



**衛生防護中心**  
Centre for Health Protection

**Scientific Committee on Enteric Infections and Foodborne Diseases**

**Updated Situation of Hand, Foot, and Mouth Disease (HFMD) and Enterovirus Infection 2010**

**Purpose**

This paper aims at providing an updated situation of HFMD and enterovirus infections in 2010, as well as the public health actions implemented in Hong Kong.

**Local situation**

Overall activity of HFMD

2. In 2010, Hong Kong experienced a high season of HFMD and enterovirus infections. HFMD activity started to rise in mid-March and peaked in June. The activity gradually declined in July as some schools had started the summer holiday. As of August 31 this year, a total of 608 HFMD/herpangina outbreaks occurring in institutions were reported to the Centre for Health Protection (CHP). This number was more than double of the highest yearly figures of 237 outbreaks reported from 2001 to 2009 (Figure 1). These outbreaks involved 426 kindergartens/child care centres (70%), 127 primary schools (21%), 43 secondary schools (7%) and 12 other institutions (2%), with a total of 3919 persons affected so far. Majority (61%) of the outbreaks were of small size (affecting 5 persons or fewer), with the number of persons affected ranging from 2 to 53 (median: 4). As of August 31, 110 (18%) of these outbreaks had laboratory confirmation. Among them, most (75%) were associated with coxsackie viruses A while 10% were associated with enterovirus 71 (EV71).

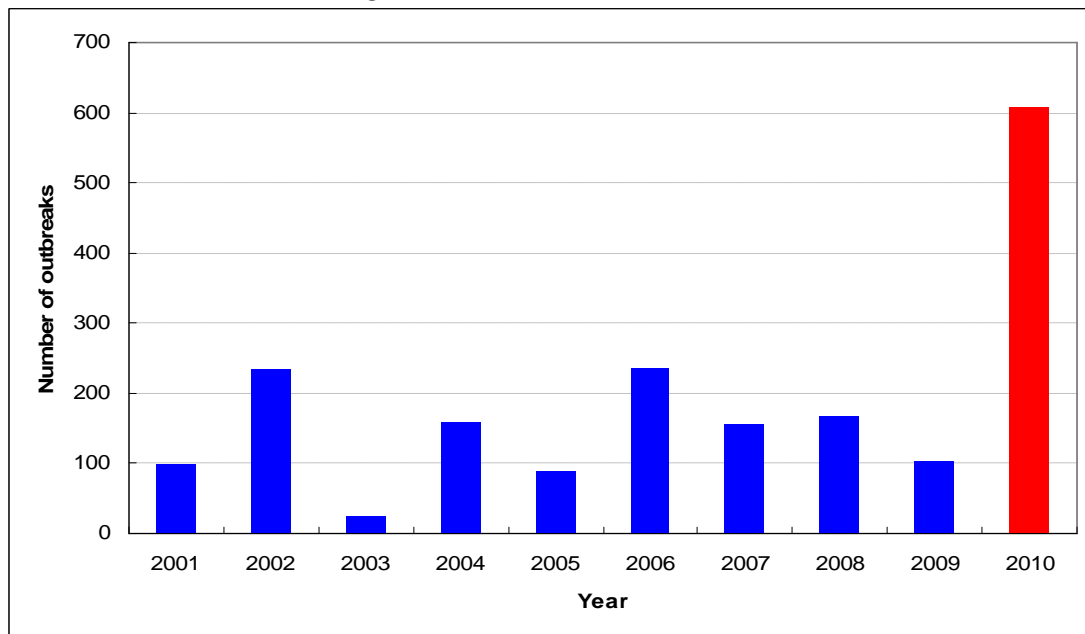


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Figure 1. Number of HFMD and herpangina institutional outbreaks reported to CHP, 2001-2010 (as of August 31, 2010)



3. Similar findings were detected from the sentinel surveillance systems based at general practitioners, general out-patient clinics, and child care centres/kindergartens (Figure 2 and 3). For instance, the HFMD consultation rate of the sentinel general practitioners had reached 7.0 per 1000 consultations in June this year, doubled the rate reported in the peak season of 2008.

