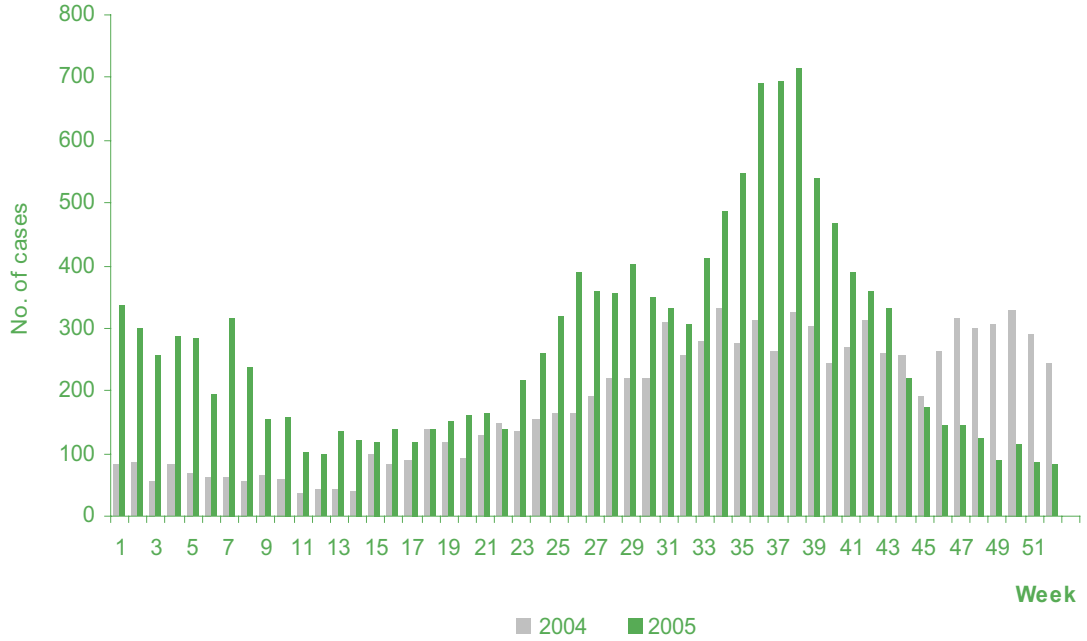
SPECIAL FEATURE

DENGUE CONTROL IN SINGAPORE, 2005

Dengue is endemic in Singapore, with year-round transmission observed. In 2005, a total of 14,209 laboratory confirmed cases of DF/DHF [comprising 13,816 cases of dengue fever (DF) and 393 cases of dengue haemorrhagic fever (DHF)] were reported, a 50.2% increase from the previous year. Majority of cases were indigenous, with a small proportion of imported cases and foreigners from overseas who sought medical treatment in Singapore. There were 27 reported dengue deaths (25 indigenous cases, one imported case and one foreigner from overseas who sought medical treatment in Singapore).

The year began with high incidence which had continued from 2004 before a decline was observed in late February 2005. This was a stark contrast to the transmission dynamics of dengue seen in previous years, where relatively lower numbers of cases were reported in the beginning of the year followed by peak incidence in the hottest months from June to August. Although the incidence remained relatively low in March and April, the number of cases in these months was as high as the seasonal peaks of 2002 and 2003. The incidence began to increase steadily in May, followed by a sharp, unprecedented surge in September with an average of 660 cases per week. The incidence then declined sharply and continued to decrease for remainder of the year (Figure.1).

Figure 1
E-weekly distribution of DF/DHF cases in Singapore, 2004 – 2005



Geographically, cases were concentrated in the eastern parts of Singapore (Figure. 2). However, dengue has also established itself in previously-classified low-endemicity areas in the western parts of Singapore since 2004.

The highest incidence rate was observed in the 15 – 24 years age group whereas the lowest was in those under 5 years. Overall, adults aged 15 – 44 years represented 65% of all cases. Residents in Housing & Development Board (HDB) flats constituted the majority of all cases, though the incidence rate was higher in compound house residents. In previous years, the HDB residents represented 46 – 65% of annual reported dengue cases. This proportion had increased to 75% in 2004 and 2005.

