

Dengue Epidemic in Southern Vietnam, 1998

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A widespread epidemic of dengue hemorrhagic fever (DHF) occurred in southern Vietnam in 1998, with 438.98 cases/100,000 population and 342 deaths. The number of DHF cases and deaths per 100,000 population increased 152.4% and 151.8%, respectively, over a 1997 epidemic. Dengue viruses were isolated from 143 patient blood samples; DEN-3 virus was identified as the predominant serotype, although a resurgence of DEN-4 was noted.

Since 1963, the incidence of dengue hemorrhagic fever (DHF), a leading cause of hospitalization and death in children, has steadily increased in Vietnam. In 1998, a widespread DHF epidemic affected 19 provinces in southern Vietnam (Figure 1); 119,429 cases of DHF and 342 deaths were reported (Figure 2); and the rates per 100,000 population were 438.98 and 1.26, respectively, for a case-fatality rate of 0.29%, an

increase of 152.4% and 151.8%, respectively, over those of a 1997 epidemic (288.02 and 0.83)(1). The epidemic curve was similar to those of previous years: cases increased substantially from June to November (1-4). Peak transmission occurred from July to September, closely associated with the rainy season, a breeding period for the mosquito vector. DHF cases were reported in the first quarter in Ben Tre (1,387.2/2.4/100,000), Binh Phuoc (635.1/0), and Kien Giang provinces (568.4/2.9).

We describe epidemiologic, virologic, and serologic studies carried out during the epidemic.

The Study

Reports of DHF cases and deaths were gathered by hospitals and Departments of

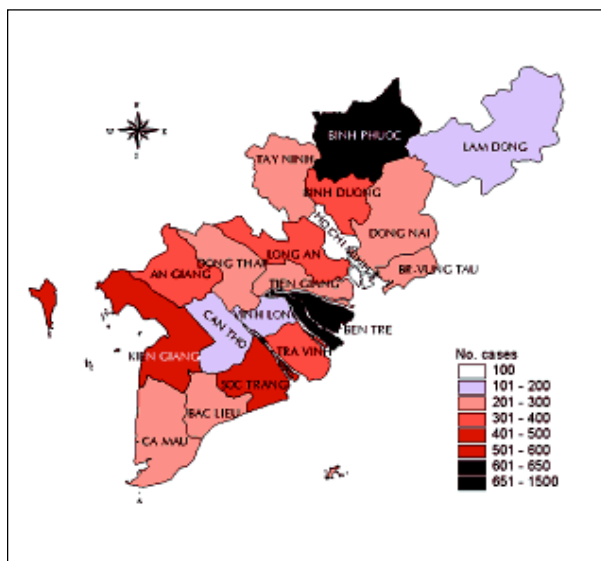


Figure 1. Nineteen provinces in southern Vietnam with mortality rates per 100,000 population, 1998.

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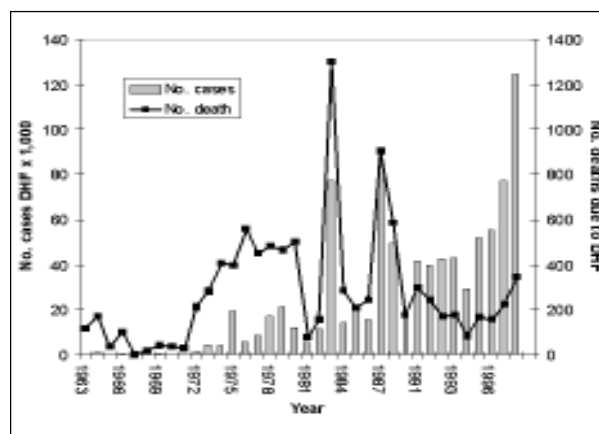


Figure 2. Reported cases of dengue hemorrhagic fever in southern Vietnam, 1963-1998.

Dispatches

Hygiene and Preventive Medicine at the district level, then sent to the Provincial Centers of Preventive Medicine. These data were reported weekly to the Pasteur Institute in Ho Chi Minh City. Seventeen of the 19 provinces submitted blood samples to the Institute for virus isolation. One hundred forty-three dengue viruses were isolated from 1,236 blood samples, for a positivity rate of 11.6% (Table 1). Although DEN-1 and DEN-2 had been the most common serotypes (1-4), DEN-3 was isolated in 15 provinces.

The blood samples were obtained on days 1 to 4 after the onset of illness and were stored at -20°C or -70°C before being injected into C6/36 (*Aedes albopictus*) cell cultures seeded at 3 x 10⁵ cells per mL in 1-mL glass tubes. Undiluted blood was injected into duplicate tubes (0.05 mL per tube) and incubated at 28°C for 7 days. Infected cell cultures were harvested and assayed for dengue virus by the direct and indirect fluorescent antibody techniques, with the monoclonal anti-

body SLE 6B6C-1/FITC conjugate and four serotype-specific monoclonal antibodies: DEN-1 (Hawaii 15F3-1-15 and D2-1F1-3), DEN-2 (NGC 3H5-1-21), DEN-3 (H87 5D4-11-24), DEN-4 (H241 1H10-6-7), and Japanese encephalitis (Nakayama 14H5) (5). To detect dengue-specific IgM antibody, samples were tested by IgM-capture enzyme-linked immunosorbent assay (Mac-ELISA) by using the monoclonal antibody SLE 6B6C-1/HRP conjugate (6).