Figure 2. Sentinel surveillance of HFMD consultation rate of general practitioners 2007-2010 (as of August 28, 2010)

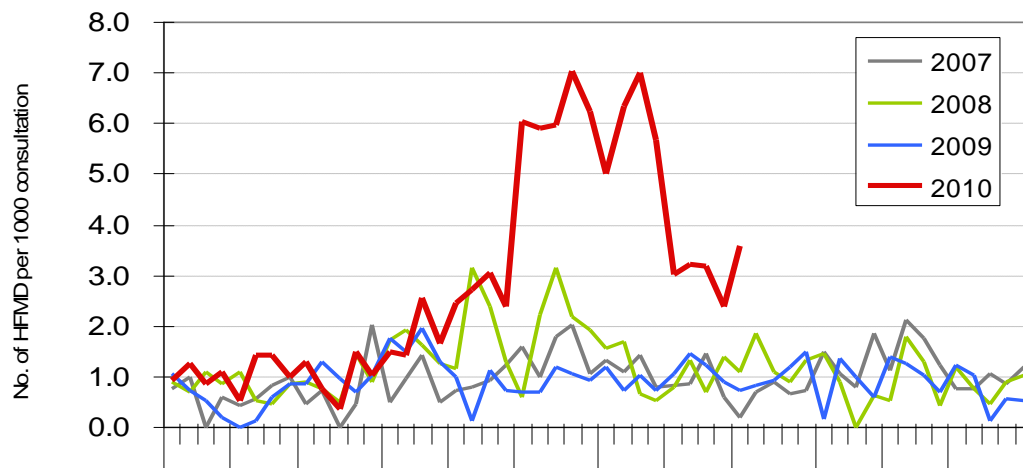
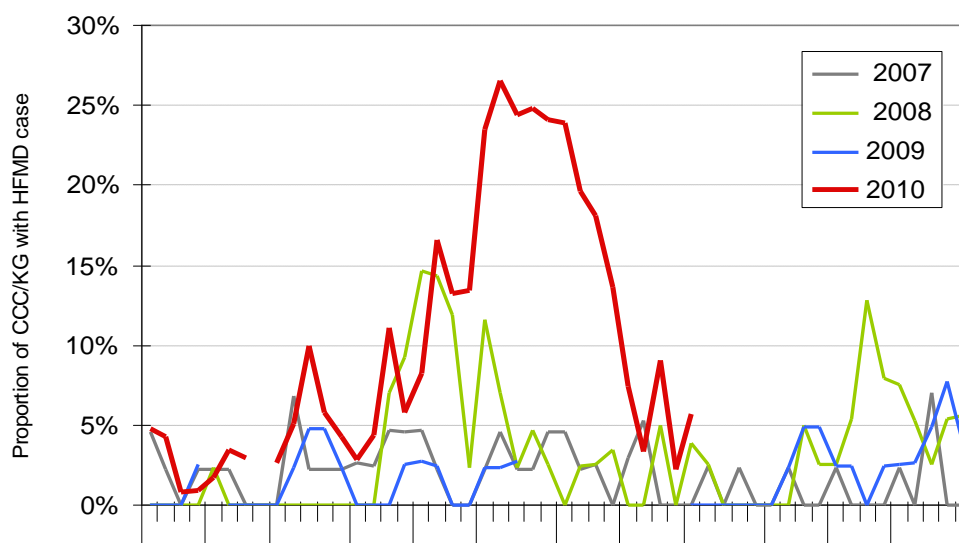


