Epidemiology and New Initiatives in the Prevention and Control of Dengue in Malaysia

by

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Abstract
Dengue continues to be a public health problem in Malaysia showing an upward trend from 27.5 cases/100,000 population in 1990 to a high of 123.4 cases/100,000 population in 1998 during the global pandemic, declining to 31.99 cases/100,000 population in the year 2000 based on notification of clinically-diagnosed cases. There is a predominance of dengue fever (DF) over dengue haemorrhagic fever (DHF), with the highest incidence among the working and school-going age groups. Major sources of Aedes breeding are at construction sites, solid-waste dumps, open spaces and in factories.

Several initiatives have been taken to strengthen dengue control. Some of the initiatives include reprioritizing Aedes surveillance aimed at new breeding sites; strengthening information system for effective disease surveillance and response; legislative changes for heavier penalties; strengthening community participation and intersectoral collaboration; changing insecticide fogging formulation, mass abating and, lastly, reducing case fatality.

Keywords: DF, DHF, Aedes, new initiatives, surveillance information system, legislative changes, Malaysia.

Introduction
Dengue fever (DF) was first reported in Malaysia in 1902 and is now one of the major public health problems in Malaysia, especially with the emergence of dengue haemorrhagic fever (DHF) in 1962. Notification of DF and DHF was instituted in 1971, requiring all medical practitioners to report any case of confirmed or suspected dengue or dengue haemorrhagic fever to the nearest health office. Prevention and control of DF and DHF was further strengthened with the enactment of the Destruction of Disease-Bearing Insects Act 1975 which was amended in 2001 for heavier penalties.

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Dengue situation in Malaysia\(^{(1)}\)

Dengue infection is predominant in urban areas where 61.8% of the country's population lives, as compared to only 34% in 1980. Rapid industrial and economic development over the last two decades has brought about massive infrastructure development and a very active construction sector for housing and commercial development, creating many man-made opportunities for Aedes mosquito breeding. This, coupled with rural-urban migration and pockets of illegal settlements, indiscriminate solid-waste disposal and a tropical rainfall, provide fertile grounds for Aedes breeding and the rise of dengue transmission in the country.

Epidemiological characteristics

Incidence

The number of clinically-diagnosed DF and DHF reported cases has been steadily increasing from below 1,000 cases a year to over 5,000 cases since 1991. There were outbreaks in 1974 and 1982, and a major outbreak in 1998 with 27,381 cases reported.

Serologically-confirmed cases ranged between 40-50% over the last five years (1996-2000). The rate was much higher in 1994 and 1995 due to pilot studies to notify only confirmed cases. The gap between clinically-diagnosed and laboratory confirmed cases remain high due to over-reporting, especially during the last major dengue outbreak in 1997-98, and also the fact that many laboratory results are inconclusive due to technical reasons. Figure 1 includes distribution of clinically and serologically-diagnosed cases per 100,000 population for the year 1991-2000.
Age distribution

Most of the reported cases were from the young and middle-age groups. These were people who were active outdoors, whether working, schooling or playing outside their homes. Aedes breeding in the homes is low, where the Aedes index is less than 1%. Figure 2 shows the age-specific morbidity rate per 100,000 population, 1991-2000.

Clinical entity

Dengue fever was the predominant type with the DF/DHF ratio of 16-25:1 over the last 5 years (Table 1), based on the notified clinically-diagnosed cases. For cases notified in the first 8 months of 2001, about 47.7% were serologically positive for dengue. From these serologically-confirmed cases, the predominance of dengue fever over dengue haemorrhagic fever was also noted where the ratio was 21.3:1, as compared to a ratio of 17.9:1 for all notified cases in the same period in 2001.

Table 1. Ratio of DF and DHF reported cases, 1996-2001 (August)

<table>
<thead>
<tr>
<th>Year</th>
<th>DF</th>
<th>DHF</th>
<th>DF:DHF Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>13,723</td>
<td>532</td>
<td>25.8:1</td>
</tr>
<tr>
<td>1997</td>
<td>18,642</td>
<td>787</td>
<td>23.7:1</td>
</tr>
<tr>
<td>1998</td>
<td>26,240</td>
<td>1133</td>
<td>23.1:1</td>
</tr>
<tr>
<td>1999</td>
<td>9,602</td>
<td>544</td>
<td>17.6:1</td>
</tr>
<tr>
<td>2000</td>
<td>6,692</td>
<td>411</td>
<td>16.28:1</td>
</tr>
<tr>
<td>2001 (August)</td>
<td>9,375</td>
<td>524</td>
<td>17.9:1</td>
</tr>
</tbody>
</table>

Figure 2. Distribution of dengue cases by age-specific morbidity rate per 100,000 population, 1991-2000.
Serotype

DEN-3 was the predominant serotype during the 1992-1995 period. This was replaced by DEN-1 and DEN-2 in the next 4 years from 1996-1999. Since the year 2000, DEN-3 has re-emerged with an increasing number of such serotypes, together with DEN-2. Figure 3 shows the distribution of circulating DEN serotypes in the last 10 years.

