

# THE 1982 DENGUE EPIDEMIC IN MALAYSIA: EPIDEMIOLOGICAL, SEROLOGICAL AND VIROLOGICAL ASPECTS

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## INTRODUCTION

Dengue fever (DF) in Malaysia was initially described by Skae (1902), and although it is endemic it does occasionally occur in localized outbreaks (Smith, 1956). Dengue haemorrhagic fever (DHF), on the other hand was first recognized on Penang island in 1962 (Rudnick *et al.*, 1965), a major outbreak was reported in 1973 (George *et al.*, 1974; Wallace *et al.*, 1980), followed by another in 1974 (Institute for Medical Research, (IMR) 1974). Since then DF/DHF has remained a public health problem with an endemic level of about 7 per 100,000 population per year (Ministry of Health, unpublished data).

In 1982, the country experienced the biggest outbreak of DF/DHF in its history. A total of 3,005 cases with 35 deaths was reported from all 14 states in Malaysia with a total population of 13.5 million (Population Census 1980).

This study presents epidemiological, serological and virological aspects of the 1982 epidemic.

## MATERIALS AND METHODS

DF/DHF has been a notifiable disease in Malaysia since 1971. The criteria for the diagnosis and categorization of the disease into DF, DHF, and Dengue Shock Syndrome (DSS) are based on the World Health Organization classification of dengue syndromes (WHO, 1980).

Data of DF/DHF cases were received by Epidemiology Unit of Ministry of Health through daily telephone and weekly returns from all 14 States of Malaysia.

Sera from clinically suspected cases were tested using the modified haemagglutination inhibition (HI) procedure of Clarke and Casals (Sever, 1962). Suckling mouse brain antigens were prepared by the sucrose-acetone method. Six antigens were used routinely: Sindbis (SIN) strain P-886, of the alphaviruses; Dengue-1 (DEN 1) Hawaiian strain, Dengue 2 (DEN-2), Trinidad 1751 strain, Dengue 3 (DEN-3), H-87 strain, Dengue 4 (DEN-4), H-241 strain, and Japanese Encephalitis (JE), Nakayama strain, of the flaviviruses. Acetone-extracted sera diluted 1 : 10 to 1 : 10, 240 were tested against 8 units of each antigen.

A positive diagnosis was recorded when a four fold rise in antibody titre occurred between acute and convalescent sera, particularly with the dengue antigens. A presumptive positive diagnosis was considered when a titer of 1 : 1280 or higher was obtained in a single serum. Serologic results where the rise in titer between paired samples was less than fourfold or where the titer of a single specimen was less than 1 : 1280 were reported as inconclusive.

Titers of less than 1 : 20 for the acute sera, and less than 1 : 2560 in the convalescent sample constituted a primary antibody response. A secondary response was indicated if antibody (> 1 : 20) was present in the acute sample and a fourfold or greater rise in titre

was obtained in the second sample. A secondary response was considered for a single serum when a titer of 1 : 1280 or greater was obtained. Single samples with a titer of 1 : 640 or less were considered unclassifiable (WHO, 1980).

Two systems were used for dengue viral isolation; the intrathoracic inoculation of *Toxorhynchitis splendens* mosquitoes, and *Aedes pseudoscutellaris* (AP-61) cell lines. In the former, mosquito head squashes were examined 10-14 days after inoculation by direct immunofluorescence with fluorescein conjugated pooled human convalescent serum. Mosquito cells inoculate with patients' sera were routinely examined after 10-14 days by direct immunofluorescence.

Typing of virus isolates was by indirect immunofluorescence using type specific monoclonal antibodies kindly provided by Drs. T. Monath and N. Karabataos, WHO Collaborating Centre for Arbovirus Reference and Research, Fort Collins, Colorado. A total of 95 acute sera of patients from General Hospital, Kuala Lumpur were processed for virus isolation.

## RESULTS

Results of the clinical findings of this outbreak, with particular reference to the General Hospital, Kuala Lumpur, have been reported elsewhere (George and Tuen, 1983).

Data from the Ministry of Health, Malaysia, show an average incidence of 49 cases per month between January and June 1982. In July, there were 122 reported cases, while a peak of 1,383 cases was reached in August (Fig. 1).

The majority of patients (about 56%) in this epidemic were 15 years of age and above. Children aged 0-9 years accounted for 29.1% of the cases (Table 2). Data for Peninsular Malaysia, indicated that the age group with

the highest risk was 5-8 years with an age-specific incidence of 38.2 per 100,000 per year (Ministry of Health, unpublished data). There appeared to be no significant sex differences in the notified dengue cases, with a sex female: male ratio of 1 : 1.06.