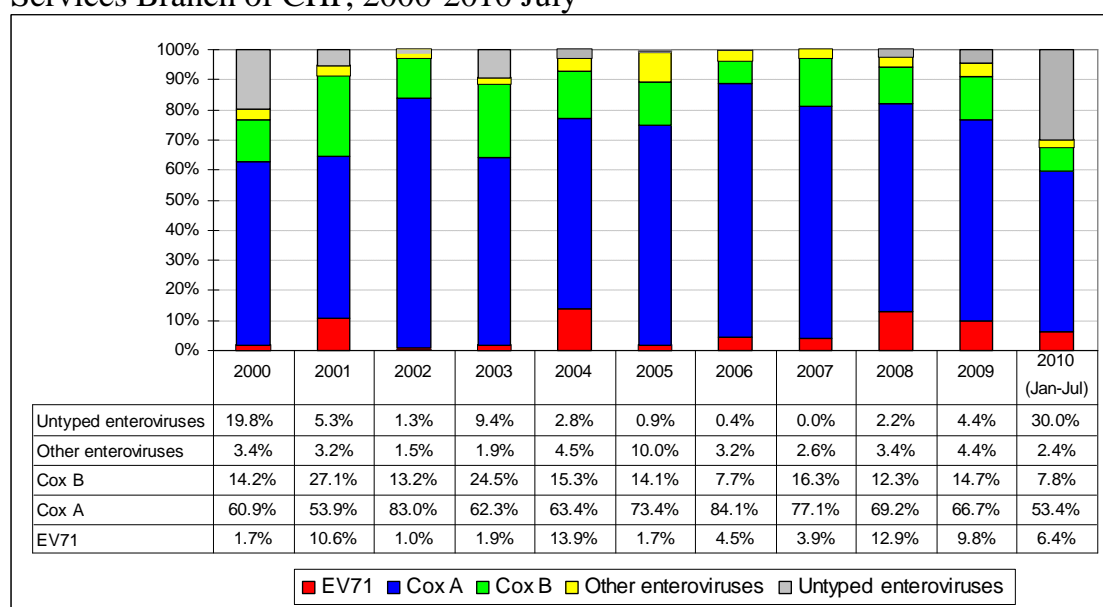
Figure 3. Sentinel surveillance of HFMD activity at child care centre and kindergartens 2007-2010 (as of August 28, 2010)



Laboratory surveillance and molecular analysis

4. The Public Health Laboratory Services Branch (PHLSB) of CHP has been monitoring the serotype and genetic sequence of enterovirus isolates. Laboratory surveillance data suggested that coxsackie A viruses were the predominant circulating enteroviruses this year, similar to the circulating patterns of the past decade. In 2010 (up to 31 July), coxsackie A viruses accounted for 53.4% of the enteroviruses detected while EV71 accounted for 6.4% (Figure 4).

Figure 4. Laboratory surveillance conducted by Public Health Laboratory Services Branch of CHP, 2000-2010 July



5. Analysis of structural gene sequences of Coxsackievirus A16 and EV71 detected this year showed they were similar to those in the Mainland in the last few years. For EV71, the current genotype is C4a which has been circulating in Hong Kong since 2004.

#### Enterovirus 71 infection and severe infection due to other enteroviruses

6. So far (as of August 31) this year, 93 cases of EV71 infection were recorded. Majority (72%) of them were aged 5 or below (median 3 years, range from 12 days to 43 years), with a male-to-female ratio of 1.1:1. Most (91%) patients had typical symptoms of HFMD or herpangina while the remaining cases presented with non-specific symptoms only such as fever, poor appetite, upper respiratory tract symptoms or vomiting. Sixty-six cases (71%) required admission for hospital care and 17 (18%) of them developed severe complications including meningitis, encephalitis, brainstem encephalitis, meningoencephalitis and acute flaccid paralysis. There was no fatal EV71 case so far this year.

7. Besides these 17 cases of severe EV71 infection, CHP also recorded twenty-four cases who developed severe complications due to other enteroviruses from April 22 to August 31, 2010. Only 27% of these 41 severe infections occurred in patients aged  $\geq$  15 years. Among these 41 cases, EV71 was still the most common enterovirus (41%) associated. Other enteroviruses identified among these severe cases included coxsackie A4, A6, A16, B4, B5, echovirus 9 and 30. Similar to EV71, these enteroviruses caused neurological complications such as meningitis, encephalitis, cerebellitis while one patient developed myocarditis (Table 1). In contrast to EV71 which commonly caused symptoms of HFMD/herpangina, a notable proportion (54%) of patients diagnosed with severe infection due to other enteroviruses did not have preceding symptoms of HFMD/herpangina.

Table 1. Characteristics of patients with severe complications due to enteroviruses reported to CHP from April 22 to August 31, 2010.

