



衛生防護中心  
Centre for Health Protection

## Scientific Committee on Vector-borne Diseases

### Japanese Encephalitis in Hong Kong Situation Update, Prevention and Control Strategy

#### Purpose

This paper updates the situation of Japanese Encephalitis (JE) in Hong Kong as of June 28, 2004, and outlines the prevention and control strategies in relation to 2 recently confirmed JE cases.

#### Epidemiology of JE<sup>1-11</sup>

2. JE is an acute viral infection of the central nervous system caused by the JE virus, a flavivirus. The infection usually does not cause clinical symptoms, with a case to infection ratio of 1:300. It is endemic in Mainland China, Japan, Korea, Taiwan, Philippines and some other South-East Asian countries. WHO estimates there are approximately 50 000 clinical cases with neurological involvement in Asia per year. The annual incidence of clinical infection with neurological involvement in endemic areas ranges from 10-100 per 100 000 population. Children suffer the highest attack rates in endemic areas and most fatalities and residual sequelae occur in children aged 10 or below.

3. JE virus is transmitted by the bite of infective Culicine mosquitoes. The principal vector of the disease in Hong Kong is *Culex tritaeniorhynchus*. Migratory birds such as egrets and herons are reservoir hosts in the transmission cycle with pigs acting as Scientific Committee on Vector-borne Diseases Discussion Paper 4/2004 amplifying hosts. The virus may be transmitted to the terminal hosts, human and horses directly from the reservoir hosts or the amplifying



hosts. The mosquito becomes infected by feeding on pigs and wild birds infected with the JE virus.<sup>1-3, 9, 10</sup>. The infected mosquitoes then transmit the virus to humans and animals during the feeding process. Mosquitoes may also have trans-ovarian transmission which may play a role in the over-wintering of the virus. Man is a dead-end host and not a reservoir for viral transmission because of the short and low viremic phase after exposure.

## Local situation

4. On June 10 and 24, 2004, the CHP confirmed two local cases of JE. The first case (Case 1) was a 29-year old Indonesian domestic helper who lived in Kwai Tsing district. She came to Hong Kong two years ago and had not traveled outside Hong Kong since. She presented with headache and vomiting since May 29 and was admitted to hospital on June 2. Her condition deteriorated and she passed away on June 7. The second case (Case 2) was a 45 year old male living in Yuen Long who presented with fever and seizures on June 8. He is now in critical condition. In both cases, JE infection was confirmed by paired serology showing a more than 4-fold rise in titre.

5. Epidemiological investigations were directed towards identifying a local focus and active case finding was carried out in the area near these patients' homes. Their local movements during the two weeks before onset of illness were mainly confined to areas near their residence, which was separated by a 20km distance. Vector surveys demonstrated larvae of Culicine mosquitoes as well as adult *Culex tritaeniorhynchus* mosquitoes in areas near to the two patients' homes. Pig farms were found approximately 2km from the home of Case 2 but not Case 1. About 170 blood samples collected among family members and neighbors of the first patient did not show evidence of acute JE infection. In these blood samples, 0% of persons aged <40 and 10% of persons aged > 40 had JE antibodies signifying previous JE exposure. These results were comparable to a JE sero-survey in 2003 (see below). More than 400 blood samples in connection with the second patient are under testing. At this moment, the interim conclusion is that the 2 cases probably acquired infection from different geographical locations, and Case 1 appeared to be an isolated, sporadic infection.

6. In a review on 45 cases of JE reported to DH from 1967 to 2003, the annual incidence ranged from 0 to 0.1 per 100 000 population, with an average of 0.01 per 100 000 population. Before the 1980s, almost all reported JE cases are acquired locally. Most of them were suspected to have contracted the disease in the New Territories where migratory bird roosts, local pig farms and rice fields were found <sup>4,8</sup>.

7. Of the 45 cases during 1967-2003, male and female were about equally affected. Over 70% of the patients were below the age of 19. Nine were classified as imported cases (4 from Singapore, 3 from China, 1 from Nepal, 1

undetermined). There were five deaths (2 of them were children below 16, 2 were adults and 1 of unknown age), corresponding to a case-fatality rate of 11.1%.

