Dengue Control in Vanuatu: Towards an Integrated Vertical and Horizontal Control Programme

By

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Abstract

Like in most Pacific island countries, dengue is not endemic in Vanuatu, and so, dengue transmission begins with the introduction of the virus via infected humans or mosquitoes into the country. The Ministry of Health, Vanuatu, has been successful in containing dengue transmission whenever the virus has been introduced, through an integrated approach using vertical and horizontal components. The identification and containment of dengue cases is dependent on both active and passive surveillance of the human population coupled with larval surveys. During epidemics, control measures emphasize clinical case-management, health education and mosquito control (larval breeding source reduction, larviciding and indoor focal house spraying in the homes of cases). During non-transmission periods, an active mosquito larval source reduction programme with community participation is emphasized along with training for health-care providers and health education of the public.

Key words: Dengue, active-passive surveillance, source reduction, Vanuatu.

Introduction

The Republic of Vanuatu is located in the Western Pacific. The archipelago that constitutes the republic contains over 80 islands and is located between Australia to the west and Fiji to the east, with the Solomon Island to the north-west and New Caledonia to the south-west. The population of Vanuatu is 186,678, with major concentrations of 29,356 and 10,738 people in the capital, Port Vila, and Luganville, respectively. Around 79% of the population lives in rural areas. Annual maximum temperatures range from 28°C in February to 23°C in July, with an annual average rainfall of 200-300 cm. The wet season occurs from December to March.

Brief history of dengue in Vanuatu

The first known cases of dengue in Vanuatu occurred in 1971-72 when dengue serotype-2 was found. Since then, all four dengue serotypes have been found in Vanuatu, with transmission occurring in 1975, 1980, 1985, 1989 and 1998. The first known cases of DHF/DSS were described in
1989 when infections with serotypes-1 and 3 were introduced after the dengue-2 outbreaks in 1971-72 and 1975 as well as the dengue-4 outbreak in 1980. The largest epidemic to date, with 3,300 suspected cases, occurred in 1989 (Table 1).

Table 1. The recent history of dengue transmission in the Republic of Vanuatu

<table>
<thead>
<tr>
<th>Year</th>
<th>Number Cases</th>
<th>Serotype</th>
<th>DHF/DSS</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971-72</td>
<td>NA</td>
<td>2</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>1975</td>
<td>NA</td>
<td>2</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>1980</td>
<td>16</td>
<td>4</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>1989</td>
<td>3,300</td>
<td>1.3</td>
<td>Yes</td>
<td>12</td>
</tr>
<tr>
<td>1998</td>
<td>120</td>
<td>2</td>
<td>No</td>
<td>0</td>
</tr>
</tbody>
</table>

NA = not available

Vectors
Unlike the Solomon Islands to the north and Fiji to the east, Aedes albopictus is not found in Vanuatu. Aedes aegypti, the primary dengue vector remains, with Aedes hebrideus of secondary importance. Primary breeding sites for Aedes aegypti are tyres, water drums and discarded refrigerators which are used to hold water.

National dengue plan
The Vanuatu National Dengue Plan (Figure 1) relies on the rapid detection of introduced dengue cases through active and passive surveillance and an immediate response to suspected dengue cases to limit outbreaks. Mosquito surveillance and control is the responsibility of the Malaria and Other...
Vector-Borne Diseases Control (VBDC) Programme, which also reviews on a weekly basis information obtained from the active and passive surveillance systems.

**Surveillance**

There are three components of the surveillance system in Vanuatu: entomological, passive case-detection, and active case-detection.

An entomological larval survey of 100 households is carried out three times a year. Larval samples are brought back to the Ministry of Health (MOH) and identified. Data on mosquito surveys are entered into an Excel file; Breteau Indices are calculated and the results tabulated as graphs. Information on the types and numbers of breeding sites as well as on the uses of tyres by households are collected (Figure 2).