	EV71	Other viruses (including coxsackie viruses A4,A6,A16,B4,B5, echovirus 9 and 30)
No. of cases	17	24
No. of cases aged $\geq$ 15 years (%)	5 (29%)	6 (25%)
No. of cases with symptoms of HFMD/herpangina (%)	14 (82%)	11 (46%)
No. of cases with complications	Meningitis (12) Meningoencephalitis (2) Encephalitis (1) Brainstem encephalitis (1) Acute flaccid paralysis (1)	Meningitis (13) Encephalitis (7) Cerebellitis (1) Acute cerebellar ataxia (1) Status epilepticus (1) Myocarditis (1)
No. of fatal case	0	1

## Regional Situation

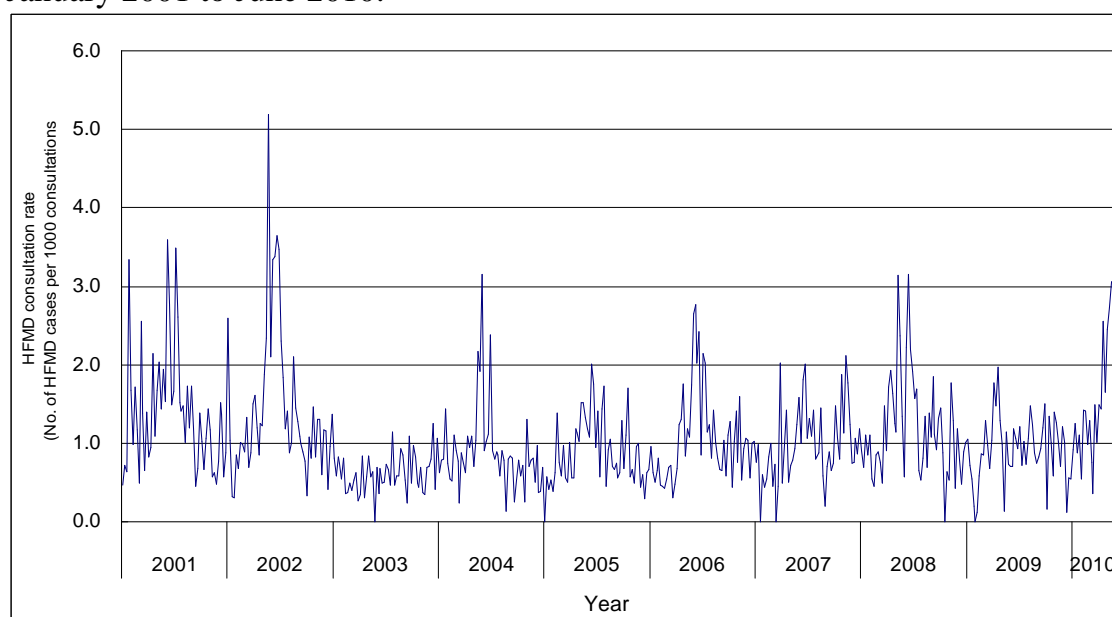
8. Higher activities of HFMD were also reported in neighbouring areas around Hong Kong. According to the Ministry of Health (MOH) of China, there were 1,346,504 cases of HFMD (with 736 fatal cases) reported in the first seven months of this year. The number of HFMD reported in May and June were about double that reported in the corresponding period last year. In Guangdong Province, 159,318 HFMD cases were reported to the Health Department from January to July this year, much higher than the number (55,008 cases) recorded in the corresponding period in 2009.

9. Similarly, Singapore reported higher number (20,249) of HFMD cases in the first 33 weeks this year, as compared with 11,067 cases reported in the corresponding period in 2009. The Singaporean Ministry of Health's sentinel surveillance has detected an increase in the circulation of EV71 among HFMD patients, with 12% of the patient samples tested positive for EV71 in July 2010. In Taiwan, surveillance findings from Accidental and Emerging Department also detected a higher consultation rate than last year. Taiwan Centers for Disease Control received reports of 15 severe infections associated with enteroviruses as of August 31 this year, in which 12 cases were EV71 infection and 3 were caused by coxsackie viruses. According to their laboratory surveillance, coxsackie A viruses were the most commonly (84.4%) detected enteroviruses while EV71 accounted for 2.4%.