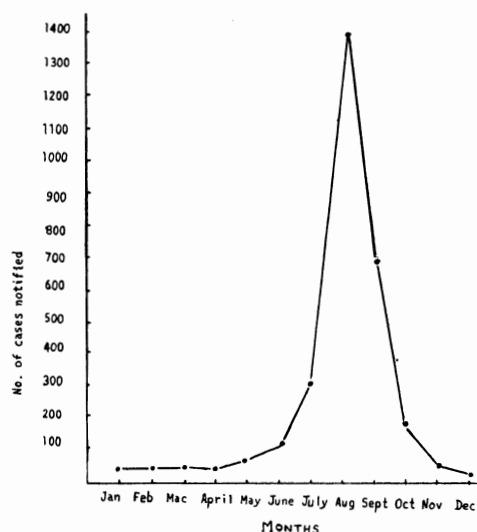


Fig. 1—Distribution of notified DF/DHF cases by month, 1982. (Epidemiology Unit, Ministry of Health).

There was a total of 35 reported dengue deaths for the year, 18 of which occurred during the epidemic months of July to October. Sixteen of the 35 deaths were 15 years or older, one was an infant, and the rest were aged between 1-14 years (Table 1).

The main ethnic group affected was the Chinese, with 58.3%, while the Malays accounted for 36.1%. The Indians and other races made up 3.9% and 1.7% respectively (Table 2).

A total of 1,001 laboratory confirmed cases were obtained (Tables 3 and 4). Of these positive cases, 88 showed haemorrhagic manifestations, and 3 suffered from shock.

There was a significant rise in the number of cases during the months of July, August,

Table 1

Distribution of cases and deaths and incidence of DF/DHF by State in Malaysia.

State	DF	DHF	Total DF & DHF		Incidence Rate* per 100,000
			No.	%	
Perak	342	127 (3)*	469	15.6	26.6
Pulau Pinang	283	161 (3)	444	14.8	48.7
Selangor	333	81 (6)	414	13.8	28.2
Wilayah Persekutuan	194	167 (6)	358	11.9	38.2
Kelantan	277	24 (3)	301	10.0	34.3
Johor	197	66 (1)	263	8.8	16.4
Pahang	145	26 (1)	171	5.7	22.2
Sarawak	92	44 (1)	136	4.5	10.5
Melaka	60	70 (4)	130	4.3	28.7
Negri Sembilan	75	46 (2)	121	4.0	21.5
Kedah	53	10 (0)	63	2.1	5.3
Perlis	42	16 (0)	58	1.9	39.4
Trengganu	39	12 (2)	51	1.7	9.4
Sabah	13	13 (3)	26	0.9	2.6
Total	2,145	860 (35)	3,005	100	22.4
Percentage	71.4	28.6	100		

\*Death shown in parenthesis.

\*\*Incidence rates are obtained on the population of 1980 obtained by Census. Data from Epidemiology Unit, Ministry of Health.

and September. Most of the cases occurred in the states of Selangor (which includes Wilayah Persekutuan), Perak, Penang and Kelantan. The majority of the cases were in young adults, i.e. over the age of 15, (64% of the total). There were 28 laboratory confirmed cases whose ages could not be determined (Table 4). There was no significant difference in the number of males and females affected. The Chinese were the main ethnic group affected, followed closely by the Malays.

Of the 95 sera from which virus isolation was attempted; 9 dengue viruses were isolated. There were 5 DEN-1 isolates, 2 DEN-2,

1 DEN-3, and 1 untyped. Six of the dengue strains were recovered from patients over 15 years of age. The age of one of the patients was unknown. The isolates were all from single serum samples, and classification of the antibody response was not possible due to serum titers of less than 1 : 640.

## DISCUSSION

The epidemiology of dengue disease in Malaysia from 1973 to 1982 has been described by Lo and Awin (1983). The 1982 dengue outbreak is considered the most severe in

Table 2  
Age, ethnic and sex distribution of notified  
DF/DHF infections.

Age Group (years)	Percent
0-4	10.6
5-9	18.5
10-14	14.9
< 15	44.0
≥ 15	55.9
Ethnic Group	
Chinese	58.3
Malay	36.1
Indian	3.9
Others	1.7
Sex	
Male	51.4
Female	48.6

Data from Epidemiology Unit, Ministry of Health.

Malaysian history, as its magnitude (3,005 cases) was about twice that of the 1974 epidemic (1,482 cases), and four times the average annual incidence for the period 1975-1981.

In 1982, all the states in Malaysia were affected, whereas in previous years cases had been confined to a few states in Peninsular Malaysia (IMR Annual Reports, 1974-1982). The state with the highest number of notified cases was Perak (469), although if the data for Selangor (414) and Wilayah Persekutuan (369) were to be combined, then Perak would rank second in terms of the absolute number of cases notified. DF/DHF was reported in Perlis, Sabah and Sarawak for the first time. The upsurge of dengue in states like Kelantan, Sarawak and Sabah may be explained by rapid development, urbanization, population movement, and increased public awareness in recent years. More than 80% of the notified cases were from urban centres.

