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THE AVIAN FLU (H5N1): ONE YEAR ON

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Introduction

In 1997, the world's attention was focused on Hong Kong Special Administrative Region (HKSAR) as human cases of influenza A (H5N1) were diagnosed one after another. The potential of this avian flu virus to become a pandemic strain in human immediately became a matter of global concern. Joint efforts of local and international health authorities, academics and administrators to contain the outbreak reached a climax during the chicken slaughtering operation in late December 1997. Subsequently, stringent control measures were observed at various levels to prevent recurrent H5N1 infection in chickens, and to prevent transmission of the virus to man should infection occur in chickens. One year after the incident, this paper summarizes past and present efforts to contain the outbreak and prevent further cases, and puts forward recommendations for future prevention strategies.

The Influenza A (H5N1) Outbreak

The first human case of H5N1 infection occurred in a 3-year old boy who presented with fever, sore throat and abdominal pain in May 1997. He subsequently died from respiratory failure and various complications including multi-organ failure and Reye's syndrome. A tracheal aspirate specimen yielded atypical influenza A virus. The isolates were confirmed in August 1997 by reference laboratories in the Netherlands and the Centres for Disease Control and Prevention (CDC) in the United States to be an avian flu A virus: H5N1, which until then has been known to infect birds only.

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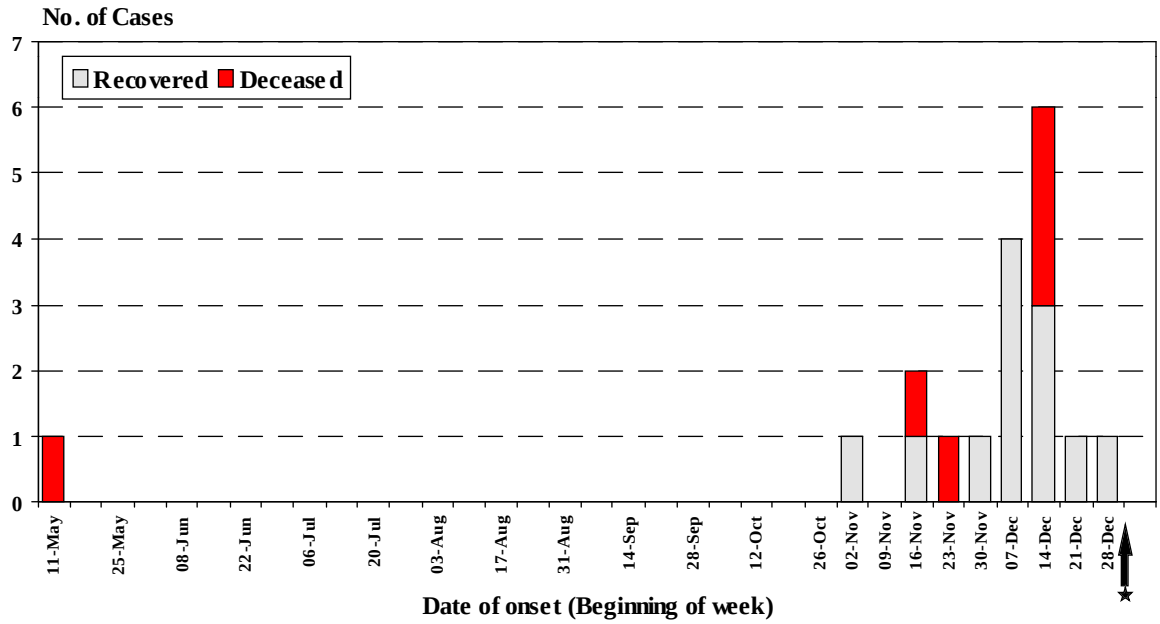
In view of the potential risk of a new influenza strain in humans, prompt actions were taken by the Department of Health (DH) in collaboration with local experts, World Health Organization (WHO) and CDC upon identification of the first human case of H5N1 in August 1997. Investigations revealed that an outbreak of avian flu had occurred in chicken farms in the northwestern part of Hong Kong (Lau Fau Shan, Yuen Long) in March and April 1997. The virus that had killed more than 4 000 chickens was also found to be H5N1. Other actions consisting of field visits, interviews and laboratory investigations were conducted and joined by experts from local universities, Hospital Authority, CDC, and other government departments. Surveillance of H5N1 in human and poultry was stepped up and the laboratory capacity was enhanced.