All four dengue serotypes were detected. DEN-1 remained as the predominant circulating serotype, although an increase in DEN-3 was also observed. The predominant circulating serotype had shifted from DEN-2 in 2001-2003 to DEN-1 in 2004-2005.

Figure 2
Geographical distribution of dengue cases in Singapore, 2005

Aedes Surveillance and Control

Aedes surveillance and control in Singapore consists of three key elements – active surveillance (in areas prone to dengue and/or high density of mosquitoes), public education/community involvement, and enforcement. The top five breeding habitats for *Aedes aegypti* were domestic containers, ornamental containers, discarded receptacles, flower pot plates, and roof gutters. The distribution of dengue cases was more closely associated with *Aedes aegypti* than *Aedes albopictus* (Figure. 3).

Figure 3
Geographical distribution of *Aedes albopictus*, *Aedes aegypti* and dengue cases, 2005

(Source: National Environment Agency)

Outbreak Control

During the outbreak in 2005, NEA and MOH, in collaboration with other partner agencies, stepped up the human and vector surveillance activities. The efforts in searching and destroying *Aedes* breeding places were also stepped up to reduce the *Aedes* mosquito population. In 2005, over 934,103 premises were inspected (an increase of 50% compared to 2004) and more than 52,129 surveys on non-residential premises and public and private areas were carried out (an increase of 60%).

In September, a new intervention called 'carpet combing exercise' was initiated which included extensive search and destroy activities aimed at eliminating mosquito breeding sites in all residential housing estates. In this exercise, local communities were mobilised through respective town councils as well as other government agencies. A total of six phases of carpet combing operations in all 84 constituencies were carried out.

In an exercise spanning over six weekends, 10,000 HDB blocks and their surroundings, as well as private estates were covered. Over 1,000 mosquito breeding habitats were found and destroyed, and another 8,400 potential breeding sites were removed. Permanent solutions to eliminate potential sources of stagnant water, such as repairs of infrastructure, sealing cracks, backfilling land and removal of roof-gutters were carried out. Volunteers from grassroots organisations distributed '10-minute Mozzie Wipe Out' pamphlets to encourage residents to carry out 10-minute mosquito prevention efforts in their homes. These concerted efforts contributed to the reduction of the mosquito population which in turn led to a drop in dengue cases in the subsequent months.

An inter-agency dengue task force was formed to enhance the communication and coordination of dengue control efforts among various government agencies and private organisations. The formation of the task force led to enhanced communication and coordination on dengue control efforts among these agencies and organisations.

In September 2005, an Expert Panel comprising local and international experts was formed to undertake an independent review of the present dengue situation and to advise the government of Singapore on additional prevention and control measures. The panel observed that Singapore's dengue control programme is regarded as one of the best in the world. However, because dengue is a re-emerging disease globally and is endemic in the region, the introduction of dengue viruses to Singapore can be expected on a regular basis. The 2005 epidemic coincided with a surge of dengue cases in the region. The causes of this epidemic may include the importation of new strains of dengue virus with greater epidemic potential into a densely populated Singapore population. Prior success of Singapore's dengue control programme has also resulted in a highly susceptible human population.

The expert panel recommended that dengue control should be driven by entomological, epidemiological, operational and formative research. New and innovative entomological surveillance methods should be explored to monitor the *Aedes aegypti* population and to assess the impact of control activities. Efforts to reduce mosquito population during inter-epidemic years may also be effective in preventing epidemic transmission.

Effective dengue control in the long-term would require community ownership. Efforts should be continued to engage private sectors and the community-at-large to enhance dengue control, including social mobilisation and mosquito control.

SURVEILLANCE OF ACUTE VIRAL CONJUNCTIVITIS

Viral Conjunctivitis

Acute viral conjunctivitis is characterised by inflammation of the conjunctiva of the eye. The commonest complaint is a sudden onset of red, itchy eyes. There may also be fever, headache, runny nose, sore throat, cough and muscle aches. The disease is usually mild but it is highly infectious. It spreads easily from person to person, especially among those living in the same household and in crowded places.

Acute haemorrhagic conjunctivitis is commonly caused by enterovirus 70 and coxsackievirus A24, both of which have been known to cause large outbreaks. It is spread by direct or indirect contact with discharges from the conjunctivae or upper respiratory tracts of infected persons. The incubation period ranges from 12 hours to three days. Cases remain infectious for at least four days after onset of symptoms.