Sixteen of 19 provinces in southern Vietnam submitted patient sera for dengue serodiagnosis. Seropositive results were seen in all provinces throughout the year, and the confirmation rates increased during the DHF season (Table 2). Despite the high sensitivity and specificity of Mac-ELISA for dengue diagnosis, the seropositivity rates in eight provinces were low (< 50%). Clinical diagnoses of DHF during the epidemic in these provinces may have been overestimated, especially in cases of suspected DHF or fever of

Table 1. Dengue viruses isolated, by province, 1998

No.	Prov.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	Lam Dong				2D3		2D3	1D3	5D1 5D3					5D1 10D3
2	Dong Nai						1D2	1D2 1D3			1D2 3D3	1D3		3D2 5D3 1D3
3	Binh Phuoc						1D3					2D3		2D3
4	Binh Duong													1D1
5	BR-V Tau						1D1							1D1
6	HCMC	2D3	1D3				2D3	2D3	2D3	2D3	7D3			18D3
7	Tien Giang						1D1 5D3	1D1 1D2	4D3		3D2 1D3			2D1 4D2 21D3
8	Dong Thap	1D4												1D4
9	Vinh Long		2D1 6D2 3D3				1D2							2D1 7D2 3D3
10	Tra Vinh							1D1 4D2 1D3			4D3 1D4	2D4		1D1 4D2 5D3
11	Can Tho					1D3			1D3					2D3
12	Soc Trang								1D1 5D3					1D1 5D3
13	Ben Tre	1D1 1D3	1D1 2D3			2D3	3D1 8D3	1D3						5D1 14D3
14	An Giang	1D2 1D3			1D3				1D3			1D3		1D2 4D3
15	Bac Lieu					1D3			1D3					2D3
16	Ca Mau					1D3								1D3
17	Kien Giang	2D2 8D3												2D2 8D3
Total		1D1 3D2 12D3 1D4	3D1 6D2 6D3		3D3	5D3	5D1 2D2 18D3	2D1 6D2 17D3	6D1 19D3	2D3	4D2 15D3 1D4	4D3 2D4		17D1 21D2 101D3 4D4
No./No. specimens		17/90	15/142	0/10	3/57	5/103	25/244	25/179	25/104	2/78	20/161	6/53	0/15	143/1,236

Dengue virus serotypes: D1 = DEN1; D2 = DEN2; D3 = DEN3; D4 = DEN4

Dispatches

Table 2. Specimens positive for dengue virus, by province, 1998

Prov	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total & rate (%)
Lam Dong				0*/10	3/10								3/20 (15)
Dong Nai						18/22	4/4			12/16			34/42 (80.95)
Br-V Tau						2/2	4/4						6/6 (100)
HCMC	9/38	35/82	6/23	20/48	14/21	38/54	78/117	71/79	40/83	63/162	24/54	16/66	414/827 (50.06)
Long An		0/38				16/24		6/7	2/3				24/72 (33.33)
Tien Giang					1/6	23/67			6/8	4/4	10/10	3/3	47/98 (47.96)
Ben Tre					9/14		25/32	16/21	12/26	3/3			65/96 (67.71)
Vinh Long		17/98				41/57							58/155 (37.42)
Tra Vinh							19/27	5/6	10/17	5/6			39/56 (69.64)
Dong Thap	3/5		1/3	1/5					3/4				8/17 (47.06)
Can Tho			2/3	1/2	11/17								14/22 (63.64)
Soc Trang							1/2	8/28					9/30 (30)
An Giang	28/118	25/101	45/138	51/117	72/116	55/68	62/86	88/114	50/88	37/60	26/38	3/4	542/1,048 (51.72)
Ca Mau					6/7	8/12	1/6			9/12	4/4		28/41 (68.29)
Bac Lieu				1/2	3/11								4/13 (30.77)
Kien Giang	1/17	0/5					0/7			11/13	0/1	0/1	12/44 (27.27)
Total	41/178	77/324	54/167	74/184	119/202	201/306	194/285	194/255	123/229	144/276	64/107	22/74	1,307/2,587 (50.52)

*Number of positive specimens/total number of sera tested by IgM capture enzyme-linked immunosorbent assay (Mac-ELISA)

unknown origin. As a result, hospitals in these provinces were overwhelmed by patients, to the extent that the quality of treatment has been affected.

Conclusions

During 1990-1998, dengue viruses were most often recovered in children 5 to 14 years of age (3). In the 1998 outbreak, more dengue viruses were isolated from adults (18.2%) than in the previous 4 years. Adults are not likely to have been exposed to the emerging DEN-3 virus.

From 1987 to 1998, the dengue virus serotypes in circulation changed (3). DEN-2 was responsible for the 1987 epidemic. From 1990 to 1995, DEN-1 predominated, but had decreased to 11.9% by 1998. DEN-2 accounted for 42.2% of the serotypes identified in 1997, but had decreased to 14.7% by 1998. The circulation of DEN-3 was the

lowest during 1987-1994; increased to 29.5% by 1996, 42.2% by 1997, and 70.6% in 1998; and was the predominant serotype of the 1998 epidemic.

DEN-3 virus was first detected in 1987 only in Ho Chi Minh City, but by 1991 it was also identified in Tien Giang Province (7). In 1994 it appeared in Tien Giang and Soc Trang, in 1997 in four additional provinces, and by 1998 in 15 provinces. After a 5-year absence, DEN-4 virus was also detected in Dong Thap and Tra Vinh provinces in the Mekong Delta.

During a 1998 DHF epidemic affecting 19 provinces in southern Vietnam, 119,429 cases and 342 deaths were reported, for an increase of 152.4% and 151.8%, respectively, over 1997. It was the largest DHF epidemic in Vietnam since 1963. DEN-3, which began to emerge in southern Vietnam in 1994, was the serotype associated with the 1998 epidemic. The simultaneous

emergence of DEN-4 should alert public health officials to the potential for outbreaks associated with that serotype. Virologic and serologic surveillance indicate that dengue is endemic in southern Vietnam and that the Dengue Control Program should be implemented in the interepidemic phase—in the first quarter of every year.

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