Mortality

The case-fatality rate (CFR) for DF and DHF is shown in Figure 4. The case-fatality for DHF was especially high but this was partly contributed by under-reporting of DHF where the initial notification as DF was not rectified when these cases subsequently were diagnosed as DHF. Thus, the denominator for DHF remains the old lower figure.

Figure 3. Circulating DEN serotypes 1990-2000

Figure 4. Dengue case-fatality rate according to DF/DHF and DHF in Malaysia 1984-2000 (August)
**Aedes surveillance**

Regular Aedes larval surveys and outbreak surveys provide the Aedes surveillance data in the country. The pattern of Aedes breeding is indicated by data from surveys for the year 2000 (Table 2). Residential premises had the lowest percentage of breeding at less than 1%.

<table>
<thead>
<tr>
<th>Type of premises</th>
<th>No. examined</th>
<th>No. positive</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factories</td>
<td>8,064</td>
<td>651</td>
<td>8.10</td>
</tr>
<tr>
<td>Abandoned housing projects</td>
<td>828</td>
<td>56</td>
<td>6.80</td>
</tr>
<tr>
<td>Construction sites</td>
<td>6,335</td>
<td>398</td>
<td>6.30</td>
</tr>
<tr>
<td>Vacant land</td>
<td>5,789</td>
<td>212</td>
<td>3.70</td>
</tr>
<tr>
<td>Garbage dump sites</td>
<td>3,439</td>
<td>110</td>
<td>3.20</td>
</tr>
<tr>
<td>Offices</td>
<td>3,199</td>
<td>94</td>
<td>2.90</td>
</tr>
<tr>
<td>Schools</td>
<td>22,464</td>
<td>576</td>
<td>2.60</td>
</tr>
<tr>
<td>Houses / Shops</td>
<td>1,916,604</td>
<td>11,187</td>
<td>0.60</td>
</tr>
</tbody>
</table>

**Dengue control programme**

**Areas of focus**

Dengue control forms part of the national Vector-Borne Disease Control Programme which encompasses malaria, dengue, Japanese encephalitis, filariasis, typhus, yellow fever and other new emerging vector-borne diseases. The dengue control programme comprises the following aspects:

- Disease surveillance and control
- Vector surveillance and control
- Public education
- Inter-agency collaboration and community participation
- Quality assurance
- Research and training

**Objective and targets of the dengue control programme**

The main objective of the programme is to reduce the morbidity and mortality caused by DF/DHF so that it will no longer pose a public health problem.

The targets set under the Eighth Malaysia Plan (2001-2005) are as follows:

1. Not more than 50 cases of DF/100,000 population.
2. Not more than 2 cases of DHF/100,000 population.
3. Case-fatality rate of DF/DHF not more than 0.2%.
4. Case-fatality rate of DHF not more than 1.0%.
5. Aedes Premise Index not more than 1%.

**Strategies**

1. Epidemiological surveillance through prompt case notification within 24 hours of clinical diagnosis via phone, fax or e-mail.
(2) Enhancing laboratory diagnostic support through the use of rapid screening tests and confirmation by standard laboratory technique.

(3) Improved clinical management through early case detection and quality assurance surveillance and audit.

(4) Case control through rapid response aimed at case investigation and destruction of vector by chemical fogging.

(5) Entomological surveillance through regular Aedes larval surveys.

(6) Legislative control on Aedes breeding through premises inspection and destruction of breeding sources.

(7) Public education through health education activities in the community and with community involvement.

(8) Inter-agency collaboration targeting at high-risk areas and population groups such as schools, construction sites, solid-waste dumps, factories and government facilities.