Conjunctivitis Surveillance

In Singapore, surveillance of acute viral conjunctivitis is carried out by monitoring the weekly polyclinic attendances for this medical condition (Figure 4). In 2004, a total of 31,261 conjunctivitis attendances were seen at the polyclinics with a weekly average of 601 attendances (range 328 to 719). In 2005, a similar trend was observed during the first seven months with a reported weekly average of 609 attendances (range 399 to 775).

A sharp increase in acute conjunctivitis attendances at the polyclinics was noted in the beginning of August 2005 (Figure 4). The number of weekly attendances rapidly exceeded the warning level (mean+ 1 SD, 844) and epidemic threshold level (mean+2 SD, 1159) and reached a peak of 2,171 within four weeks. During the period August to October 2005, the average weekly attendances were 1,525.

Based on NHG Polyclinic's data, the majority (59.7%) of the patients was below 25 years of age and those between 10 years and 19 years accounted for 33% of the total weekly attendances reported during the week from 22 to 27 August 2005 (Figure 5).

Outbreak Investigation

To identify the aetiological agent for the nationwide outbreak, eye swabs were collected from patients presenting with conjunctivitis at polyclinics and nursing homes and submitted to the Virus Laboratory, Dept of Pathology, Singapore General Hospital for viral isolation. Coxsackievirus A24 was isolated from 15 samples tested.

Figure 4
Conjunctivitis polyclinic attendances

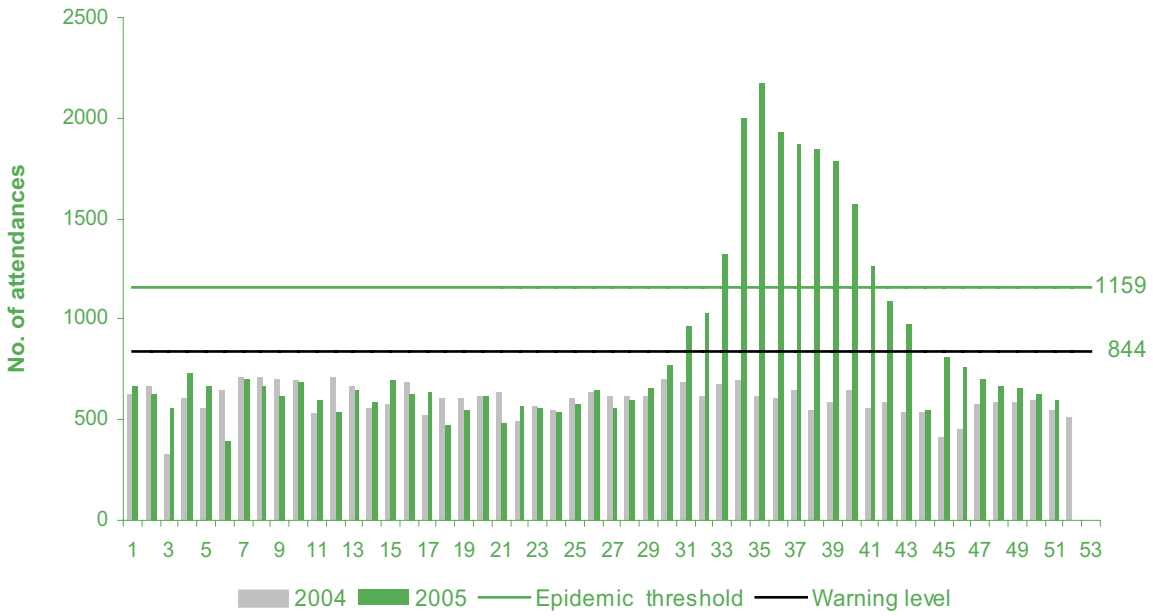
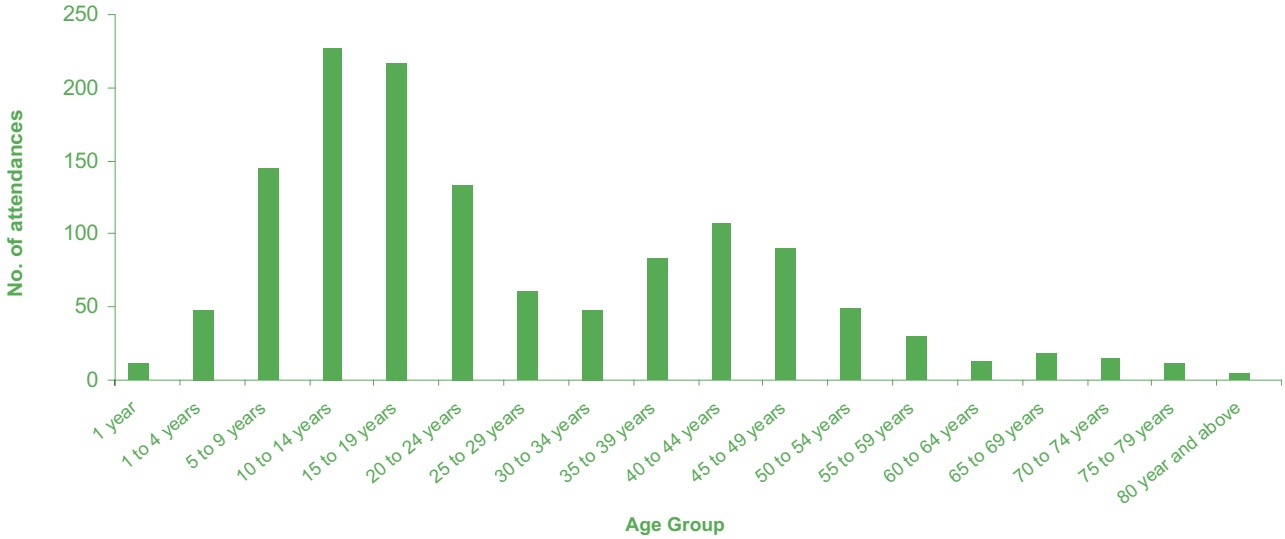


