



衛生防護中心  
Centre for Health Protection

## Scientific Committee on Vector-borne Diseases

### Update on epidemiology, prevention and control of Japanese encephalitis in Hong Kong

#### Purpose

This paper provides update on the latest epidemiology of Japanese Encephalitis (JE) and examines the prevention and control measures in Hong Kong.

#### Background<sup>1-4</sup>

2. Japanese encephalitis (JE) is a mosquito-borne disease caused by the JE virus. The JE virus transmission cycle involves *Culex* mosquitoes that lay eggs in fields with wet cultivation, pools, ditches and other large water bodies. Pigs and wading birds act as principal vertebrate amplifying hosts and reservoir hosts respectively. Humans get infected when bitten by an infected mosquito. Since humans seldom develop enough viremia to infect feeding mosquitoes, they are considered a dead-end host for viral transmission.

3. Most JE infections are asymptomatic or present as a mild non-specific febrile illness. Approximately 1 in 250 infections results in severe disease characterised by rapid onset of high fever, headache, neck stiffness, disorientation, coma, seizures, spastic paralysis and death. Approximately 30% of JE cases are fatal and 30-50% of survivors have significant neurologic sequelae.



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## **Epidemiology**

### Global situation

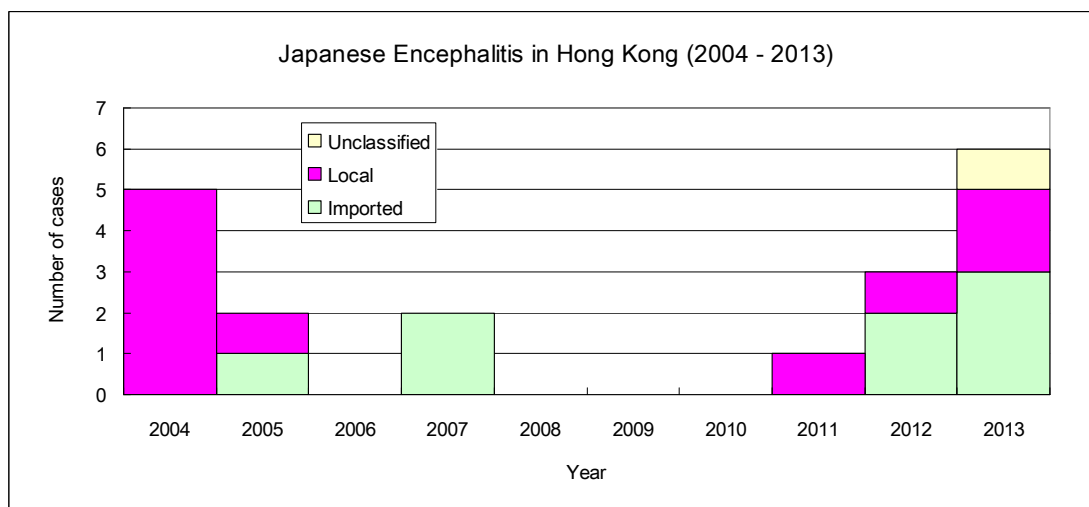
4. The global incidence of JE is uncertain due to difference in intensity and quality of JE surveillance and the availability of diagnostic laboratory testing throughout the world. According to the World Health Organization, it occurs from the islands of the Western Pacific in the east to the Pakistani border in the west, and from Korea in the north to Papua New Guinea in the south.<sup>5</sup> Cases were also documented in Cape York, Australia.<sup>6</sup> Transmission of JE virus is mainly related to the rainy season in Southeast Asia, but may take place all year-round, particularly in tropical climate zones. In the temperate regions of China, Japan, the Korean peninsula and eastern parts of the Russian Federation, transmission occurs mainly during summer and autumn.<sup>7</sup> According to the World Health Organization (WHO), 24 countries in Asia and the Western Pacific have areas where there is a risk of JE virus transmission including China and India which contain almost two thirds of the world's population of JE.<sup>2</sup>