Surveillance using passive case detection is based on clinical diagnosis at the Vila Central Hospital in Port Vila, on Efate, as well as in the Northern District Hospital in Lavanille, on Espiritu Santo, Lenakel Hospital on Tanna, Lolowai Hospital on Ambae, and Norsup Hospital on Malakula.

Separate case definitions for adults and children are used. In adults, a patient with high fever (>38°C) for more than two days, plus at least two of the following: severe headache and/or pain behind eyes, bone and/or joint pain, rash and/or flushing, nausea and/or vomiting and/or dizziness, is considered as a suspect for dengue fever. In

![Figure 2. Tyre operation in Port Vila in 1999-2000 showing the number of tyres collected and the uses of tyres not collected](image-url)
children the definition is: high fever (>38°C) for more than two days plus at least one of the following: poor drinking and/or poor urine output, rash and/or flushing, nausea and/or vomiting and/or dizziness.

An ongoing programme of refresher training of health-care providers (both nurses and clinicians as well as village health workers) in both dengue case recognition and treatment has been supported by the Pacific Regional Vector-Borne Diseases Programme. Suspected cases based on clinical observations are immediately reported by telephone to the office of the Malaria and Other VBDC Programme, entered into the Vanuatu Health Information System and analysed serologically with a rapid diagnosis test. Prior to 2000, the Dengue Fever IgM and IgG rapid immunochromatographic test (Panbio, Australia)(2) was used and sera positive in the rapid test were sent to the WHO Collaborating Centre for Arbovirus Reference and Research, Queensland Health Scientific Services, Brisbane, Australia, for confirmation by neutralization assays.

Active dengue case detection is by analyses of the ratio of positive to negative malaria slides. An increase in the number of slides taken (indicative of fever), with no increase in the number of malaria positives, would indicate the possibility of a cause of fever other than malaria. The numbers of slides that were malaria negative and malaria positive during the 1998 dengue outbreak are shown in Figure 3. Increases in requested malaria slides require further testing to incriminate dengue as the cause of fever. The change in the number of malaria slides requested and the lower proportion of such slides that were malaria positive indicates an increase in fever cases, which could be caused by dengue. Laboratory testing of serum from persons who were malaria slide negative is necessary to confirm dengue cases.

**Routine preventive measures**

All information from the surveillance systems goes to the Malaria and Other VBDC office, which coordinates routine anti-mosquito
activities in the absence of dengue. These activities consist of vector control through source reduction including regular tyre collection. Another routine activity to diminish container-breeding mosquitoes is through monthly clean-ups. For these activities, community involvement is essential. Furthermore, larviciding is carried out on mosquito-positive containers at the time of the routine larval surveys. In addition, ULV spraying of malathion using a truck-mounted Leco sprayer is undertaken fortnightly at the international airport and wharfs during the peak Aedes aegypti breeding season.

**Manples - Community-based control project**

The Manples project utilizes community involvement in removing breeding sites. This community-based project, inaugurated in 1999, is supported and supervised by the Ministry of Health through the VBDC office. The purpose of this project is to both educate the people in the Manples area (in a suburb of Port Vila) on vector-borne diseases and mosquito control and to use this knowledge to reduce mosquito breeding sites by community participation.

The Manples project evolved from the routine larval collection team who noticed that a lot of tins, drums and tyres accumulated in this area because there was no established disposal facility. Once every three months the staff of the VBDC office distributes one plastic bag to each household in the Manples area. Each plastic bag costs 100 vatu (US$ 0.71). All tins and water containers are collected in this bag by people living in that household. Every three months the Malaria and Other VBDC office collect the bags and distributes new ones. Financial expenses are low, even when including the cost of petrol to reach the Manples area, and are charged to the recurrent budget of the Ministry of Health.

Education of the Manples residents is based on two activities. First, the staff of the Malaria and Other VBDC office do house-to-house talks each time they distribute the bags. Secondly, trained volunteers then do continuous education in the Manples community. The community is very active with nearly all the Manples population actively participating in the project.

