healthcare workers, essential service providers and workers involved in culling operations; as well as post-exposure prophylaxis for contacts. Despite possessing an antiviral stockpile, we actively promote public awareness that antivirals are not silver bullets against pandemic influenza. Until a vaccine becomes available, strict personal hygiene and meticulous infection control are as important as antivirals.^{33–35}

While pandemic vaccine is regarded as the most effective intervention against pandemic influenza, there are a number of uncertainties in its development and use. It is difficult to predict the virus strain that will cause a pandemic beforehand, as influenza viruses continuously undergo antigenic drift.³² As a result, the pandemic virus which emerges may be quite different from current prototype H5N1 strains.^{45,46} The issue is further complicated by the emergence of different clades of avian influenza viruses, which render

vaccines based on earlier strains no longer effective.⁴⁷ On the other hand, there have been recent, though preliminary, results from certain vaccine clinical trials showing effects of cross-protection and priming across different H5 strains. This would improve the feasibility and usefulness of maintaining a pre-pandemic stockpile. While HKSARG does not possess a pre-pandemic vaccine stockpile currently, the Department of Health is monitoring the latest scientific development and making regular contacts with potential suppliers to assess the situation closely.

Risk Communication

One lesson to learn from previous outbreak crisis is: transparent, open, timely, accurate, consistent and updated information should be conveyed to the public during public health emergencies to gain public trust and gear up their support.⁴⁸ A survey conducted in Hong Kong showed that widespread unconfirmed beliefs or misconceptions about the HN51 epidemic have adversely affected the public's behavioural responses.^{49,50} Effective risk communication is crucial to building a foundation of community preparedness to ensure compliance with pandemic mitigation measures.^{51,52}

A phased approach is found to be useful in conducting risk communication—pre-event risk communication, crisis communication and post-event risk communication. During pre-pandemic period, pre-defined, tailor-made and scenario-specific messages are developed for different pandemic events and circumstances. Gaps in risk communication are identified via designated surveys. For example, survey results indicate public inadequacy in hand washing after coughing/sneezing and mask wearing during a respiratory infection.^{53,54} In response, a respiratory hygiene etiquette campaign has been launched to address this deficiency since 2007. The effectiveness of the campaign will be closely monitored.

Risk communication messages can be penetrated more effectively through the use of diverse channels. These may include television and radio broadcasts, websites, public forums, printed publicity materials such as pamphlets and posters.

Building Surge Capacity

Providing adequate and essential medical services during an influenza pandemic is both a necessity and a challenge.⁵⁵ The SARS Expert Committee, set up by HKSARG to review the management and control of SARS outbreak in Hong Kong, highlighted the under-use of skills and expertise in the private sector to support public health services.⁵⁶ Thus, strengthening surge capacity across the whole community is a crucial part of our pandemic planning.

A particularly useful initiative is setting up a volunteer scheme whereby doctors, nurses, pharmacists, and allied

medical personnel can register and receive simple training on public health functions. These volunteers may come from the private sector, non-governmental and voluntary organisations. They will be ready to assist the Government during public health emergencies to maintain the provision of essential services such as patient care, outbreak control operations, infection control, vaccination programme, antiviral administration, hotline management and conducting health education activities.

Another essential element is to conduct exercises to evaluate the effectiveness of our contingency plan.^{57,58} Through regular territory-wide, interdepartmental exercises, we gain much insights on how to improve decision-making, communications, and coherence in field operations. The planning, execution, and evaluation processes engage numerous governmental and non-governmental participants and they are extremely useful in building surge capacity. Besides, much can be gained via participation in exercises on a regional scale. For example, HKSARG took part in the *APEC Pandemic Response Exercise 2006*, which tested communications channels in ensuring preparedness across Asia-Pacific Economic Cooperation economies in responding to emergencies (Fig. 2). In addition, a joint exercise on avian influenza, codenamed *Exercise Great Wall 2006* was organised on in November 2006 by the Chinese Ministry of Health, Health Bureau of Macao SAR and Department of Health of HKSAR. This exercise provided a valuable opportunity for participants to review joint response actions on avian influenza with cross-border impact.