5. Despite continued enzootic transmission of JE virus, introduction of vaccination programmes, increased urbanisation and evolving agricultural practices have resulted in a significant decrease in JE cases over the past decades.<sup>8</sup> It was estimated in a recent systematic review that approximately 67,900 JE cases typically occur annually worldwide, with around 75% of JE cases occurring in children aged 0 to 14 years.<sup>3</sup> The estimated annual mortality ranges from 10-15,000 deaths.<sup>1</sup>

### Local situation

6. In Hong Kong, JE has been made statutorily notifiable since 16 July 2004 and all medical professionals are required to report suspected or confirmed cases to the Centre for Health Protection (CHP), Department of Health (DH). From 2004 to 2013, 19 cases of JE (including 3 cases reported voluntarily before the disease became notifiable) were recorded. The annual number of cases ranged from zero to six and the annual incidence ranged from 0 to 0.1 per 100 000 population (Figure 1).

Figure 1. Annual number of cases of JE recorded by the CHP from 2004 to 2013.



7. Among the 19 cases, there were ten local cases, eight imported cases and one unclassified case. No epidemiological linkage was identified after epidemiological investigation and thus all these cases were classified as sporadic. Thirteen males and six females, with ages ranging from five to 59 years (median: 37 years) were affected. Among them, 14 patients (74%) enjoyed good past health. Two patients had hypertension and/or diabetes mellitus, one patient suffered from nasopharyngeal carcinoma, one patient had a history of psychiatric illness and gynaecological problem requiring operation, and one patient had a history of asthma and febrile convulsion.

8. All patients presented with fever and the majority of them (89%) had various forms of neurological symptoms including confusion (37%), impaired mental state/decreased consciousness (26%), unbalanced gait/limb weakness or involuntary movements (26%), convulsion (21%), slurred speech (11%) and double-vision (5%). Other symptoms including headache and vomiting were present in 37% of the patients respectively.

9. Eight patients (42%) recalled mosquito bite(s) during the incubation period. No patient recalled receiving JE vaccine in the past.

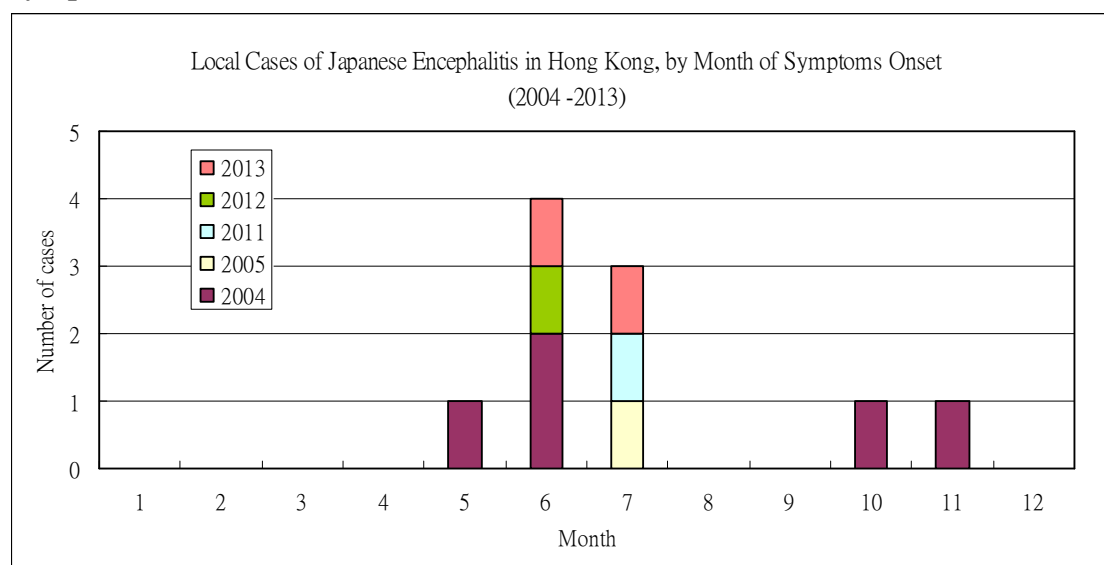
10. Laboratory diagnosis: serum from 15 patients (79%) demonstrated a four-fold or greater rise in antibody titres against JE virus between paired acute- and convalescent-phase serums. JE virus-specific IgM was detected in the cerebrospinal fluid (CSF) of eight patients (42%), while JE virus genomic sequence was detected in the CSF sample of one patient by polymerase chain reaction (PCR).