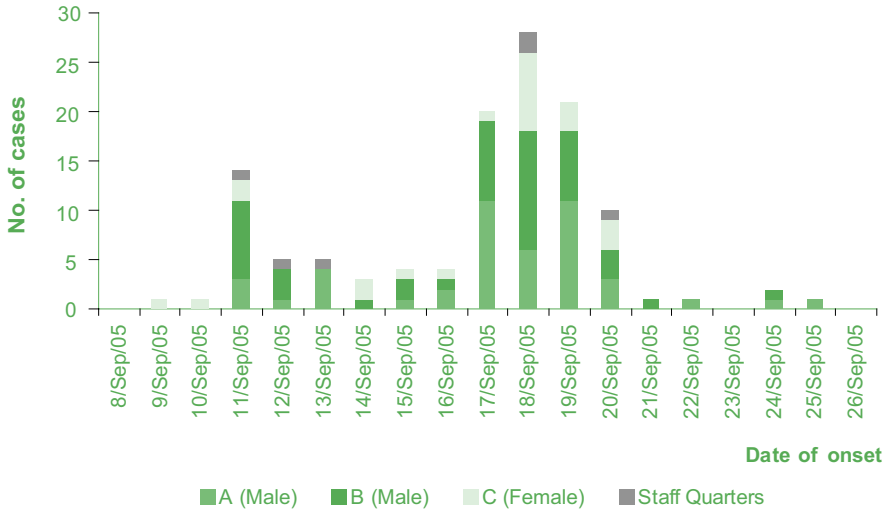
Figure 5
Conjunctivitis by age group – NHG Polyclinics (22nd – 27th August 2005)



Epidemiological investigations were also conducted in several institutional outbreaks. One institution investigated was a nursing home with 30 staff and 178 residents licensed by the Ministry of Community Development, Youth and Sports. It was housed in a 3-storey building with seven dormitories in each level and there were 4 - 15 residents in each dormitory.

A total of 115 residents and six staff came down with acute conjunctivitis between the period 13 and 28 September 2005, giving an overall attack rate of 58.2%. The ages of the affected persons ranged from 25 to 94 years. The index case was a 79 year-old female inmate who had an acute onset of red, itchy eyes accompanied by discharge on 8 September. The infection spread rapidly to other inmates and staff in two waves, one which peaked on 11 September and another on 18 September. The epidemic curve is in Figure 6.