## Situation Analysis

10. Hong Kong was experiencing a high season of HFMD and enterovirus infections in 2010. The high activities were results of multiple reasons. Enteroviruses were known to cause cyclical high activity every 2 to 4 years in various countries such as Malaysia and Japan (1-2). In Hong Kong, higher HFMD activities were detected in a 2-year cycle in 2002, 2004, 2006 and 2008 by sentinel surveillance statistics (Figure 4). The last regional epidemic occurred in 2008 when high activities of HFMD were reported in many Southeast Asia areas including Mainland China, Taiwan, Singapore and Hong Kong (3-7). It has been suggested that the quiescence between epidemics is probably due to the development of population immunity that occurs during the high-infection-rate epidemic (8). During the years of the quiescence of the virus, the accumulation of a susceptible population, especially in younger cohorts, probably contribute to the next epidemic (9,10).

Figure 4. HFMD consultation rates detected by sentinel general practitioners, January 2001 to June 2010.



11. The control measures implemented during the pandemic influenza H1N1 in 2009 might reduce the HFMD transmission and increase the susceptible population this year. During the pandemic phase, territory-wide public health measures, e.g. hand washing, wearing masks and school closure, have been implemented throughout Hong Kong. These enhanced personal and environmental hygiene measures might reduce enterovirus infections which could also be transmitted through throat and nose discharge. This was supported by the absence of traditional summer peak as observed in various surveillance systems (Figure 2 and 3). This increased the proportion of population subgroup which did not have antibodies to enteroviruses, rendering the community to become more susceptible to the epidemic.

12. In addition, evidence had showed that various meteorological factors including temperature, vapour pressure and duration of sunshine were associated with cases of HFMD and herpangina (11). According to the Hong Kong Observatory, higher relative humidity was reported this year compared with average of the past 5 years in Hong Kong. Further studies examining the relationship between climate factors and HFMD are encouraged. Lastly, increased awareness of public and health care professionals might in turn increase the number of clinical consultation, laboratory diagnosis and notification, especially after the report of the fatal case due to coxsackie A16 in April.

13. Enteroviruses of multiple types were circulating in the community this year, but the predominant ones were still coxsackie A viruses while EV71 only accounted for a small portion of the enteroviruses (Figure 4). In fact, laboratory surveillance by PHLSB has demonstrated a 3-4 year cycle of EV71 and the proportion of EV71 dropped in the past two years after its last peak occurred in 2008.

14. It has been reported from the literature that various enteroviruses may also cause severe complications (12-14). For instance, coxsackie A16 has been associated with rhombencephalitis and pneumonitis (12-13). In a case series of enterovirus meningitis, coxsackie A9, B5, echovirus 5,9,11 and 14 were identified (14). Nevertheless, EV71 was still the commonest enterovirus associated with neurological complications, accounting for 40% in the severe case series detected this year. In the epidemic of HFMD in Taiwan occurring in 1998, EV71 accounted for majority (78 cases) out of 96 severe infections while others such as coxsackie A16, B5, echovirus 6 and 7 were identified in a small portion (15).

15. Regarding the adult infections, only 27% of the 41 severe infections occurred in patients aged  $\geq 15$  years. This proportion was lower than the average of 55% shown from discharge records of Hospital Authority between 2004-2009 among patients aged  $\geq 15$  years who had neurological complications associated with enterovirus. The 35 severe infections covered different clinical presentations and were attributable to a variety of enteroviruses instead of a single serotype (Table 1). Adult enterovirus infections with severe complications have been reported from literature (12,14). Current data suggested that the higher number of adult cases with serious complications observed this year was due to greater incidence of enterovirus infection, and not genetic mutation of enteroviruses.



## **Public Health Measures implemented**

16. To combat with the epidemic this year, CHP had initiated a series of public health actions to prevent and control the enterovirus infections. Besides, it was noted that concerted effort from health care professionals and all sectors of the community should be solicited. An inter-departmental working group meeting was held in May to review the latest situation and discuss the preventive and control measures required.