Country initiatives and policy changes

Reprioritizing Aedes surveillance areas

Prior to 1998, Aedes larval surveys were concentrated in residential areas. However, Aedes breeding was noted to be low, at around or below 1% of houses inspected. On the other hand, surveillance at construction sites indicated Aedes index to be very high (20.4% in 1995; 23.8% in 1996; and 15.6% in 1997) (3).

In 1998, the approach was changed where dengue teams carried out regular inspections at construction sites, factories, abandoned housing projects, garbage dump sites, schools, government facilities and others, besides inspections at any site during case/outbreak investigations. Targets were set in terms of proportions of different premises and areas to be inspected, based on three classifications of priority areas.

Strengthening information system for effective disease surveillance and response

Communicable Disease Control Information System (CDCIS)

The Ministry of Health is in the process of developing a comprehensive national computerized communicable disease control information system (CDCIS) that would cover the following aspects:

- Disease notification
- Disease registration
- Case investigations
- Case follow-up
- Report generation
- Early warning system

A geographical information system (GIS) is in the early stage of development. This would initially be developed for vector-borne diseases before being expanded to other communicable diseases.
**Legislative changes**

Legislative control is an important means for dengue prevention and control in Malaysia. The Destruction of Disease-Bearing Insects Act, 1975, was recently amended and new provisions for heavier penalties became enforceable from 1st January 2001. This was aimed at big offenders like housing developers and factory owners where the earlier penalty was found to be not deterrent enough. Among the changes made were:

- First offence – fine not exceeding RM 10,000 or imprisonment for a term not exceeding 2 years, or both (previously RM 1,000 fine and 3 months’ imprisonment);
- Second or subsequent offence – a fine not exceeding RM 50,000 or imprisonment for a term not exceeding 5 years (previously RM 2,000 fine and 1 year imprisonment);
- Continuing offence – further fine not exceeding RM 500 for every day that the offence is continued (previously RM 50).

**Community participation and intersectoral collaboration - national cleanliness and anti-mosquito campaigns**

In 1999, the Government reaffirmed its commitment towards the control of mosquito-borne diseases such as dengue by the launching of a multi-ministerial National Cleanliness and Anti-Mosquito Campaign that is still ongoing. The aim of the campaign is to create awareness amongst the community on the dangers of mosquitoes and to inculcate good practices to rid of mosquito-breeding sites in and around their places of stay, work and play.

The campaign will be further strengthened with a nationwide “Promotion of a Healthy Environment” campaign, to be launched in 2002. The aim is to promote community participation in ensuring the environment is free from mosquitoes and pests.

**Changing insecticide fogging formulation and mass Abating**

Traditionally, malathion was the chemical of choice for dengue control. Observations and feedback by the fogging teams indicated that the people did not accept fogging inside their houses since malathion was smelly and diesel-solvent which left oily residues on the floors and walls of houses.

The use of malathion was stopped in 1996 and replaced with water-based pyrethroid fogging formulations such as Resigen and Aqua-resigen. The use of Abate larvicide on a large scale in high-risk areas was also initiated in 1998 to reduce Aedes larval density.

**Reducing disease burden - DHF case fatality**

The DHF case fatality was still high at 9.9% in 2000, against the target of not more than 1%. While one of the reasons for the high rate was due to the under-reporting of DHF cases (DHF cases being initially notified as
DF and remained so, even after revision of diagnosis, thus affecting the denominator for DHF cases, strengthening of patient management in hospitals is certainly one strategy to reduce deaths.

In this respect, the Ministry of Health, together with the Academy of Medicine, Malaysia, developed a Clinical Practice Guideline on the management of dengue infection in 2000(5). Further, under the revised indicators for the national Quality Assurance (QA) programme for patient care that is being implemented this year, dengue case fatality has been included as a national indicator to improve the quality of care for DFH patients (one of the 53 indicators on patient care). Under this QA programme, DHF deaths are considered sentinel events that need to be audited immediately. Appropriate remedial actions are to be taken to rectify any weaknesses identified in the audit. The QA on DHF deaths would certainly create greater awareness about the proper management of DHF and bring about reduction in such deaths.

Conclusion

Control of dengue and dengue haemorrhagic fever is a multi-sectoral effort which requires strong community participation.

The Ministry of Health in Malaysia will continue to provide the leadership in getting all parties to work together while enhancing its own capacity and technical capability to face the many challenges in the control of dengue in the country. Several initiatives have been taken to strengthen dengue control in the country but certainly, more could be done. With proper focus, new initiatives and continual effort, we hope to achieve or even surpass the targets set for the programme.

References