The success of the Manples project can be gauged by the fact that it is in the process of extension to the northern suburbs of Port Vila: Blacksands, Ohlen, Tagabe and Malapoa. A one-day meeting is organized for the initial training of new volunteers and a one-week workshop was organized in June 2001 for all the volunteers.

**Awareness of the population**

Many kinds of IEC (information, education and communication) materials about dengue are available and are used in Vanuatu. Educational posters on mosquito control are distributed in hospitals, health centres, dispensaries and communities on a regular basis. In case of suspected cases of dengue, booklets in Bislama, the most common of the three official languages of the country, are copied and distributed in the communities. Each booklet gives very simple and basic information about dengue fever, the main symptoms and the way to prevent the disease.

One video in Bislama on mosquito control entitled “One present long niufala Bebe”, produced by a local theatre group, “The Wan Smal Bag Theatre”, is broadcast on TV during the wet season. Another video, in English, “It can’t happen here”, is focused on dengue disease and is shown on TV when suspected cases of dengue are found in the country. Finally, during the “at dengue risk season”, messages are displayed at the national radio and TV to remind everyone to clean their gardens and to destroy all potential mosquito breeding sites.
Response

Upon evidence of a suspected case of dengue, anti-vector activities are undertaken at houses within 200 metres of a case house. The control teams consist of 3-4 individuals. In addition to indoor spraying with Hudson backpack sprayers, larviciding with Abate is undertaken and educational materials on dengue distributed. Severe clinical dengue cases are admitted to the medical ward. The medical ward is screened and, in addition, dengue patients are required to sleep under insecticide-treated mosquito nets.

When evidence of more than one suspected dengue case is reported to the Malaria and Other VBDC office, the Dengue Early Warning Committee is convened. Members of this committee are: Manager of the Malaria and Other VBDC Programme, the MOH Director-General, the six directors of the MOH, physicians from the Vila Central Hospital, representatives of the World Health Organization and the Secretariat of the Pacific Community. The Dengue Early Warning Committee discusses plans for controlling a dengue outbreak as presented by the Manager of the Malaria and Other VBDC Programme and approves a plan for control. This committee has the added responsibility of informing the public and soliciting additional resources from supporting institutions including the business community and the municipalities. This support could include additional manpower and transportation. This committee can also request the Cabinet to authorize the public to undertake larval source reduction activities.

One other committee that may become involved during a dengue outbreak is the Disaster Committee. Dengue is officially considered a disaster in Vanuatu. It is the responsibility of the Disaster Committee to coordinate efforts should a dengue outbreak occur concurrent with another disaster (e.g. earthquake, Tsunami, etc.).

Epidemic plan

In a large-scale dengue outbreak, control efforts shift from treatment of homes in the immediate vicinity of a case to treatment of "hotspots" (e.g. areas with significant numbers of cases), as well as hospitals, airports and seaports. Furthermore, greater emphasis is placed on larval source reduction rather than on indoor space spraying for adult mosquitoes. Manpower to supplement the strength of the workers from the Malaria and Other VBDC Programme comes from 40 previously trained volunteers. The Dengue Early Warning Committee would be responsible for coordinating the provision of additional manpower and transportation. Furthermore, this committee may solicit the Cabinet to organize national clean-up days, thereby enlisting the entire community in the dengue outbreak control effort.

The future

Vanuatu, like many other island countries, is constrained by a small number of vector-borne disease specialists in the MOH. A relatively small population also means a limited public health budget. By necessity, Vanuatu must rely on public education, community participation, a small well-trained team of professionals in the MOH, rapid communication within Vanuatu and with its Pacific island neighbours as well as cooperation with its neighbours for laboratory confirmation of suspected dengue cases.

Most importantly, Vanuatu relies on a vigilant surveillance system to rapidly identify suspected cases before they become outbreaks. Cooperation of the community is essential for outbreak prevention through larval source reduction programmes. The Maniples project has attracted the interest of other communities in Vanuatu and is being expanded to the main suburban
communities. Successful expansion of the community-based projects will rely on an educated community that realizes that dengue is often a problem generated by communities themselves and, as such, the solution is in their hands.

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