11. Fifteen patients (79%) required intensive care treatment. Four patients (21%), including two local cases in 2004 and two imported cases in 2012 died from JE. One patient with pre-existing medical comorbidities died due to medical problems other than JE. One of the patients notified in 2013 was a tourist and was escorted back to his country of residence. The remaining patients have all been discharged. Neurological sequelae were documented in six (46%) of the 13 discharged patients, including cognitive impairment, convulsion attacks, swallowing and motor problem, oral-facial dyskinesia, memory loss and bilateral vocal cord palsy.

#### *Local cases*

12. Local cases have been recorded in 2004 (5 cases), 2005 (1 case), 2011 (1 case), 2012 (1 case) and 2013 (2 cases). The majority of cases (80%) had symptoms onset in the summer months during the rainy season (Figure 2).

Figure 2. Distribution of local JE cases recorded by the CHP, by month of symptoms onset from 2004 to 2013.



13. No patient worked as pig farmer or in a pig farming-related / avian-related industry. The residential distribution of local cases is thus: seven (70%) out of the ten patients resided in Yuen Long District, while the three other patients lived in Kwai Tsing, Sham Shui Po and Southern District respectively. Seven patients (70%) resided in area where pig farm(s) were located within two kilometers from their residences. Details of the ten local cases are listed in Table 1 below:-

Table 1. Summary of local cases of JE from 2004 to 2013 (as at 15 April 2014)

Date of symptoms onset (MM/YYYY)	Sex	Age (Year)	Residential district	Nearby pig farm(s)	Outcome
05/2004	F	29	Kwai Tsing	No	Died
06/2004	M	45	Yuen Long	Yes	Discharged
06/2004	M	50	Sham Shui Po	No	Discharged
10/2004	M	5	Yuen Long	Yes	Discharged
11/2004	M	40	Southern	No	Died
07/2005	F	37	Yuen Long	Yes	Died*
07/2011	F	6	Yuen Long	Yes	Discharged
06/2012	F	20	Yuen Long	Yes	Discharged
06/2013	M	59	Yuen Long	Yes	Discharged
07/2013	M	52	Yuen Long	Yes	Discharged

\* This patient, with pre-existing medical comorbidities, passed away due to medical problem other than JE

14. Larvae and/or adult of the principal vector *Culex tritaeniorhynchus* were collected during the investigation of all 10 cases, but only a batch of adult mosquito collected during the investigation of a case notified in 2004 tested positive for JE virus by PCR. No further case was identified through active case finding and all the blood specimens collected from the contacts or neighborhoods of these local cases showed negative results. With prompt and effective implementation of control and preventive measures, these local cases were contained with no further spread.

### *Imported cases*

15. Eight imported cases were recorded in 2005 (1 case), 2007 (2 cases), 2012 (2 cases) and 2013 (3 cases) respectively. Among them, 6 cases were imported from China and 2 cases, both recorded in 2013, were imported from Thailand. All their travel collateral(s) and home contact(s) remained asymptomatic.

### *Unclassified case*

16. The place where a case, reported in November 2013, contracted the disease is classified as undetermined. The patient lived in Eastern District in Hong Kong. It is noted that there is no pig farm close to Eastern District. He had travelled to Tokyo for a few days within the incubation period where he mainly stayed in an apartment in Toshima-ku in Tokyo metropolis but paid a 1-day visit to the Tokyo Disneyland. The patient did not recall any mosquito bite, either in Hong Kong or Japan during the incubation period. Investigation revealed that a few adults of *Culex tritaeniorhynchus* and *Culex fuscocephala* were identified near his residence but mosquito samples tested negative for JE virus. The patient made a complete recovery with no neurological deficits.