The second case of H5N1 infection was confirmed on 26 November 1997 and more cases appeared in December 1997 (Figure 1). There were a total of 18 confirmed cases affecting 8 males and 10 females. Their ages ranged from 1 to 60 with half of them aged 12 and below. Six of them passed away due to viral pneumonia or other medical complications. The remaining twelve cases made a full recovery from the illness. The cases were scattered in different residential districts (Figure 2).

Meticulous investigations were conducted to elucidate the mode of transmission, the extent of infection and possible spread of this virus. Field visits, laboratory tests, and epidemiological studies were done in collaboration with local and overseas experts.

When the HKSAR Government obtained the evidence that the H5N1 virus was circulating among the poultry population, a decision was made on 28 December 1997 to slaughter all the poultry in farms and markets. The operation started on 29 December 1997 and no new infections appeared afterwards (Table 1).

Figure 1 Epidemic Curve of Influenza A (H5N1) Cases in HKSAR, May - Dec 1997



★ Slaughting of poultry commenced on 29 December 1997

Figure 2 Geographical Distribution of Influenza A (H5N1) Cases in HKSAR, May - Dec 1997

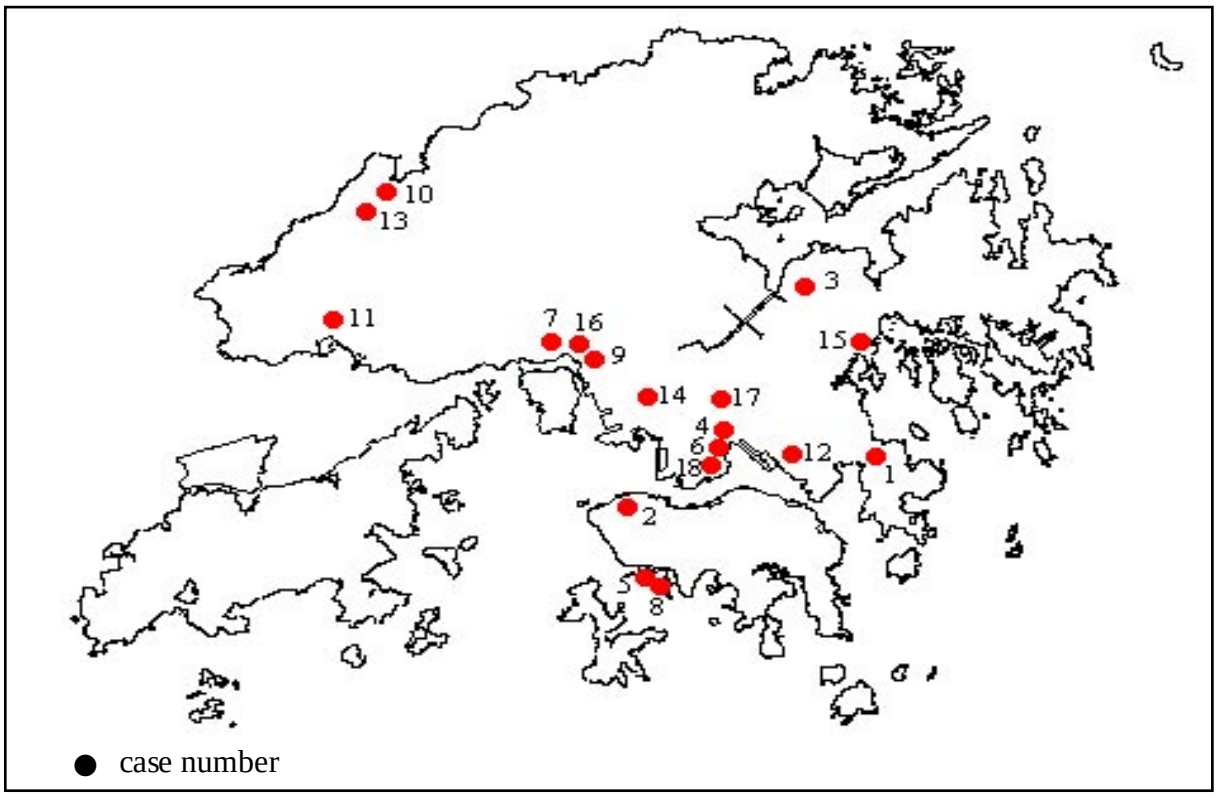


Table 1 Chronology of Influenza A (H5N1) Outbreak in HKSAR 1997

March / April 1997	Avian flu outbreak among chicken farms in northwestern part of Hong Kong.
9.5.1997	Onset of illness for the first case of influenza A (H5N1).
18.8.1997	Laboratory confirmation of H5N1 infection for the first case.
26.11.1997	Confirmation of the second case of human infection.
December 1997	Isolation of H5N1 virus for chicken markets. More human cases.
23.12.1997	Poultry export from Mainland suspended at midnight.
28.12.1997	Evidence of widespread H5N1 infection in a chicken farm and wholesale market.
29.12.1997	Slaughtering of chickens and poultry commenced. No new human infections occurred since then.

Measures Taken to Contain the Influenza A (H5N1) Outbreak

To contain the outbreak and to minimize the risk of recurrence, a whole host of measures were implemented and co-ordinated by an inter-departmental co-ordinating committee :

I. Pre-slaughter Measures

(1) Influenza surveillance was further enhanced. The sentinel surveillance network was extended on 11 December 1997 to cover all public hospitals, all the 63 public out-patient clinics and 18 (now 28) private

doctors. Virology tests for confirmation were provided to private laboratories which performed Directigen tests. In addition, hospital cases of respiratory infections, pneumonia and influenza-like illness were monitored.