It appears that a shift in the main age group affected by the disease occurred in 1982. During the 1973 outbreak, 54% of the laboratory confirmed cases were under 15 years of age (Wallace *et al.*, 1980), whereas in 1982, this age group only accounted for 36% of the total (Table 4). Fifty six percent of the notified cases in 1982 were over 15 years of age, compared with 35.5% for 1974. This change in age group was also reflected in the mortality data. In the 1973 epidemic, all the fatalities were from 0-10 years old (Wallace *et al.*, 1980), whereas in 1982, only 12 of the 35 fatal cases occurred in this age group. The reason for this shift is unclear, but could be related to the immunity status of the community in which the viruses circulate, and immunopathology of the disease. The case fatality rate (CFR) for 1982 was 1.16%, was low compared with 1974-1981. This low CFR could be due to a genuine decline in case fatality as a result of increased public awareness, better diagnosis and early treatment, or a shift in the virulence of the virus. On the other hand, the decline may only be apparent. This could be due to overnotification, i.e. a large number of false positives being notified as DF/DHF: a result of the intensive publicity and health education campaigns carried out by the health authorities, and voluntary agencies.

While all ethnic groups were involved, the Chinese living mainly in urban areas were most seriously affected. This was in accordance with the data of previous years. There was also a marked increase amongst the Malays, probably due to the recent increase in migration to the urban areas. Chinese accounted for 21 out of 35 deaths, whereas 12 out of 35 deaths were Malays. The remaining 3 deaths were from indigenous population of Sabah.

The virus isolation rate from the IMR was low, and made interpretation difficult, although DEN-1 appeared to be the main sero-

Table 3

Distribution of laboratory confirmed dengue cases in 1982 by state and month.

Months	Perlis	Kedah	Penang	Perak	Selangor	N.Sembilan	Malacca	Johore	Pahang	Trengganu	Kelantan	Sabah	Sarawak	Total
January	-	-	4	4	22	5	1	13	-	-	2	-	1	52
February	-	-	4	7	6	1	1	10	1	-	2	-	3	35
March	-	-	-	2	16	2	-	6	1	-	1	2	1	31
April	-	-	7	4	24	3	1	5	-	-	2	5	-	51
May	-	-	-	6	25	2	2	4	3	1	-	1	-	44
June	-	1	12	16	35	2	6	12	1	-	1	1	-	87
July	-	8	29	51	38	4	6	6	3	-	12	-	1	158
August	1	7	33	50	34	10	8	16	14	3	36	10	11	233
September	3	12	29	39	39	11	2	12	13	1	40	4	13	238
October	-	1	10	4	4	1	1	11	3	1	4	5	2	47
November	1	3	4	1	2	-	-	3	-	-	1	-	1	16
December	-	1	-	2	-	-	-	-	1	-	1	2	2	9
<b>Total:</b>	<b>5</b>	<b>33</b>	<b>132</b>	<b>206</b>	<b>245</b>	<b>41</b>	<b>28</b>	<b>98</b>	<b>40</b>	<b>6</b>	<b>102</b>	<b>30</b>	<b>35</b>	<b>1,001</b>

Data from Institute for Medical Research.

Table 4

Laboratory confirmed dengue cases in 1982 by month age, sex and ethnic group.

Months	Age				60	Unknown	Sex		Ethnic Groups		Indians	Others	Total
	0-4	5-15	15-24	25-29			Male	Female	Malays	Chinese			
January	1	11	21	19	-	-	20	32	28	21	2	1	52
February	1	7	12	2	-	3	20	15	20	14	1	-	35
March	2	9	12	8	-	-	16	15	14	14	2	1	31
April	5	15	14	16	-	1	33	18	26	19	3	3	51
May	1	11	16	15	-	1	23	21	23	16	4	1	44
June	4	22	26	33	-	2	50	37	31	51	4	1	87
July	8	60	43	44	-	3	87	71	51	99	7	1	158
August	11	72	81	57	2	10	105	128	95	121	10	7	233
September	7	78	85	61	-	7	109	129	95	125	13	5	238
October	3	14	14	15	-	1	27	20	18	24	3	2	47
November	-	2	5	9	-	-	8	8	8	6	1	1	16
December	-	4	1	4	-	-	6	3	1	7	1	-	9
Total	43	305	330	293	2	28	504	497	410	517	51	23	1,001

Data from Institute for Medical Research.