### **Seroprevalance studies: human**

8. A serosurvey on JE antibodies was conducted from July to November 2003 among five different population groups (Table 1). A serum titre of 1:40 was used as the cutoff for seropositivity.

- (a) Patients attended General Out-patient Clinics: Out of the 142 blood samples obtained for thyroid function tests, 18 (12.7%) were tested seropositive. The seroprevalence among subjects aged below 40 was 2.8% compared with 16.0% among subjects aged 40 and above.
- (b) Pig Farmers and AFCD staff working near pig farms: 8 out of 34, ie, 23.5%, were tested positive. The seroprevalence among pig farmers aged below 40 was 0% compared with 27.6% among pig farmers aged 40 and above.
- (c) Abattoir workers: 2 out of 34 (5.9%)
- (d) Yuen Long residents: 6 out of 112 residents (5.4%). Four of these positives were from overseas domestic helpers. Excluding them, the seropositivity rate becomes 1.9%. (Why would we exclude domestic helpers? Local residents are likely to travel out of the country as well.)
- (e) Blood donors: 0% (out of 30 specimens)

9. Older persons (persons aged 40 years or above), male sex, and pig farms workers were more likely to have serum titre > 1:40. Age in particular is a significant confounder in interpreting serological results. The limitations of this study included small sample size and the use of convenient sampling for certain groups.

### **Seroprevalance studies: pigs and wild birds**

10. In Hong Kong, there are approximately 285 local pig farms with an estimated population of 400,000 pigs. Regular sero-surveillance on JE antibodies in 6-month-old local pigs and wild birds finds that enzootic infection with seasonal mosquito activity and aviphilic mosquitoes is present. The findings are as below:

- (a) From November 1999 to July 2003, pigs which were born in winter season and raised throughout the rainy/spring seasons showed seroprevalence of up to 91% when tested for JE antibodies. On the other hand, pigs raised through the winter/dry season had seroprevalence of up to 34%.

(b) In 2003, out of the 44 wild birds (wild water birds, egrets, ducks, quail, dove, etc) trapped, shot or seized, 30 (68.2%) were seropositive for JE antibodies.

11. Vector surveys conducted by FEHD demonstrated *Culex tritaeniorhynchus* and *Culex vishnui* in the past 5 years, especially in abandoned fields and irrigation ditches located in Yuen Long and Northern district. During the most recent survey (2003-04), *Culex tritaeniorhynchus* was identified in 10 locations in Yuen Long, Tuen Mun, and Sheung Shui.

12. The geographical distribution of pig farms, routes of migratory birds, breeding sites of *Culex tritaeniorhynchus*, and the place of residence of the 2 JE cases in 2004 are shown in Figure 2.

### **Prevention and control strategies for JE**

13. Strategies for JE prevention and control have been published by WHO and some other health authorities. In the following sections, we describe our current strategies in relation to vectors (i.e., mosquito control), intermediate hosts (i.e., pig farms), and protection of humans.

### **Vector Control**

14. Control of the mosquito vector in areas where local cases are found and in the vicinity of wild bird habitats and pig farms constitute the most effective risk reduction strategy under present circumstances. The WHO concurs with this view in our recent Vector Control 14. Control of the mosquito vector in areas where local cases are found and in the vicinity of wild bird habitats and pig farms constitute the most effective risk reduction strategy under present circumstances. The WHO concurs with this view in our recent

15. The AFCD has inspected the three pig farms located within two kilometers of the patient's residence. They carried out animal surveys and worked with pig farmers to carry out anti-mosquito measures. The FEHD is also providing technical assistance to AFCD in stepping up mosquito control work in the three pig farms.

16. Notwithstanding the above efforts, total elimination of the mosquito vector is not a realistic task as it is found over large parts of the rural areas of Hong Kong.

