

10

Challenges for dengue control in Brazil: overview of socioeconomic and environmental factors associated with virus circulation

Paulo de Tarso R. Vilarinhos[#]

Abstract

Successive epidemics of dengue have been occurring in Brazil since 1986 and more than three million cases of dengue fever (DF) had already been recorded by November 2003. The introduction of the three serotypes in circulation (DEN-1, DEN-2 and DEN-3) has always started in Rio de Janeiro. During the nineteen nineties, the incidence of dengue increased greatly as a consequence of the dissemination of *Aedes aegypti* in the country, beginning mainly in 1994. Between 1990 and 2000, several epidemics occurred, principally in the major urban centres of the southeast and the northeast of Brazil, where the majority of reported cases were concentrated. The first great incidence of the disease was observed in 1998, with 528,000 DF cases. Circulation of serotype 3 of the virus was detected for the first time in December 2000, in the state of Rio de Janeiro. In the period of 2001-2002, epidemics occurred in several states of the country, with more than 1.2 million of notified DF cases. Two years after the introduction of Den-3, the number of DHF cases notified achieved more than 3000, representing almost 0.3% of the total DF cases. By 1997 more than 50% of the 5543 counties were infested by *Ae. aegypti*. Unplanned urban growth, with deficiencies in water supply and urban cleaning, has increased the opportunities for the mosquito reproduction.

Keywords: dengue; *Aedes aegypti*; vector control

Background

Dengue is a global disease of the tropics, and one of the most important emerging tropical diseases, affecting nearly half of the world population. According to the World Health Organization (WHO 2002) the disease is now endemic in more than 100 countries in Africa, the Americas, the Eastern Mediterranean, Southeast Asia and the Western Pacific. Southeast Asia and the Western Pacific are most seriously affected. WHO currently estimates there may be 50 million cases of dengue infection worldwide, 550 million hospitalizations and at least twelve thousand deaths per year.

In 2001 alone, there were more than 609,000 reported cases of dengue in the Americas, of which 15,000 cases were DHF. This is greater than double the number of dengue cases that were recorded in the same region in 1995 (WHO 2002).

Successive epidemics of dengue have been occurring in Brazil since 1986 and more than three million cases of dengue fever (DF) had already been recorded by

[#] Diretoria de Vigilância Ambiental, SAIN Estrada Contorno do Bosque Lote 04, 70620-000 Brasília - DF, Brazil. E-mail: paulo.vilarinhos@terra.com.br

November 2003 (Figure 1, see Colour pages elsewhere in this book). The introduction of the three serotypes in circulation (DEN-1, DEN-2 and DEN-3) has always started in Rio de Janeiro (Da Silva Jr et al. 2002).

Epidemiology

The occurrence of dengue in Brazil is well-defined by the seasons, the greater incidence occurring in the first months of the year, particularly between March and May (Figure 2, see Colour pages elsewhere in this book), when the prevailing temperature and humidity conditions around the country favour the proliferation of the vector *Aedes aegypti* (Teixeira et al. 2002).

During the nineteen nineties, the incidence of dengue increased greatly as a consequence of the dissemination of *Ae. aegypti* in the country, beginning mainly in 1994 (Figure 3). Dispersion of the vector was followed by the dissemination of serotypes 1 and 2 in 20 of the 27 states of the country. Between 1990 and 2000, several epidemics occurred, principally in the major urban centres of the southeast and the northeast of Brazil, where the majority of reported cases were concentrated (Figure 1, see Colour pages elsewhere in this book). The midwestern and northern regions were subsequently affected by dengue epidemics starting in the second half of the 1990s. The first great incidence of the disease was observed in 1998, with 528,000 DF cases (Figure 1, see Colour pages elsewhere in this book).

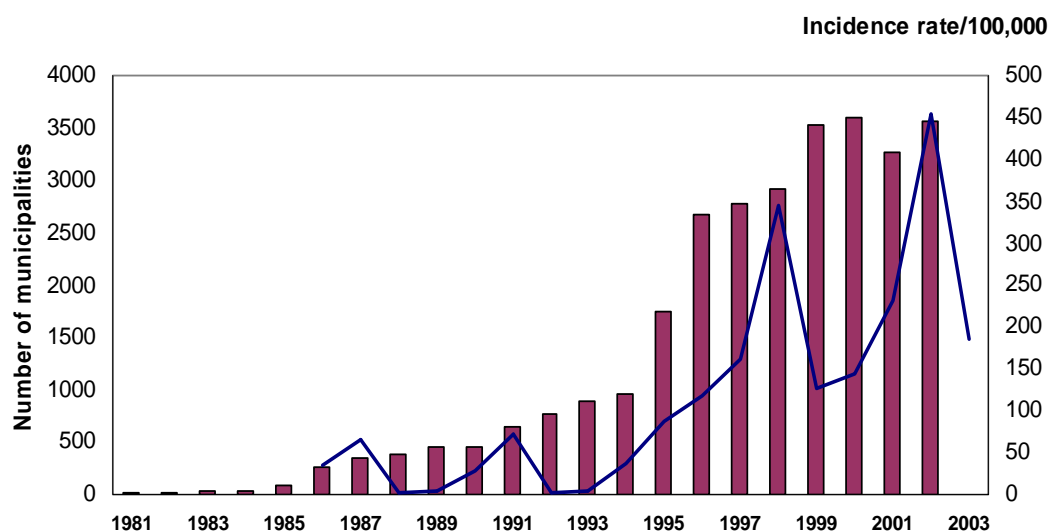


Figure 3. Incidence rate of notified cases of dengue fever and number of municipalities with *Aedes aegypti* in Brazil, 1986-2003 (Source: SVS)

