

SEROPREVALENCE OF DENGUE VIRUS INFECTION, SINGAPORE

DENGUE haemorrhagic fever (DHF) is a public health problem in Singapore. Following the first reported outbreak of 70 hospitalized cases in 1960, the disease became endemic with large epidemics occurring almost annually from 1961-1964 and 1966-1968.

A nationwide *Aedes* control programme, which incorporated source reduction, health education and law enforcement, was implemented in 1969. The overall *Aedes* house index (percentage of houses positive for *Aedes* breeding) dropped markedly from less than 25 to around 5 in 1972 and corresponded with the sharp decline in disease incidence rate from 42.2 per 100 000 population in 1968 to between 3 and 10 per 100 000 for the period 1969-1972.

However, an epidemic of 1 187 cases with 27 deaths occurred in 1973. With further intensification of *Aedes* control, the house index was reduced to 3, but this could not prevent the reappearance of another epidemic of 384 cases with 2 deaths in 1978.

The whole strategy of *Aedes* surveillance and control was reviewed and the overall *Aedes* house index was brought down to 2 in 1983 and to a record low level of 1 in 1985. In spite of this, nationwide outbreaks occurred with even greater frequency and intensity in subsequent years: 1986 (354 cases with 1 death), 1987 (436 cases with 2 deaths), 1989 (944 cases with 2 deaths), and 1990 (1 733 cases with 3 deaths). For the first eight months of 1991, a total of 1 417 cases with 5 deaths have been reported.

All four dengue serotypes have been isolated from infected persons, with type 2 predominating in recent outbreaks.

SEROPREVALENCE DURING 1982-1988

A seroepidemiological survey, conducted in 1982-1984, confirmed the low level of dengue transmission in the country after the 1973 epidemic. More than half (54.4 per cent) of

the healthy population aged between 6 months and 50 years or more and virtually all children below 10 years of age, possessed no haemagglutination-inhibition (HI) antibody to dengue type 2 virus.

In 1987, a survey conducted soon after a localized outbreak showed that although 71 per cent of the residents there had HI antibody to dengue 2, more than 60 per cent of the children and young adults below 20 years of age were seronegative.

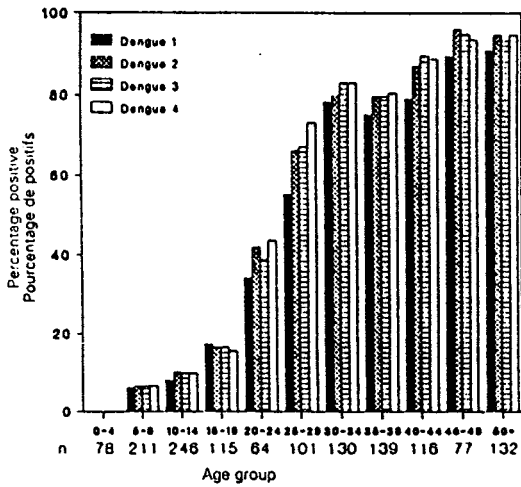
In 1988, another seroprevalence survey was carried out to assess the level of immunity of the general population after two successive epidemics in 1986 and 1987. The seroprevalence was low, with 64.3 per cent of the population possessing no HI antibody to Dengue 2. Children below 15 years of age remained highly susceptible to dengue virus infection. All the children below 5 years and 2.1 per cent of those between 10 and 14 years were found to be seronegative.

SEROPREVALENCE DURING 1990-1991

A total of 1 409 blood samples were obtained from healthy children and adults (785 males and 624 females) aged between 6 months and 50 years or more. Determination of HI to Dengue 1,2,3 and 4 was carried out at the Singapore General Hospital. A titre of less than 10 was considered negative.

Overall, between 44 and 48 per cent of the population surveyed possessed HI to one or more of the four serotypes of dengue virus. All the children below 5 years of age were seronegative. The antibody prevalence increased gradually from 6.2-6.6 per cent in the 5-9 year age group; to 8.1-10.2 per cent in the 10-14 year age group, and to 15.6-17.4 per cent in the 15-19 year age group. A marked increase in seroprevalence was noted thereafter from 34.4 to 73.3 per cent in young adults 20-29 years of age; to 89.6-96.1 per cent in those above 45 years

Figure 1. Age-specific prevalence of haemagglutination-inhibition antibody to Dengue 1,2,3 and 4, 1990-1991



involved mainly adults rather than children, as shown by the age-specific seroprevalence and the continuous increase in GMT of HI antibody with age. The age-specific incidence rate of reported dengue fever (DF)/DHF cases was highest in teenagers and young adults between 15 and 24 years of age.

