

Dengue fever outbreak prevention in New Caledonia: principles and tools

Dengue fever is a viral disease that is transmitted to humans by a vector, generally *Aedes aegypti*, a peri-domestic mosquito, i.e. one that lives in and around dwellings. This virus, which has four known serotypes, causes outbreaks with very high attack rates. The disease has a short incubation period (about 5 days) and this has a significant effect on efforts to prevent outbreaks. Dengue fever is introduced into disease-free countries by patients from infected areas, and more theoretically by infected mosquitoes. General practitioners play a crucial role in the outbreak prevention system since they are the first to identify suspected clinical cases.

Principles of dengue fever outbreak prevention:

- Avoid introduction of the virus into susceptible disease-free areas, i.e. where a vector exists and the climate is favourable for breeding;
- Monitor and control vectors;
- Ensure early case detection (dengue fever has a short incubation period);
- Limit spread of the virus once it has been introduced, i.e. avoid human-to-vector and vector-to-human transfer.

For each of these principles, there are corresponding dengue outbreak prevention tools. Below we discuss tools that correspond to the first three principles.

A – To avoid introduction of the virus to a country free of dengue outbreaks such as New Caledonia, three tools should be used:

- Eliminate mosquitoes from aircraft arriving from areas where there is a dengue fever outbreak or where dengue fever is endemic;
- Provide travellers from infected areas with information and advice, i.e. in the event of flu-like symptoms within a week of their arrival, particularly fever and muscle pain, they must see a doctor immediately and inform the doctor that they have recently visited an infected area. Also, warn people going to areas that are known to be infected to protect themselves from mosquito bites (using repellents, mosquito netting, long sleeves, etc.).
- When incoming passengers arrive at the airport, detect all those who have a fever through use of a thermal imaging camera, or some other device for measuring external body temperature. If a passenger with a fever is detected, this should be considered a probable case of dengue fever, e.g. provide advice on isolation, mosquito netting, lab confirmation, destroying mosquitoes around the suspect's residence.

B – A permanent vector surveillance system should be set up in those countries where *Aedes aegypti* or any other dengue fever vectors are spreading. Four tools are used for vector surveillance and control:

- Ongoing surveillance of heavily populated areas should be conducted on a monthly basis to monitor entomological indexes for both larvae and adult mosquitoes. This makes it possible to assess the risk of propagation of the virus by the current vector population.
- Community education on vector control (destroying potential and/or active breeding areas) should be conducted through normal media outlets (radio, television, newspapers) whenever possible and during special events, e.g. 'Dengue Control Day', during which red garbage bags and information leaflets are distributed free of charge. Children are also educated about vector control in the school setting through teaching kits provided to primary school teachers. These kits include a video cassette, lesson plans, instructions on how to build an electric mosquito, a comic strip, instructions on how to find mosquito breeding sites, a Happy Families-type card game with the various stages of development for different insects, and posters and leaflets. During the school year, CM2 (Year 5) classes in Noumea can ask to have a Municipal Hygiene Service team visit their class to talk to them about mosquitoes and larval breeding areas. The team gives the class a bottle of water with a mosquito and larvae and nymphs sealed inside for them to observe and they are given the task of finding and destroying all the larval breeding areas at their school and at home over the weekend. The team comes back a few days later to check on what they have found and to give them

mosquito 'hunter diplomas' and magnets. This education also occurs when vector control agents interact directly with the public during monthly entomological surveillance of dwellings, gardens, garages, etc.

- Entomological surveillance should also include monitoring the vector population's sensitivity to insecticides that are available and may be used.
- Finally, it is essential to provide proper training and equipment for vector control teams (municipal, territorial, departmental, etc.).

C – Early case detection is a crucial aspect of outbreak prevention. Dengue fever is an infection with a very short incubation period, i.e. about five days between the infectious bite and the appearance of initial symptoms. Patients are viremic from about day 4 to day 10 after the infectious bite, i.e. they are at risk of contaminating the mosquitoes that bite them during that period. Because everything happens quickly, we must also react quickly, using the following four measures:

- Set up and run a network of sentinel physicians, who systematically request lab confirmation for all clinically suspect cases. Tests prescribed by the doctors who are part of this sentinel network are free.
- Provide information and advice to general practitioners on a regular basis; in particular, maintain a high level of information exchange during periods between outbreaks.
- Declare to health authorities both confirmed and suspected clinical cases, i.e. those cases where there is enough suspicion to request lab confirmation.
- Ensure that very rapid and sufficiently specific lab confirmation tests, such as viral antigen detection tests or tests that identify the viral genome, e.g. using RT-PCR, are available.

As the above list shows, there is a comprehensive range of dengue fever outbreak prevention measures in New Caledonia. These are summarised in the sequential table below, with the actions to be taken shown in the left-hand column and the health agents responsible for carrying them out shown on the right.

Actions to be taken	Health agents responsible for carrying out the actions
Clinical: identifying suspected cases	General practitioners
▼	
Reporting cases to DASS and/or samples	General practitioners
▼	
Assessment by DASS	DASS Epidemiology
▼	
D0: Perifocal entomological response	Municipal Hygiene Department
▼	
Lab confirmation at DASS (primary or secondary cases)	Laboratory and DASS
▼	
D2: Perifocal (or zonal) entomological response	Municipal Hygiene Department
▼	
Increased medical surveillance and assessment of effectiveness	General practitioners and entomological surveillance

In 2006 and 2007, a relatively high number of cases of dengue fever were diagnosed in New Caledonia. All the measures described have been implemented, thus avoiding a dengue fever epidemic up to now.

This system is sophisticated but effective, calling into play the entire curative and preventive health care chain, e.g. specialised laboratory, municipal vector control services and the media.

Mandatory reporting: a constraint or a benefit?

The New Caledonia congressional resolution on notifiable diseases (13 March 1991) makes reporting cases of dengue fever to DASS-NC mandatory. The usefulness of prompt reporting is well understood by all the territory's health professionals: it has an immediate operational objective since it allows DASS-NC to implement a well-organised mosquito control plan run by the townships, which have jurisdiction in this area. Municipal hygiene services intervene as quickly as possible at the patient's residence to assess the existence of larval breeding areas and to provide information to neighbourhood residents. These services also eliminate larval and adult mosquitoes likely to contribute to the development of an outbreak in the vicinity of the index case.

Patients expect the appropriate agencies to take action to protect public health. Doctors provide their patients with explanatory leaflets to ensure they understand the importance of the measures that will be implemented.

Therefore, what appears at first glance to be a constraint is, in reality, a guarantee for doctors that prevention measures will be implemented and that they will not be liable for an outbreak spreading or intensifying.

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