(2) Guidelines on influenza prevention and proper hygiene were prepared for doctors, health care workers, and staff of schools, child care centres and elderly centres as well as poultry workers. The Hospital Authority prepared special guidelines for hospital infection control and developed quick tests for rapid diagnosis for Influenza A.

(3) Collaboration with CDC was expanded to include case investigations, epidemiological studies, development of diagnostic serological and confirmatory tests for the new virus and technology transfer. Close liaison was also maintained with WHO on related issues including vaccine development and pandemic planning.

(4) The Mainland voluntarily suspended export of chickens to HKSAR from midnight of 23 December 1997 to allow new control measures be developed and implemented.

II. Post-slaughter Measures

(1) Enhanced influenza surveillance was maintained. During the year 1998, over 20 000 flu specimens were submitted by the sentinel surveillance network and hospitals for testing by the Government Virus Unit. No new H5N1 infections were discovered.

(2) Hospital admissions due to respiratory tract infections were also monitored. Apart from the usual seasonal upsurge in spring months, there was no significant change in the incidence of influenza-like illnesses, respiratory infections and pneumonia during the year 1998.

(3) Safe supply of chickens was ensured through the following measures :

- New poultry import control measures include segregation of chickens in designated farms in the Mainland for five days, examination and testing for H5 infection in poultry before export, introduction of health certificate and use of rapid diagnostic tests on chickens for H5 infection upon arrival. By 1998, over 200 000 blood samples have been examined and no evidence of infection with avian influenza (H5) has been detected in any consignments.

- A policy to segregate chickens from waterfowls has been recommended for implementation at all levels from import to retail.

- Poultry surveillance in farms was introduced along with new licensing conditions covering hygiene and management practices. All flocks are to be serologically tested during the growing period. All farms have remained free from infection with H5 influenza virus so far. Testing programmes were instituted on other farms raising quails, ducks and pigeons etc. *No evidence of infection has been detected in any of these farms*.

(4) A high standard of cleanliness and hygiene is maintained in the markets and enforcement actions against contravention of licensing conditions

have been stepped up.