Presuming that the samples collected in the surveys in 1982-1984, 1988 and 1990-1991 were representative of the general population, outbreaks of DF/DHF during the past five years had not raised the overall immune status of the population. This shows that the epidemic vector control measures implemented in the foci of transmission have been effective in preventing wide dissemination of the virus to the general population. The low level of seroprevalence in those below 20 years of age showed that the nationwide *Aedes* surveillance and control programme, implemented since 1969, has been effective in reducing the risk of dengue transmission. Compared to the results in the 1982-1984

(Figure 1). The geometric mean titres (GMT) increased with age for all the four serotypes.

COMMENTS

Although the 1990-1991 survey was conducted during the outbreak period (Figure 2), the immunity level of the general population remained low, with less than half of the population possessing antibody to one or more of the four serotypes of dengue virus. The serological results showed that dengue infection

Figure 2. Reported cases of dengue fever/dengue haemorrhagic fever, 1990-1991

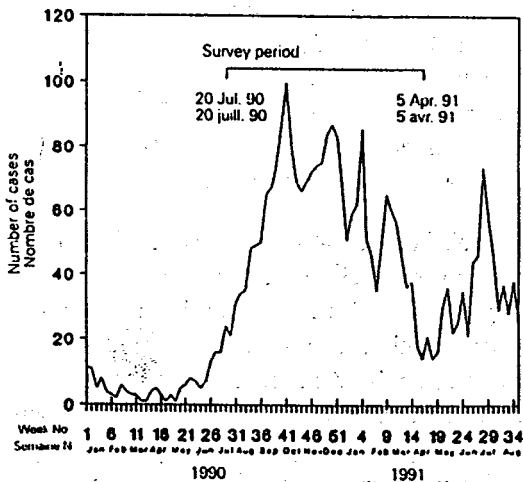
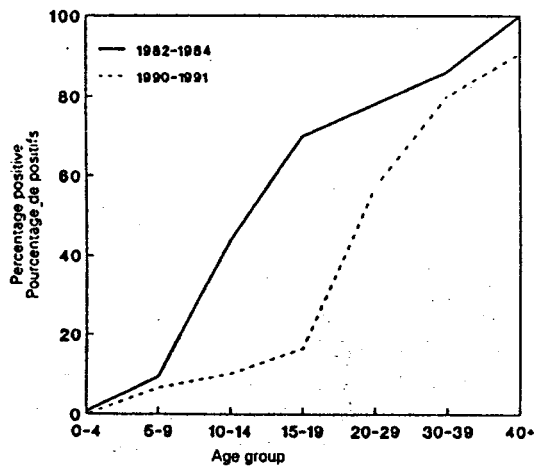


Figure 3. Age-specific prevalence of haemagglutination-inhibition antibody to Dengue 2 virus, 1982-1984 and 1990-1991



survey, there has in fact been a marked shift in seroprevalence in the 10-19 year age group (Figure 3). The increasing level of susceptibility of the high-risk group of dengue virus infection could have accounted for the largest ever recorded outbreak in 1990. The aggressive vector surveillance and control programme during the last two decades has therefore brought about a paradoxical situation in that outbreaks of DF/DHF tend to occur more frequently and with greater intensity because of the declining herd immunity of the population.

As there is no vaccine against the disease to raise the herd immunity of the population, dengue transmission will continue as long as *Aedes* mosquitoes are present in the country. The overall national *Aedes* house index has been maintained at a very low level of around 1 per cent. It is impossible to achieve a zero house index because breeding habitats in premises are constantly available at replacement level, i.e. habitats are created as quickly as they are eliminated by routine

source reduction control measures. The main thrust of the *Aedes* surveillance and control programme is to prevent any high-density *Aedes* pockets from developing into a potential focus of transmission. The community should actively participate in the programme and every householder should adopt a routine system of checks for *Aedes* breeding habitats within the home and in its vicinity.

Source: Weekly Epidemiological Record, No.14, 3 April 1992