Current status

Circulation of serotype 3 of the virus was detected for the first time in December 2000, in the state of Rio de Janeiro. In 2002, it has been observed that the diffusion of serotype 3 from the state where it was originally detected presents a different profile from the diffusion observed with serotypes 1 and 2. Previously, diffusion of a new serotype occurred slowly and some years elapsed before indigenous cases occurred in other states. In the first three months of the year 2002, the presence of the new serotype of the virus had been detected in ten more states (Bahia, Ceará, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará, Paraíba, Pernambuco and São

Paulo) (Figure 4, see Colour pages elsewhere in this book). At the same time, the suspected and confirmed cases of dengue increased considerably in some states, strengthening the trend toward the increase in cases observed in 2000 and 2001. In the period of 2001-2002, epidemics occurred in several states of the country, with more than 1.2 million of notified DF cases. During the same period, a switch on DHF profile was observed (Figure 5). Up to the year 2000, when only Den-1 and Den-2 virus were circulating, DHF records represented 0.05% of the more than 1.7 million DF cases. Two years after the introduction of Den-3, the number of DHF cases notified achieved more than 3000, representing almost 0.3% of the total DF cases. Previous exposure to the two other serotypes in the population hit by Den-3 may explain this raise in DHF cases (Teixeira et al. 2002). Also of concern is the high fatality rate (over 5% observed), when compared with levels below 1% reported for Southeast Asia (Rojanapithayakorn 1998).

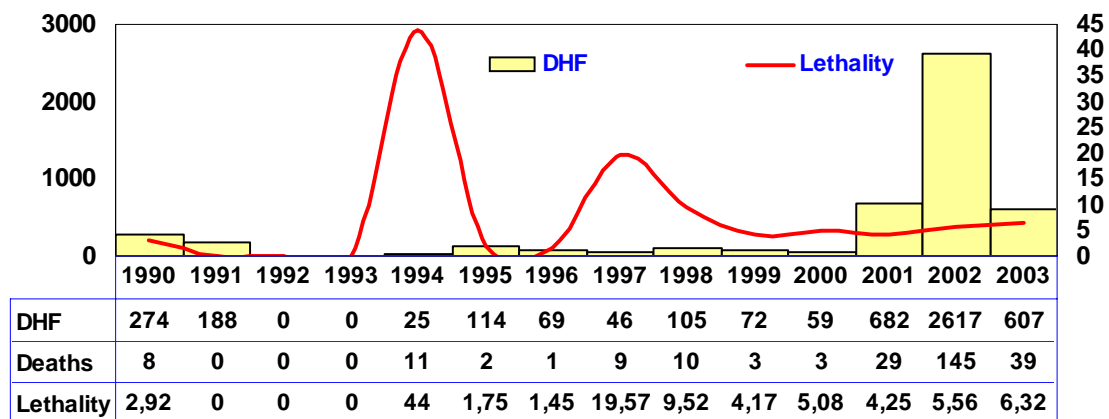


Figure 5. Dengue haemorrhagic fever reported cases and deaths in Brazil, 1990-2003 (Source: SVS)

Fight against the vector

In 1973 it was declared that *Ae. aegypti* had been eradicated from Brazil. However, three years later, the vector reappeared and since then has gradually spread throughout the country. Figure 5 shows that during the 1990s the number of municipalities infested increased steadily, followed by a rise in dengue incidence. By 1997 more than 50% of the 5543 counties were infested by *Ae. aegypti*. Data from the 2000 demographic census comparing the population growth in some metropolitan regions show growth rates varying from 3 to 29% in counties around large cities such as São Paulo, Rio de Janeiro, Belo Horizonte and Recife (IBGE 2004). It is recognized that unplanned urban growth, with deficiencies in water supply and urban cleaning has increased the opportunities for the mosquito reproduction. The intensive disposure of non-biodegradable materials such as plastic containers and tyres in the environment plays an important role in the dispersion and maintenance of foci for the mosquito (Gubler 1997). Entomological surveillance presented in Figure 6 shows the main foci of *Ae. aegypti* in 2001, per county. In the Northeast region, where less than 70% of premises are equipped with piped water (IBGE 2004) and water supply is often unreliable, the main breeding site is related with water reservoirs (tanks, metal drums etc.). In the Southwest region, where most of the large urban centres and high-population-density areas are, the main foci of the vector are associated with waste collection and tyres.