### **Action targeted at Intermediate Hosts**

17. The high seroprevalence of JE antibodies among pigs in local pig farms shows that enzootic JE transmission is clearly present. Blocking the virus amplification cycle in pigs is one of the possible options in controlling the

transmission of JE. Swine vaccination has been used to control JE virus transmission in several prefectures in Japan with some positive results<sup>13</sup>. However this vaccination is targeted solely at breeding pigs to prevent future reproductive failure. It is not targeted at preventing infection of marketable pigs.

18. In most JE endemic countries, swine vaccination is not used as a principal method to control human JE because of; the high turn-over rate of pig populations; the large number of newborns to be vaccinated every year; the period of effective immunization using live vaccines is limited by the presence of maternal antibodies. Killed vaccines have been shown to have a doubtful immunity response.

19. Hong Kong, with a low incidence of JE in the human population, is not an endemic area for JE with regards to the human population. However, with regards to the pig population, JE is enzootic in Hong Kong as shown by the continued seroconversion of pigs and birds in Hong Kong throughout the year. We have a large number of pig farms situated close to some residential estates in the NTW area (e.g., Yuen Long), and *Culex tritaeniorhynchus* is found in considerable numbers near those farms. In general, *Culex* mosquitoes prefer feeding on pigs and birds rather than humans.

20. Besides vector control strategies targeted at pig farms and its surrounding areas, the Government is considering, as an additional control measure, the vaccination of pigs, and is currently studying the effectiveness and feasibility of this strategy.

## **Protection of humans**

21. When a local JE case is found, epidemiological teams are deployed to conduct active case finding through door-to-door interviews of the neighborhood, distribution of pamphlets, and setting up telephone hotlines. Health education and advice is given to residents and the general public through press conferences, health talks, and dissemination of educational materials.

22. To enhance surveillance of JE, The CHP and Hospital Authority have set up an encephalitis alert since June 11 to monitor the occurrence of clinically suspected viral encephalitis cases. Both public and private hospitals will report to the CHP such encephalitis cases without a known cause. All reported cases are investigated and have serum samples sent for JE studies. A total of 10 cases are currently under investigation. The number of viral encephalitis cases is within historical baseline range (160-260 HA hospital discharges per year).

23. The issue of whether or not JE vaccine should be added to the local childhood immunization program for Hong Kong has been deliberated by

the Advisory Committee on Immunization (ACI) in 2003. The ACI recommends against JE vaccination for the general population based on a risk assessment, which finds that the benefits of human JE vaccination in Hong Kong, which has a very low incidence of JE, are outweighed by potential serious side effects of the vaccine. It recommends the use of JE vaccine for those who stay one month or longer in JE endemic areas.

24. Currently, a mouse-brain-derived inactivated JE vaccine (“Biken”) is licensed in Hong Kong. Controlled studies have shown that the vaccine had vaccine efficacy of 80-91% when two doses were administered. Local vaccination reactions occur in about 20% of vaccinees, mild systemic illness in about 10%. Hypersensitivity reactions occur in 0.6% of vaccinees, which manifest as urticaria, angioedema, respiratory distress, and hypotension. Incidents of fatal anaphylaxis have been reported. Post-vaccination neurological complications such as encephalitis and peripheral neuropathy are reported in 1-2.3/million vaccinees<sup>9-12</sup>.

25. To better define the risk of JE infection in different population groups in Hong Kong, CHP is conducting a systematic serological survey that covers people from different ages, geographical districts, and certain occupations at supposedly higher risks of JE (e.g., pig farm or abattoir workers). The results will provide more scientific basis in defining target groups to vaccinate for the purpose of outbreak management, should this become necessary. Additional vaccine stockpiles are being sought in the meantime.