## **Prevention and control of JE in Hong Kong**

### Surveillance and investigation of human cases

17. According to the WHO, surveillance of JE is critical in order to characterise the epidemiology and burden of the disease.<sup>9</sup> The CHP has established mechanisms in place for surveillance, prompt investigation and implementation of control actions against JE in Hong Kong. Whenever a case is notified, investigation is commenced immediately. A detailed case history including onset date, residential and workplace addresses, travel history and local movement is taken. If a local case is identified, field investigation is conducted. Active case finding, questionnaires distribution as well as blood tests are conducted, and a telephone hotline is set up. To increase the awareness of the general public, health advice and education is given through health talks, press releases, letter-to-doctors and dissemination of educational materials.

18. Close contacts and collaterals would be interviewed for any symptoms of JE and invited to have blood tests. Asymptomatic contacts would be put under medical surveillance, while symptomatic contacts would be referred to hospitals for further investigation and management. The Pest Control Advisory Section (PCAS) of the Food and Environmental Hygiene Department (FEHD) would be informed of the case and the areas visited by the patient to conduct vector survey. Vector control and preventive measures would be carried out promptly. The Agriculture, Fisheries and Conservation Department (AFCD) would also be informed for action. They will carry out inspection to pig farms within two kilometers of places reported by CHP and remind farmers on mosquito control.

#### Vector surveillance and control

19. The vectors responsible for the transmission of JE are mainly *Culex* mosquitoes including *Culex tritaeniorhynchus*, *Culex gelidus* and *Culex fuscocephala*. The major vector in Hong Kong is *Culex tritaeniorhynchus*. Infected mosquitoes transmit the virus to humans and animals whilst feeding and can also pass the infection to their progeny by transovarial transmission which potentially contributes to virus survival.<sup>8</sup>

20. In Hong Kong, FEHD is taking the lead on mosquito control. FEHD organises annual anti-mosquito campaigns on a territory-wide basis to heighten public awareness of the potential risk of mosquito-borne diseases, encourage community participation and promote concerted efforts of Government departments concerned in anti-mosquito work. Under the steer of the Anti-Mosquito Steering Committee, relevant Government departments also play important roles in mosquito control through anti-mosquito activities and by enlisting community support through their networks.

21. Control of mosquito vectors in areas where local cases are found is also one of the most effective risk reduction strategies. Currently, a survey on *Culex* would be carried out by the FEHD whenever there is a local JE case. They would visit the patients' residence and areas visited by the patients. Mosquito control work including fogging and larviciding would be carried out at areas where breeding and potential breeding places of mosquitoes are detected.

22. Vector surveillance provides information on the distribution, intensity, and abundance of circulating JE viruses. The information can be used to predict the risk of occurrence of local JE infection and serve as an alert for early intervention and risk communication. In Hong Kong, the latest territory-wide survey on local JE vectors was carried out by the FEHD from October 2004 to October 2005 to provide information on distribution of *Culex tritaeniorhynchus* in Hong Kong.<sup>10</sup> Among the 181 batches of mosquitoes caught, 5 batches were detected to have JE virus. All these positive batches were collected from Yuen Long.

23. FEHD stepped up surveillance efforts by launching a JE vector surveillance programme in 2013. After considering the local epidemiology and distribution of registered pig farms it was decided to monitor the vectors in Yuen Long District for JE virus from April to October each year. Vectors are collected and sent to the Public Health Laboratory Services Branch of DH for testing for JE virus. Appropriate mosquito control measures and risk communication would be carried out promptly in case of significant findings. No *Culex tritaeniorhynchus* was tested positive for JE virus in 2013.

#### Action targeted at pigs and pig farms

24. Currently, there are a total of 43 registered pig farms in Hong Kong. Majority of them are located in Yuen Long (34 farms) and North District (8 farms). Another pig farm is located in Sai Kung. In the event of a local case, AFCD would liaise with FEHD to step up mosquito control in pig farms near the patient's residence. AFCD would also increase the frequency of inspection on pig farms near the patient's residence to reduce the chance of mosquito breeding. All pig farms in Hong Kong would regularly be advised to carry out appropriate mosquito prevention and control measures.