type involved. Data from the WHO Collaborating Centre for Arbovirus Reference and Research (1982), however, indicate DEN-3 to be the main isolate. The 9 DEN-3 isolates obtained by the WHO Centre were from July onwards, probably associated with the peak of this outbreak. If the data from the IMR and the WHO Collaborating Centre were to be combined, the major epidemic type would then be DEN-1 (11 isolates), followed by DEN-3 (10 isolates) and DEN-2 (8 isolates), with 9 untyped isolates. No DEN-4 was isolated. It would appear, that DEN-1 and DEN-3 were the main serotypes involved in this outbreak. This is in contrast to the previous years when DEN-1 and DEN-2 were the predominant serotypes and to the 1973 outbreak when DEN-3 was incriminated as the main epidemic type (Wallace *et al.*, 1980). It should be noted that the isolates were only obtained from Wilayah and Selangor, probably as a result of the difficulties in transportation of suitable specimens from other states. Hence the pattern of virus infectivity may not be representative of the whole country.

#### SUMMARY

In 1982, Malaysia experienced the worst dengue/dengue haemorrhagic fever outbreak in its history. All states in Peninsular and East Malaysia were similarly affected. There was a total of 3,005 cases with 35 deaths, with the majority of cases occurring between the months of July to October. There was a total of 1,001 laboratory confirmed cases. Most of the cases were in patients over the age of 15 years. The Chinese population was mainly affected, although a much higher proportion of Malays was noted in comparison to previous years. The main serotypes involved were dengue-1 and dengue-3. No dengue-4 serotype were isolated.

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#### REFERENCES

- ANNUAL REPORT, (1982). WHO Collaborating Center for Arbovirus Reference and Research - Department of Medical Microbiology, University of Malaya, Kuala Lumpur.
- CLARKE, D.H. and CASALS, J., (1958). Techniques for haemagglutination and haemagglutination-inhibition with arthropod-borne viruses. *Amer. J. Trop. Med. Hyg.*, 7 : 561.
- GEORGE, R., MOHD. SHAM BIN KASSIM and LIM, T.W., (1974). Mosquito-borne haemorrhagic fever. *Med. J. Malaysia*, 29 : 11.
- GEORGE, R. and TUEN, K.S., (1983). Changing pattern in the clinical presentation of dengue haemorrhagic fever in Malaysia during the period 1962-1972 and clinical studies of 89 serologically proven cases during 1982 epidemic. *In: Proceedings of the International Conference on Dengue/Dengue Haemorrhagic Fever*. University of Malaya Press.
- GILL, M.S., (1978). Dengue haemorrhagic fever in Malaysia. *ASEAN J. Infect. Dis.*, 2 : 9.

- INSTITUTE FOR MEDICAL RESEARCH, (1974-1982). Annual Reports. Inst. Med. Research, Kuala Lumpur, Malaysia.
- KUBERSKI, T.T. and ROSEN, L., (1977). A simple technique for the detection of dengue antigen in mosquitoes by immunofluorescence. *Amer. J. Trop. Med. Hyg.*, 26 : 533.
- LO, E.K.C. and NARIMAH bt AWIN, (1983). Epidemiology of dengue disease in Malaysia, 1973-1982. *J. Malaysia Soc. Hlth.*, (in press)
- RACE, M.W., WILLIAMS, M.C. and AGOSTINI, C.F.M., (1979). Dengue in the Caribbean: Virus isolations in a mosquito (*Aedes pseudoscutellaris*) cell line. *Trans. Roy. Soc. Trop. Med. Hyg.*, 73 : 18.
- ROSEN, L. and GUBLER, D., (1974). The use of mosquitoes to detect and propagate dengue viruses. *Amer. J. Trop. Med. Hyg.*, 23 : 1153.
- RUDNICK, A., TAN, E.E., LUCAS, J.K. and MOHAMED BIN OMAR, M., (1965). Mosquito-borne haemorrhagic fever in Malaya. *Brit. Med. J.*, 4 : 1269.
- SEVER, J.L., (1962). Application of a micro-technique to viral serological investigations. *J. Immunol.*, 88 : 320.
- SKAE, F.M.T., (1902). Dengue fever in Penang. *Brit. Med. J.*, 2 : 1581.
- SMITH, C.E.G., (1956). A localized outbreak of dengue fever in Kuala Lumpur : Epidemiological and clinical aspects. *Med. J. Malaya.*, 10 : 289.
- WALLACE, H.G., LIM, T.W., RUDNICK, A., KNUDSEN, A.B., CHEONG, W.H., and CHEW, V., (1980). Dengue haemorrhagic fever in Malaysia : The 1973 epidemic. *Southeast Asian J. Trop. Med. Pub. Hlth.*, 11 : 1.
- WHO, (1980). Guide for diagnosis, treatment and control of dengue haemorrhagic fever (Second edition). Technical Advisory Committee on dengue haemorrhagic fever for the South East Asian and Western Pacific Regions.