- Additional requirements and conditions have been imposed on licensees to achieve a high standard of hygiene including the use of plastic or metal poultry cages only, keeping the premises clean and keeping the processing of chickens hygienic and safe to staff.

(5) A contingency plan for influenza pandemic was drawn up with emphasis on influenza surveillance, provision of medical service, stocking of medicine for chemoprophylaxis and presumptive treatment of influenza A cases where necessary.

Results of Investigations and Studies

Much energy and attention have been devoted by all concerned to ensure that the epidemiological investigations and studies are robust and properly carried out. Work is still ongoing at this stage. The main findings available are summarized as below:

(*1*) *Investigation of the First Case*

Five (1.1%) out of 476 persons investigated were found to have H5 antibody. Among the five seropositives, one had exposure to the patient only, three had exposure to poultry only, and the remaining one had exposure to both. The results suggest that the main mode of transmission is from bird to man.

(2) Gene Sequencing

Gene sequencing results show that all the viral genes of the H5N1 viruses are avian in nature and that these avian viruses were able to infect humans without reassortment with human virus. The viruses isolated from patients are nearly identical to those from chickens. Hence, the source of infection was most likely from poultry. The virus isolates fall into two closely related but distinguishable groups. This implies that multiple introduction from poultry to man have occurred.

(3) Case-Control Study

The results of a case-control study jointly carried out by DH and CDC on influenza A (H5N1) in HKSAR found that visiting poultry stalls in the one week before becoming ill was the strongest risk factor for infection by those viruses.

(4) Cohort Studies

Cohort studies were done on health care workers, classmates and colleagues of patients. The results suggest that health care workers who took care of more sick and dependent influenza A (H5N1) patients, especially before the diagnosis of H5N1 infection was made, had a higher chance of contracting the virus. However, such man-to-man transmission was inefficient as reflected by the low prevalence (3%) of antibody among the exposed health care workers.

(5) Animal Studies

Meticulous animal and poultry studies were conducted to examine the extent of H5N1 infection in the animal population. Intensive sampling was done for poultry in the markets before the chicken slaughtering commenced. It was found that nearly 20% of the chickens in the markets were infected

by the H5N1 virus while only about 2% of the ducks and geese in the markets carried this virus. This provides the evidence that the H5N1 virus was widespread among the chicken population. On the other hand, samples taken after the slaughtering exercise from chickens, ducks, waterfowls, rats, feral birds, stray and pet animals, etc, did not reveal any evidence of H5N1 infection. Only a few unidentified influenza viruses were detected from farm ducks and waterfowl. These findings illustrate that the market chickens were probably the major source of H5N1 virus for the community. Hence, the slaughter of all chickens and market aquatic birds had effectively abolished the virus load and helped to bring the outbreak to an end.

Up to now, all investigation results have indicated that the main mode of transmission for H5N1 viruses is from bird to man. The man-to-man transmission did occur but was inefficient and rare.

Recommendations

The actions and measures taken to contain the influenza A (H5N1) outbreak and to prevent its further spread were effective. In order to protect the community against the threat of H5N1 and other viruses, the following control and preventive measures, already in place, should be maintained with vigour.

Influenza Surveillance

- *The surveillance of influenza in the human population should be continued and further expanded, resources permitting.*

- *The influenza surveillance in animals and poultry should be maintained and further enhanced whenever possible.*

- *Global networking and collaboration, particularly exchange of epidemiological information, technology transfer and capacity building, should be enhanced and improved.*

Influenza Pandemic Plan

- *A contingency plan has been drawn up and should be regularly updated.*

Vaccine Development

- *The development of H5 vaccine should be kept under close review.*

  Although the existing evidence illustrates that the man-to-man transmission is inefficient, and hence the need for developing a vaccine for use on a large scale is no longer compelling, experimental studies with pilot lots of H5 vaccine should continue.

Discontinue Mixed Farming

- *Mixed farming involving chickens and pigs or water birds should be discouraged and phased out.*

Conclusions and Lessons Learned

Influenza is a continuing threat to every health authority of the world. Southern China, including HKSAR, is known to be an epicentre of this disease entity because of its unique ecological environment in which man and animals, especially poultry, live in close proximity. The H5N1 outbreak, which occurred in Hong Kong from May to December 1997 and affected 18 residents with 6 deaths, illustrates how influenza viruses can spread easily, and

even cross the species barrier from poultry to man.

