

## Review

# Imported dengue fever/dengue hemorrhagic fever cases in Japan

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Published online 12 October, 2011

**Abstract:** Several dengue outbreaks occurred in Japan from 1942 to 1945. Dengue fever emerged in Nagasaki in August 1942 and soon spread to other cities such as Sasebo, Hiroshima, Kobe and Osaka, recurring every summer until 1945 and constituting the greatest outbreak in the temperate zone. Domestic outbreaks have not been reported in Japan since then. However, the number of imported dengue cases has increased year by year: 868 imported cases were reported in Japan between 1999 and 2010 according to the Infectious Diseases Control Law. Moreover, 406 imported cases were confirmed to be dengue virus infection among 768 dengue suspected cases received at NIID from 2003 to 2010. A total of 142 cases (35.6%), 103 cases (25.8%) and 62 cases (15.5%) were noted in the 20–29, 30–39 and 40–49 age groups, respectively. Infecting dengue virus serotypes were determined for 280 of the 406 cases. The number of cases infected with each of the 4 serotypes was 98 (35%) with type 1, 78 (28%) with type 3, 72 (26%) with type 2, and 32 (11%) with type 4. Sixty percent of dengue cases were imported from July to October, the summer vacation season in Japan.

**Key words:** dengue fever, imported case

Dengue virus infections are a major public health problem in tropical and subtropical countries around the world [1, 2]. In Japan, which is located in the temperate zone, there were dengue outbreaks from 1942 to 1945. Dengue fever emerged in Nagasaki in August 1942 and soon spread to other cities such as Sasebo, Hiroshima, Kobe and Osaka, recurring every summer until 1945 [3]. Endemic cases had been reported in Okinawa since 1893 before the outbreak [4]. Domestic outbreaks have not been reported in Japan since 1945, but there have been many imported dengue cases [5]. Dengue fever (DF), including dengue hemorrhagic fever (DHF), is one of the Category IV notifiable infectious diseases designated by the Infectious Diseases Control Law of Japan since 1999. In the present study, the demographic features of imported DF/DHF cases confirmed by laboratory tests were analyzed over the period from 2003 to 2010 at the Vector-Borne Virus Laboratory, Department of Virology 1, National Institute of Infectious Diseases (NIID), Japan.

We confirmed 406 cases of dengue virus infection from 2003 to 2010: 28 cases in 2003, 20 in 2004, 43 in 2005, 29 in 2006, 51 in 2007, 67 in 2008, 43 in 2009 and 124 in 2010 (Table 1). We received blood specimens from 768 suspected dengue cases for laboratory confirmation. The rate of confirmation was 52.8% among clinically suspected cases over the 8-year period.

Infecting dengue virus serotypes were determined for 280 cases by real-time reverse transcriptase polymerase chain reaction (TaqMan method) [6] (Table 2). The number of cases infected with each of the 4 serotypes was 98 (35%) with type 1, 78 (28%) with type 3, 72 (26%) with type 2, and 32 (11%) with type 4. Interestingly, there was no case infected with dengue virus type 4 in 2003 or 2006 and only one in 2007, but the number increased to 7 in 2008, 8 in 2009 and 10 in 2010. Age distribution was analyzed for the

Table 1. The number of DF/DHF cases confirmed in Department of Virology 1, National Institute of Infectious Diseases.

Year	Cases examined and confirmed in NIID		
	examined	confirmed	positive rate (%)
2003	41	28	68.3
2004	54	20	37.0
2005	71	43	60.6
2006	100	29	29.0
2007	104	51	49.0
2008	129	67	51.9
2009	86	44	51.2
2010	183	124	67.8
Total	768	406	52.9

Table 2. Dengue virus types detected in dengue cases from 2003 to 2010

Dengue virus type	2003	2004	2005	2006	2007	2008	2009	2010	Total (%)
type 1	4	6	8	10	10	17	8	35	98 (35%)
type 2	8	4	5	1	5	9	13	27	72 (26%)
type 3	4	0	13	9	16	16	7	13	78 (28%)
type 4	0	2	4	0	1	7	8	10	32 (11%)
Total	16	12	30	20	32	49	36	85	280