## **Discussion**

26. Members are welcome to note the contents of the paper and comment on the current prevention and control strategies.

Centre for Health Protection  
June 2004

## References

1. Vaughn D. Hoke C. The epidemiology of Japanese encephalitis: prospects for prevention. *Epidemiol Rev* 1992;14:197-221
2. Mandell, Douglas and Bennett. *Principles and Practice of Infectious Diseases*. Fifth edition. Churchill Livingstone, 2000
3. Monath T. Flaviruses. In Fields BN and Knipe Dm eds *Virology*. New York: Raven Press 1990: 763-814
4. LEE S. H. *Prevention and Control of Communicable Diseases in Hong Kong*. Department of Health
5. John Simon. Japanese Encephalitis: A Review. The Hong Kong Medical Association Circular No. 1137
6. World Health Organization. Japanese Encephalitis. *WER* 1994: 69:113-120
7. World Health Organization. State of the art of new vaccines: research & development: Japanese Encephalitis. Accessed on 26 June 2004 at [http://www.who.int/vaccine\\_research/documents/new\\_vaccines/en/index6.html](http://www.who.int/vaccine_research/documents/new_vaccines/en/index6.html)
8. Internal information paper: Japanese Encephalitis (2003). NTERO, Department of Health.
9. Centre of Disease Control, United States. Inactivated Japanese encephalitis vaccine. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 1993: 42 (RR-1): 1-15
10. World Health Organization. Japanese Encephalitis Vaccine. *WER* 1998:73:337-344
11. Thongcharoen P. Japanese encephalitis: an overview. *Southeast Asian J Trop Med Hyg.* 1989:20:559-73
12. Plesner A et al. Neurological complications to vaccination against Japanese encephalitis. *Eur J Neurol.* 1998:5(5):479-485
13. Igarashi A. Control of Japanese encephalitis in Japan: immunization of humans and animals, and vector control. *Curr Top Microbiol Immunol.* 2002; 267: 139-52

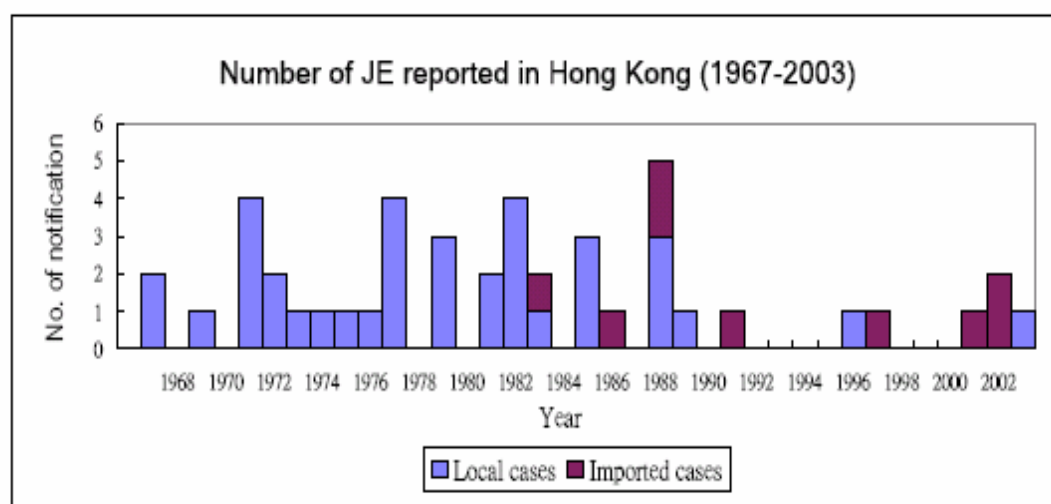
**Table 1: Results of a serosurvey among 5 different population groups conducted in 2003**

Population Group	Age Group		Total
	Below 40	40 or above	
Pig farmers	0/5 (0%)	8/29 (27.6%)	8/34 (23.5%)
Abattoir workers	0/4 (0%)	1/29 (3.4%)	2/34 (5.9%)*
Yuen Long local residents	1/70 (1.4%)	1/38 (2.6%)	2/108 (1.9%)
GOPC patients	1/36 (2.8%)	17/106 (16.0%)	18/142 (12.7%)
Blood donors	0/15 (0%)	0/15 (0%)	0/30 (0%)
Total	2/130 (1.5%)	27/217 (12.4%)	30/348 (8.6%)

Notes:

\* The age of one seropositive abattoir worker was unknown.

**Figure 1**



**Figure 2: Geographical distribution of pig farms, roost of migratory birds, breeding sites of *Culex tritaeniorhynchus* and the two local JE cases reported in 2004**