Figure 6
Time distribution of 121 cases of conjunctivitis by dormitory in an institution, September 2005



Six eye swabs were obtained from the affected inmates when field investigations were carried out on 14 September and 22 September and sent for laboratory investigations. Coxsackievirus A24 was isolated from four of the samples tested.

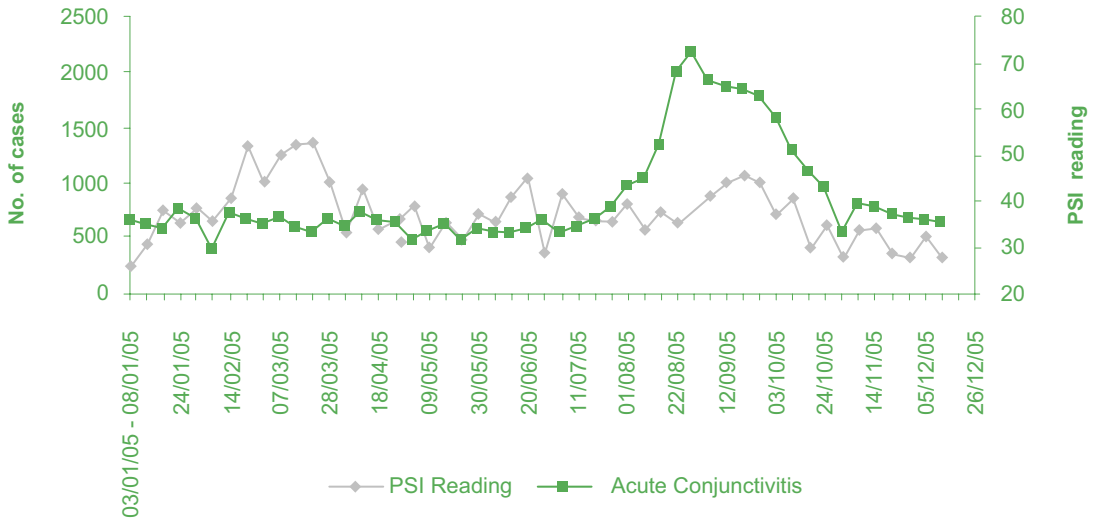
The management of the institution was advised to take the following infection control measures:

- Advocate strict personal hygiene practices including frequent hand washing and refraining from touching their eyes.
- Discourage sharing of personal items such as face towel, bed linen, etc.
- Discontinue communal congregation including mass bathing, exercises, social outings and gatherings. Meal times were alternated for the different dormitories.
- Keep environment clean by frequent sanitization including segregation of used linen and decontamination of common environmental surfaces with a disinfectant.
- Detect and isolate affected inmates immediately to minimise further spread of the infection.

Following the intervention, no new cases were reported on 26 September and the outbreak was considered over when no new cases were detected for two incubation periods.

During this period, there was a worsening haze situation in the neighbouring countries. However, no association between the surge in conjunctivitis attendances and local pollutants standards index (PSI) levels was observed

Figure 7
Polyclinic attendance For conjunctivitis and haze, 2005



The public was alerted through a press release and advised to practise basic personal hygiene by not sharing face and bath towels, handkerchiefs, pillows or beddings and by proper hand hygiene and disposal of contaminated materials.

Comments

Epidemics of acute haemorrahagic conjunctivitis caused by picornaviruses recurred in a five year cycle in the 1970s and 1980s. The 1970, 1975 and 1985 epidemics were caused by coxasckievirus A24 and the 1980 epidemic by enterovirus 70[1]. Coxsackievirus A24 continued to cause outbreaks in 1987, 1992[2] and 2002.

Most of the viruses isolated during small outbreaks in the inter-epidemic period were adenoviruses. The clinical features of conjunctivitis caused by coxsackievirus A24, enterovirus 70 and adenovirus are indistinguishable. Laboratory investigations are necessary to confirm the aetiological agent or agents.

References

1. Goh KT, Doraisingham S, Yin-Murphy M. An epidemic of acute conjunctivitis caused by enterovirus 70 in Singapore in 1980. Southeast Asian J Trop Med Pub Health 1981; 12: 473-80.
2. Yin-Murphy M, Goh KT, Phoon KC et al. A recent epidemic of acute haemorrhagic conjunctivitis. Am J Ophthal 1993; 116:212-7.