Table 3. Age distribution of dengue cases

Age	year	2003	2004	2005	2006	2007	2008	2009	2010	Total
0–9		0	1	2	1	2	1	0	2	9
10–19		2	2	1	5	3	3	1	13	30
20–29		9	5	10	10	24	22	14	48	142
30–39		11	9	16	4	9	14	16	24	103
40–49		2	1	7	6	8	9	7	22	62
50–59		0	2	3	1	4	9	3	8	30
≥60		1	0	4	1	1	8	1	7	23
unknown		3	0	0	1	0	1	2	0	7
Total		28	20	43	29	51	67	44	124	406

Table 4. Monthly distribution of dengue cases

month	year	2003	2004	2005	2006	2007	2008	2009	2010	Total
Jan		1	1	3	1	0	2	5	3	16
Feb		2	0	2	0	3	7	4	4	22
Mar		2	0	0	3	4	2	0	8	19
Apr		2	0	1	5	5	1	2	9	25
May		2	0	0	1	3	6	3	5	20
Jun		2	0	3	2	3	4	0	5	19
Jul		5	3	2	4	7	7	2	12	42
Aug		5	9	7	2	10	10	7	25	75
Sep		2	6	11	3	5	12	9	25	73
Oct		3	1	5	2	6	9	10	19	55
Nov		1	0	7	1	3	6	0	6	24
Dec		1	0	2	5	2	1	2	3	16
Total		28	20	43	29	51	67	44	124	406

399 cases in which information on age was available (Table 3). A total of 142 cases (35.6%) were in the 20–29 year age-group, the most active for overseas travel, while 103 cases (25.8%) and 62 cases (15.5%) were noted in the 30–39 and 40–49 year age groups, respectively. Thus, 165 cases (41.4%) ranged in age between 30 and 49, an age-group that often traveled abroad for business. Monthly distribution was analyzed (Table 4), and cases were found

to occur in all of the 12 months. However, 75 cases were diagnosed in August, 73 in September, 55 in October and 42 in July, indicating that 60% of dengue cases were imported from July to October. The period from July to September is the summer vacation season in Japan when many overseas travelers visit dengue endemic areas. According to Japanese Emigration and Immigration Management, about 40% of immigration was recorded from July to September.

Table 5.

Year	Number of reported cases
1999	9
2000	18
2001	50
2002	52
2003	32
2004	49
2005	74
2006	58
2007	89
2008	104
2009	88
2010	245
Total	868

Up to 100 million cases of dengue fever (DF) and 250,000 cases of dengue hemorrhagic fever (DHF) are estimated to occur annually in the world [7], and the epidemics have been expanding. Recently, dengue outbreaks occur every year in Taiwan [8], and dengue virus endemicity was confirmed for the first time in Nepal [9, 10]. Nearly 11 million Japanese visit tropical and subtropical areas annually and 2 million people visit Japan from these areas. The number of imported dengue cases has increased year by year, 245 imported cases being reported in 2010 and total 868 cases being reported between 1999 and 2010 according to the Infectious Diseases Control Law (Table 5). Dengue epidemics often occur in urban areas because the breeding sites of *Aedes aegypti* concentrate in residential areas. The urbanization of dengue endemic countries contributes to frequent dengue epidemics or outbreaks in tropical and subtropical regions. Japanese travelers trend to visit urban areas more frequently than rural areas. There is a need for closer surveillance of DF and DHF in Japan. Updated information on dengue should be made available for the travelers to tropical and subtropical areas.

## ACKNOWLEDGMENTS

This work was supported by grants for Research on Emerging and Re-emerging Infectious Diseases (H20-shinkou-ippan-015 and H23-shinkou-ippan-010) from the Ministry of Health, Labour and Welfare, Japan.

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