### Capacity building for child care institutions

17. Early alert was issued by CHP through letters to child care institutions and schools since March this year to reinforce preventive and control measures, reiterate the reporting criteria of HFMD outbreak, and inform the scenarios for school closure. In collaboration with Education Bureau and Social Welfare Department in April 2010, CHP organized refresher seminars to operators of child institutions with about 300 attendances. The seminars reinforced the management of HFMD outbreak and infection control practices.

### Infection control for hospitals and enhanced surveillance of severe cases

18. The factsheet on infection control of enteroviral infection for hospitals was updated by Hospital Authority. Infection control forum was organized in June. Over 130 health care professional participated the forum including infection control nurses/officers from public and private hospitals, doctors of related specialties including Infectious Disease, Microbiology, Accident and Emergency Department, Pathology, Paediatrics, Internal Medicine, Community Medicine and Family Medicine. This provided a good platform to discuss the clinical features, potential complications and management options of enteroviral infection, as well as appropriate infection control measures in healthcare settings.

19. Apart from EV71, enhanced surveillance has been made to track the trends of severe infections due to other enteroviruses. On July 22, “Severe paediatric enterovirus infection (other than EV71 and poliovirus)” was added as one of the “Other communicable diseases of topical public health concern”. Doctors are requested to report paediatric patients who have severe complication(s) with laboratory confirmation of enterovirus infection to CHP for prompt epidemiological investigation and control. Detailed reporting criteria are available at <http://www.chp.gov.hk/ceno>.



## Control HFMD outbreaks and class suspension

20. Upon receiving notifications from schools or institutions, CHP would conduct epidemiology investigation and field visit where appropriate. Health advice would be given to encourage staff to screen for sick children before they enter the school, advise children with HFMD to take sick leave until fever has subsided and all the vesicles have dried and crusted, supervise children on personal hygiene practices, especially on hand washing with soap, disinfection of environment /toys with diluted bleach, avoid mixing of activities between different classes. Medical surveillance would be conducted for 14 days.

21. Most of the HFMD outbreaks were contained after implementation of prompt infection control and disinfection measures. If situation warranted, class suspension would be advised when there was (i) occurrence of HFMD with serious complications in a school experiencing HFMD outbreak, or (ii) occurrence of further cases in a school with EV71 outbreak despite stepping up control measures. Under these criteria, eight kindergartens/child care centres and one primary school required class suspension this year. Territory wide suspension was considered not necessary after careful consideration of the whole situation.

## Enhanced risk communication

22. Currently, there is no effective vaccine or chemoprophylaxis available, prevention of infection is one of the key components in the overall public health strategies. Since April 2010, messages on prevention measures against HFMD were disseminated through health education materials distributed to child care institutions, schools, clinics, playrooms; a 24 hours hotline; announcement of public interest at television, radio and public venues. To further enhance risk communication, the weekly online publication “EV SCAN” was revised as a “Daily report of HFMD and EV71 infection” during the peak of the epidemic, i.e. from May 31 to July 30. Other means to increase public awareness of HFMD included issuing press releases for large scale outbreaks or severe infections associated with enterovirus. A designate mini-website has been made under CHP homepage since May for easy access of information such as factsheet, guidelines, latest figures, health promotion materials, press release, etc.

## Summary

23. The high activity of HFMD this year was probably reflecting the cyclical pattern of enteroviruses. There was so far no evidence suggesting change in genetic composition of the enteroviruses this year associated with change in susceptible population or higher virulence of the disease. Similar to epidemiological trends in the past years, coxsackie A viruses were the predominant circulating strains while EV71 accounted for a higher risk of complications compared to other enteroviruses.

24. After the peak activity of HFMD detected in June, there were signs of gradual decline since July as some schools have started their summer holiday. Nevertheless, there is no room to be complacent as we may encounter another rise in activity when schools re-open in September. Moreover, a small winter peak is also anticipated from October to December.