Business Continuity Plans

Maintaining essential societal functions and services during an influenza pandemic is critical. Much effort has been devoted in Hong Kong to support enterprises and essential services providers to develop relevant business continuity plans (BCP). Examples of sectors involved include banking, utilities, telecommunications, transportation, pharmaceuticals, food supply, funeral parlours, tourism, aviation and hotels. To assist enterprises and providers develop their own BCP, the Department of Health made use of consultation forums, briefings, meetings, training workshops, lectures, internet, and guidelines. Many questions have arisen concerning antiviral stockpiling, and to address this issue, the Department of Health have produced a guideline on antiviral stockpiling for businesses.

Regional and International Collaboration

The International Health Regulations (IHR) (2005) endorsed by the World Health Assembly officially took effect since June 2007. HKSARG regards this as a highly positive development in regional and international collaboration against avian and pandemic influenza.

HKSARG is taking steps to amend legislation to better serve IHR (2005) and use this opportunity to strengthen other legal provisions on the local prevention and control of infectious diseases.

The Department of Health liaises closely with the WHO and national health authorities to monitor developments in avian influenza. An important achievement took place in 2005 when HKSARG signed a Cooperation Agreement on Response Mechanism for Public Health Emergencies with the Mainland Ministry of Health and Macao Health Bureau. Under this Cooperation Agreement, when a cross-boundary public health emergency occurs, the Mainland, Hong Kong and Macao will form a joint emergency response group to facilitate sharing of intelligence and expertise. HKSARG also receives information on avian influenza outbreaks among poultry in the Mainland.

Discussion

The threat of influenza pandemic has increased over the past few years.⁵⁹ In Hong Kong, the pandemic preparedness initiative has evolved into a major public health programme encompassing surveillance of novel viruses in human and animal populations, pharmaceutical and non-pharmaceutical interventions, expansion of medical facilities for patient care and infection control, capacity building and business continuity planning in the entire community. These enhancements have resulted in better public health infrastructures. The investments made pertain not only to avian/pandemic influenza preparedness, but also have improved the ability to deal with many other public health emergencies as well.

One particular challenge in drawing up a broad-spectrum pandemic response involves complex ethical issues, which need to be addressed well in advance.⁶⁰⁻⁶² When HKSARG implemented compulsory quarantine and imposed limitation of movement for close contacts during the SARS epidemic, controversies erupted between safeguarding public health and maintaining individual rights to privacy, and freedom of movement. An appropriate balance between security and liberty is of paramount importance.⁶⁰ Unfortunately during that time, unwarranted discrimination of SARS patients has also arisen from anxiety and misinformation.⁵⁶

According to an excellent Canadian review, the key issues include ethics of quarantine (e.g., individual liberty to be balanced against protection of public), privacy of personal information versus the public's need to know, duty of care, collateral damage (e.g., restriction on entry to hospitals designated for SARS patients lead to denial of care to other patients), and travel restrictions.⁶¹ In 2006, WHO convened a global consultation on ethical issues in pandemic planning to address similar issues.⁶² In these reviews, common themes of precautionary principle, equity,

fairness and justice, transparency, and community engagement are advocated.

It is paramount for Hong Kong that public and stakeholder views (e.g., healthcare workers, business sector, community leaders) on these ethical issues be collected and considered in pandemic planning. In the process, one must communicate well on the scientific limitations of pandemic preparedness, what individuals and families can do to be better prepared, and what the public may be asked to do in a pandemic.⁶³

A final problem concerning public fatigue towards avian influenza is the difficulty to sustain a high degree of public awareness and attention over a couple of years before a pandemic strikes. The public may be desensitised over time; compliance with personal hygiene may wane. The strategy used in Hong Kong is to leverage on local incidents of avian influenza as much as possible, such as the occasional finding of H5N1 virus in migratory birds in Hong Kong during winter months. People pay closer attention when there is a change in the season. There is also a need to package avian influenza prevention messages in different ways to suit different groups. In addition, relevant campaigns such as that on respiratory hygiene etiquette will be organised. The outcomes and effectiveness of such campaigns will be evaluated for further improvement of on-going programmes. Still, maintaining the momentum is a challenging task.

Conclusion

Despite the maturity of Hong Kong's pandemic preparedness plan and related activities,⁶⁴ pandemic influenza is too big a threat to allow any room for complacency. There will always be situations that catch everybody by surprise, gaps that scientists do not foresee. In this regard, the best way to improve is to learn from other nations' experience, successes and failures. We all face a challenging enemy and we will surely be better off by joining forces together to fight this common enemy.

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