It also reaffirms the importance of a sound and robust public health system for early identification and prompt containment of new and re-emerging human pathogens before they can develop the potential to cause a worldwide pandemic.

The available investigation results all support the view that the main mode of transmission was from bird to man and that man-to-man transmission, although it did occur, was inefficient and rare.

The HKSAR Government's decisive action to depopulate 1.5 million chickens and poultry from the territory effectively brought the outbreak to an end. It is crucial that this timely intervention was taken before the virus could acquire the ability to spread with ease among the human population. Complemented with a whole host of measures to ensure a safe supply of H5-free chickens and strict segregation of chickens from waterfowls, HKSAR has been free from human H5 infection.

This incident reminds health authorities that the threat of influenza is ever real and imminent. It therefore calls for maintenance of surveillance for influenza in both human, animal and poultry populations.

The influenza A (H5N1) outbreak drives home again the message that the control of influenza is never a local issue; it is a mission beyond any geographical or political boundaries and frontiers. Global support, international collaboration and concerted efforts across different specialties and disciplines have contributed to the success in nipping the problem in the bud. It also reminds us that the constant battle between mankind and infectious agents will continue to be fought all the time and that it is how we act together in unity that gives us the winning edge.

Acknowledgement

The Government of the HKSAR wishes to thank the many experts in the various organizations and agencies who have contributed their expert advice and time in the management of this incident, particularly to those in the World Health Organisation; the Ministry of Health, China; the Animal and Plant Quarantine Bureau, China; the Centres for Disease Control and Prevention, USA; St Jude Children's Research Hospital, USA; the Department of Agriculture, USA; the National Influenza Center of the Netherlands; the University of Hong Kong; the Chinese University of Hong Kong; and the Hospital Authority.

NEWS IN BRIEF

Notification of Chickenpox

The list of notifiable diseases has been recently amended with the addition of chickenpox. From 1 February 1999 onwards, medical practitioners are required to report chickenpox cases to the Department of Health. The amendment is in line with the recommendation of the Advisory Committee on Immunization. It will enable the Department of Health to assess the impact of chickenpox vaccination on the epidemiology of this disease in the local community, and to plan future prevention and control strategies. The standard notification form (Form 2) has been revised accordingly and has been distributed to members of the profession. It can also be downloaded from the Department of Health web site (http://www.info.gov.hk/dh).

NUMBER OF NOTIFICATIONS OF INFECTIOUS DISEASES

DISEASE	1997	1998
	Cases	Cases
1) Cholera	14	71
2) Plague	-	-
3) Yellow Fever	-	-
4) Acute Poliomyelitis	-	-
5) Amoebic Dysentery	12	3
6) Bacillary Dysentery	363	513
7) Dengue Fever	10	15
8) Diphtheria	-	-
9) Food Poisoning: *Outbreak*	364	578
Persons Affected	1 900	3 017
10) Legionnaires' Disease	2	1
11) Leprosy	11	13
12) Malaria	101	54
13) Measles	316	56
14) Meningococcal Infections	5	2
15) Mumps	51	25
16) Paratyphoid Fever	18	16
17) Rabies: *Human*	-	-
Animal	-	-
18) Relapsing Fever	-	-
19) Rubella	4 958	35
20) Scarlet Fever	77	27
21) Tetanus	8	3
22) Tuberculosis	7 072	7 673
23) Typhoid Fever	71	70
24) Typhus Fever	9	9
25) Viral Hepatitis:	736	665
- *A*	*595*	*452*
- *B*	*100*	*134*
- *Non-A Non-B*	*27*	*37*
- *Unclassified*	*14*	*42*
26) Whooping Cough	12	3

AIDS/HIV Surveillance

Cumulative Number of Cases	as at 30.6.98	as at 30.9.98
AIDS	349	359
HIV	1 066	1 098