Methods traditionally used in the fight against vector-borne diseases in Brazil and on the continent have not been successful in controlling the vector. Previous programmes centred on chemicals, with limited or no community participation, without intersectorial integration and with little utilization of epidemiological instruments. These programmes were unable to contain the vector because of its great capacity for adaptation to an environment rapidly changing by urbanization and new customs.

In 1996, the Ministry of Health decided to revise the strategy against *Ae. aegypti* and proposed a Programme of Eradication of the vector (PEAa). The new programme took into account the difficulties of the previous control strategy and, paradoxically, it proposed an even more complex objective, stemming from the assumption that the vector could be eradicated. Though the PEAa stemmed from this mistaken assumption and presented omissions or deficiencies in important areas such as community participation and epidemiological surveillance, it had undeniable merits. For example, the programme proposed multisectorial action and foresaw the participation of the three levels of government – federal, state and municipal – in the endeavour.

In practice, the PEAa contributed to strengthening the fight against the vector, considerably increasing resources for the project. Prevention activities however were centred mainly on utilization of insecticides.

Results obtained in Brazil and at the international level brought into question the viability of a short-term policy of eradication of the vector. This led the Ministry of Health to re-evaluate the progress and limitations of the programme, with the objective of establishing a new programme to control dengue.

Prevention and control strategy

The increase in observed incidence of dengue in the last two years and the introduction of a new serotype (DEN 3) led to a prediction of increased risk of dengue epidemics and an increase of the cases of DHF. To face the expected risks for 2002, the Ministry of Health, in collaboration with the Pan-American Health Organization, carried out an international seminar in June 2000 to evaluate the situation and prepare a National Dengue Control Plan (PNCD). The plan targeted the 657 municipalities of greatest risk in the country, with the objective of more effectively utilizing the positive results of previously adopted initiatives. These include: 1) a large infrastructure for vector control in the states and municipalities (vehicles, spraying equipment, microscopes and computers); 2) nearly 40,000 agents trained in vector control, in more than 3,500 municipalities; and 3) a set of nationally standardized activities and technical standards for vector control.

The PNCD was conceived with three goals: i) to bring *Ae. aegypti* infestation levels (house index) below 1%; ii) to reduce DF cases by 50% in 2003, in comparison with 2002, and by 25% every year after; and iii) to reduce DHF fatalities to less than 1%. To accomplish these goals the Plan was focused in the 657 counties that historically have held more than 70% of the notified dengue cases, in the 25 states where transmission occurs. The guidelines developed to implement the Plan are:

- **Strengthening epidemiologic surveillance** – to seek early detection of virus circulation;
- **Integrating vector control with epidemiological surveillance** – aiming to block transmission at initial focus;

- **Basic health-care integration (health family programme)** – to support detection of suspected cases and orient at prevention of breeding sites;
- **Reduction of DHF burden** – to improve clinical management of cases to reduce fatality rates;
- **Environmental-management support** – to develop sanitation solutions for low-income communities;
- **Proposing new laws** – to support and enforce behavioural change, to sustain infestation levels below 1%;
- **Social mobilization for behaviour changes** – integrate actions of health education with social communication to induce preventive behaviour;
- **Setting up a political agenda** – sensitize and mobilize political sectors to bring more funds and facilitate intersectorial actions of the programme.

The Plan is very comprehensive and covers all activities necessary for its implementation, including the application of recent regulations on the attributions of Federal, State and Municipal levels regarding epidemiology and disease control. In this regard a National Fund has been created establishing rules for a monthly flow of money to all country states and municipalities, based on an annually agreed set of activities and goals for the main diseases.

References

- Da Silva Jr, J.B., Siqueira, J. B., Coelho, G.E., et al., 2002. Dengue in Brazil: current situation and prevention and control activities. *Epidemiological Bulletin / Pan American Health Organization*, 23 (1), 3-6. [http://www.paho.org/english/dd/ais/EB_v23n1.pdf]
- Gubler, D.J., 1997. Dengue and dengue haemorrhagic fever: its history and resurgence as a global public health problem. In: Gubler, D.J. and Kuno, G. eds. *Dengue and dengue hemorrhagic fever*. CAB International, New York, 1-22.
- IBGE, 2004. *Atlas do Censo Demográfico de 2000*. Instituto Brasileiro de Geografia e Estatística.
- Rojanapithayakorn, W., 1998. Dengue haemorrhagic fever in Thailand. *Dengue Bulletin*, 22, 60-68. [http://w3.whosea.org/en/Section10/Section332/Section520_2417.htm]
- SVS, *Programa nacional de controle da dengue (website)*. Ministério da Saúde, Secretaria de Vigilância em Saúde. [<http://dtr2001.saude.gov.br/svs/epi/dengue/dengue0.htm>]
- Teixeira, M.G., Costa, M.C.N., Guerra, Z., et al., 2002. Dengue in Brazil: situation-2001 and trends. *Dengue Bulletin*, 26, 70-76. [http://w3.whosea.org/LinkFiles/Dengue_Bulletin_Volume_26_Chap08.pdf]
- WHO, 2002. *Dengue and dengue haemorrhagic fever*. World Health Organization, Geneva. Fact sheet no. 117. [<http://www.who.int/mediacentre/factsheets/fs117/en/>]