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## References

1. Podin Y, Gias EL, Ong F, Leong YW, Yee SF, Yusof MA, et al. Sentinel surveillance for human enterovirus 71 in Sarawak, Malaysia: lessons from the first 7 years. *BMC Public Health*. 2006 Jul 7;6:180.
2. Hosoya M, Kawasaki Y, Sato M, Honzumi K, Kato A, Hiroshima T, et al. Genetic diversity of enterovirus 71 associated with hand, foot and mouth disease epidemics in Japan from 1983 to 2003. *Pediatr Infect Dis J*. 2006 Aug;25(8):691-694.
3. The Chinese Center for Disease and Control and Prevention, and Office of the World Health Organization in China. Report on the hand, foot and mouth disease outbreak in Fuyang City, Anhui Province and the prevention and control in China. May 2008 [Cited 2009 May 7]. Available from <http://www.wpro.who.int/NR/rdonlyres/591D6A7B-FB15-4E94-A1E9-1D3381847D60/0/HFMDCCDC20080515ENG.pdf>
4. Ding NZ, Wang XM, Sun SW, Song Q, Li SN, He CQ. Appearance of mosaic enterovirus 71 in the 2008 outbreak of China. *Virus Res*. 2009 Oct;145(1):157-161. Epub 2009 Jun 18.
5. Huang SW, Hsu YW, Smith DJ, Kiang D, Tsai HP, Lin KH, Wang SM, Liu CC, Su IJ, Wang JR. Reemergence of enterovirus 71 in 2008 in taiwan: dynamics of genetic and antigenic evolution from 1998 to 2008. *J Clin Microbiol*. 2009 Nov;47(11):3653-3662. Epub 2009 Sep 23.
6. Ministry of Health, Singapore. EV71-associated epidemic hand, foot and mouth disease in Singapore. *Epidemiological News Bulletin* 2008 Oct to Dec; 34(4):63-66.
7. Edmond Ma, KC Chan, Peter Cheng, Christine Wong, SK Chuang. Epidemic of enterovirus 71 in 2008 - its public health implication to Hong Kong. *Int J Infect Dis*. 2010 Jul 2. [Epub ahead of print] [DOI: 10.1016/j.ijid.2010.02.2265]
8. Hosoya M, Kawasaki Y, Sato M, Honzumi K, Kato A, Hiroshima T, et al. Genetic diversity of enterovirus 71 associated with hand, foot and mouth disease epidemics in Japan from 1983 to 2003. *Pediatr Infect Dis J*. 2006 Aug;25(8):691-694.
9. Chen KT, Chang HL, Wang ST, Cheng YT, Yang JY. Epidemiologic features of hand-foot-mouth disease and herpangina caused by enterovirus 71 in Taiwan, 1998-2005. *Pediatrics*. 2007 Aug;120(2):e244-252.
10. Khetsuriani N, Lamonte-Fowlkes A, Oberst S, Pallansch MA; Centers for Disease Control and Prevention. Enterovirus surveillance--United States, 1970-2005 *MMWR Surveill Summ*. 2006 Sep 15;55(8):1-20.
11. Urashima M, Shindo N, Okabe N. Seasonal models of herpangina and hand-foot-mouth disease to simulate annual fluctuations in urban warming in Tokyo. *Jpn J Infect Dis*. 2003 Apr;56(2):48-53.
12. Dumaidi K, Frantzidou F, Papa A, Diza E, Antoniadis A. Enterovirus meningitis in Greece from 2003-2005: diagnosis, CSF laboratory findings, and clinical manifestations. *J Clin Lab Anal*. 2006;20(5):177-83.
13. Goto K, Sanefuji M, Kusuhara K, Nishimura Y, Shimizu H, Kira R, Torisu H, Hara T. Rhombencephalitis and coxsackievirus A16. *Emerg Infect Dis*. 2009 Oct;15(10):1689-91.
14. Legay F, L ev eque N, Gacouin A, Tattevin P, Bouet J, Thomas R, Chomelt JJ. Fatal coxsackievirus A-16 pneumonitis in adult. *Emerg Infect Dis*. 2007 Jul;13(7):1084-6.

15. Ho M, Chen ER, Hsu KH, Twu SJ, Chen KT, Tsai SF, Wang JR, Shih SR. An epidemic of enterovirus 71 infection in Taiwan. Taiwan Enterovirus Epidemic Working Group. N Engl J Med. 1999 Sep 23;341(13):929-35.