25. The Scientific Committee on Vector-borne Diseases (SCVBD) has evaluated whether pig vaccination is a suitable control strategy to reduce JE in humans in Hong Kong back in 2005. The discussions took into account various aspects including local epidemiology, pig farming practices, published literature, as well as correspondence with and experience of overseas experts. The SCVBD came into conclusion that the overall benefit of pig vaccination as a control strategy remains to be demonstrated.<sup>11, 12</sup> Currently, there is no statutory requirements/guidelines on JE vaccination for pigs in Hong Kong for



the purpose of preventing JE in humans. According to AFCD, about 9% of pig farms are currently vaccinating their pigs against JE.

### JE vaccine

26. The Vero cell culture-derived inactivated vaccine based on the SA<sub>14-14-2</sub> strain (JE-VC) was registered in Hong Kong in October 2010. Another live attenuated vaccine, which could be used for individuals at 12 months of age and over, was registered in Hong Kong in April 2014. After reviewed the local epidemiology, overseas experience, efficacy and safety profile of available vaccines, the Scientific Committee on Vaccine Preventable Diseases and SCVBD, in 2011, recommended JE vaccination for travellers who planned to stay one month or longer in endemic areas during the JE transmission season, and for short-term (less than one month) travellers if they plan to have significant extensive outdoor or night-time exposure in rural areas during the transmission season.<sup>13</sup>

### Travel health

27. The Travel Health Centre of DH provides travel health advice to the public. Travellers visiting areas with high risk of JE infection should arrange a travel health consultation with their family doctor or DH's Travel Health Centre at least 6 weeks before departure to determine their need for vaccination. Information on private practitioners providing travel health services is also available at the website of the Primary Care Directory ([www.pcdirectory.gov.hk](http://www.pcdirectory.gov.hk)) for easy access by the public.

### Health education

28. Public health education forms an increasingly important component to raise awareness about individual and communal actions that may control vectors, their breeding sites, prevent disease transmission and provide access to treatment.<sup>14</sup> The DH, in collaboration with various Government bodies, provides information of JE and effective preventive measures against mosquito bites via a wide range of channels including Announcement of Public Interests (API) in radio and television, health talks, website information, pamphlets and posters.

29. The World Health Day, which is celebrated on 7 April every year to mark the anniversary of the founding of the WHO in 1948, selected vector-borne diseases as the topic for 2014. Each year, a theme is selected that highlights a priority area of public health.<sup>15</sup> To echo the theme of the World Health Day 2014, DH prepared a series of community-wide publicity campaign to raise public awareness about the threat posed by vector-borne diseases and to stimulate families and communities to take actions on preventing vector-borne diseases and vector proliferation.

## **Conclusions and recommendations**

30. Both local and imported JE cases were recorded in Hong Kong in the past decade. Although the situation had been well controlled locally by prompt and intensive investigation with effective implementation of control measures, JE remains a potential threat to the public health of Hong Kong.

31. Clinicians should maintain a high index of suspicion for JE and notify to CHP immediately any suspected case of JE so as to facilitate swift investigation and implementation of necessary public health measures. Travellers visiting endemic areas should be reminded to take all necessary preventive measures to avoid mosquito bites during their stay. While concerted effort in health education and promotion against JE is to be maintained, constant review and evaluation on the effectiveness of these health promotional activities is encouraged in order to provide feedback and recommendations for further improvements.

32. The current JE vector surveillance programme should be continued and it is recommended that the locations selected for vector surveillance, as well as the surveillance plan, to be reviewed periodically to meet the latest need. The Government and the pest control industry are also recommended to keep abreast of the latest technological development and innovations on effective mosquito control since it is particularly important in the case of pesticides resistance developed among the vector mosquitoes.

33. The Government departments are recommended to strengthen actions in encouraging community participation and enabling the public with knowledge and skills in preventing breeding of mosquitoes in order to combat the disease in Hong Kong.

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