

Japanese B Encephalitis Among United States Marines at Nham Phong
Marine Air Base, Thailand, July 1972

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INTRODUCTION: In July 1972 the occurrence of cases of Japanese B encephalitis at a United States Marine Air Base provided an opportunity to study the epidemiology of Japanese encephalitis virus in a population of United States servicemen at risk.

OBJECTIVE: To describe an acute outbreak of Japanese encephalitis among susceptible U.S. servicemen.

DESCRIPTION: Nham Phong Marine Air Base is located approximately 60 miles south of Udorn, and 30 miles north of Khon Kaen on the Korat Plateau in central Thailand. The area surrounding the base is an elevated scrub forest interrupted by rice paddies approximately 700—900 feet above sea level. The base itself was under construction, the men living in canvas tents. Roads were unpaved; water services consisted of water trailers of potable water brought from a water treatment point. Urine "tubes" and "burn out" latrines were used for human waste disposal. Shower areas were not screened and were operational daily for only limited periods. The men were provided with insect repellent, bed nets, and insect spray.

The base was divided into several discrete living areas (see map Fig. 1). The construction battalion (MCB-5) and the logistic support group (LSG) had their own galleys and dispensaries and were located at the north—west end of the runway. Security, MABS-15, and HAMS-15 were located south of the runway and had their meals served on the flight line.

METHODS:

Clinical Cases: Patients seen at the sick bay at Nham Phong with clinical signs and symptoms (fever, headache, stiff neck) suggesting Japanese B infection were examined and blood was drawn for serological testing. Patients were hospitalized at the 432nd Air Force Hospital, Udorn RTAFB. The patients were visited in the hospital and their clinical charts reviewed.

Serum Survey: A serum survey of randomly selected individuals was begun on 15 July 1972. (From each unit men were selected by randomly choosing final digits of the social security number). Men selected were subsequently identified in either pay lines or unit formations. One month following the original serum collection an attempt was made to re—bleed as many individuals as could be found. The sera were transported to the SMRL for HAI testing against dengue I—IV and chikungunya antigens as well as against JEV.

Village Survey: Three Thai villages in the vicinity of the base were visited to assess their possible contribution to the outbreak among the U.S. servicemen. The distances from these village areas to the Air Base are within the flight range of the known vector mosquitoes in Thailand. Each village consists of approximately 70 elevated wooden houses. Each house has animal pens underneath to keep hogs and cattle. The agricultural industry in the area consists of rice, cattle, kenaf fiber, hogs, silk and corn.

Entomological Survey: New Jersey light traps were operated inside the theater tent of LSG and in the area of the outdoor theater of the MCB-5 group. Battery—powered CDC traps were run in the vicinity of the LSG showers and the southern end of the runway. CDC traps were also placed in various locations in the villages. These traps were operated for two consecutive nights.

PROGRESS:

Clinical Cases: Seventeen patients from Nham Phong Marine Air Base were hospitalized with a presumptive diagnosis of Japanese B encephalitis. Sixteen patients were hospitalized at the 432nd Air Force Hospital at Udorn RTAF Base. One patient became ill in-transit to Japan and was hospitalized there. Three other patients were seen and followed closely at the Sick Bay at Nham Phong. Fourteen of the total of 20 patients (17 hospitalized, 3 followed as outpatients) demonstrated serological evidence of recent infection with Japanese B encephalitis virus, and of these, eleven had clinical and laboratory evidence of encephalitis.

Serum Survey: At the time of the first serum collection in July, 436 men contributed specimens for testing. One month later 351 of these were available for rebleeding and 332 were ultimately re-bled (see Table 1). This represents approximately a 20% sample from the five units that were bled.

Thirty-one persons re-bled had a rise in titer from the first bleed to the second. Fifty-seven persons had a fixed titer in the two specimens of 1:80 or greater. Thus a total of 88 persons of the sample of 332 had evidence of infection with JEV. Thus (assuming the sample is representative) 27% of the men in these five units were infected with JEV during the period of the epidemic. There were approximately 1800 persons in these five units, indicating approximately 480 men were infected. There were 8 cases of clinically recognized encephalitis among the men in these units yielding an apparent to inapparent clinical encephalitis ratio of 1:60. (Weighting the percentage by units would give a ratio of 1:63. (See Table 2).

As can be seen in Table 3 the Security and LSG units had a greater percentage of persons positive for JEV antibody possibly indicating greater exposure. This increased exposure may be explained by night-time activity (see Table 3). Security is responsible for patrols around the base at night; almost all of the men in this group may thus have been exposed to the mosquito vectors. LSG, the logistic support group, had men working in bulk fuel and in the ammunition dump at night; thus their exposure may also have been high.

Rates of non-specific URI illness during the period of the outbreak were similar between those developing JEV antibody and those not developing antibody. Those with no JEV antibody titers had more illness in each category. (See Table 4).

Village Survey: There were no known human cases of encephalitis among the villagers at any time before, during, or after the period when cases were appearing on the Air Base. Approximately 60% of the swine in the villages were bled and serologic evidence indicated that transmission in swine had occurred in the area within the previous five months.

Entomological Survey: Mosquito collections made on the base on the nights of 10 and 20 July yielded adults of three proven JEV vectors, *Culex fuscocephala*, *C. gelidus* and *C. tritaeniorhynchus*. These and other *Culex* species were the most abundant mosquitoes in these collections. The drainage system of the base seemed excellent, with little permanent standing water, except for a marshy area receiving waste water which was located about 50 meters west of the LSG showers. Larvae of *C. fuscocephala* were present in this drainage area.

Mosquito collections in the villages also yielded all three vector species. Larvae of *C. fuscocephala* and *C. tritaeniorhynchus* were also collected in the vicinity of each of the villages.

SUMMARY: An outbreak of Japanese B encephalitis occurred at Nham Phong Air Base where approximately 3000 presumably non-immune US servicemen were stationed. From the middle to the end of July, 14 clinically apparent encephalitis cases occurred and were sent to Udorn RTAFB Hospital for treatment. It is estimated that approximately 850 inapparent infections also occurred. At this time, in the early rainy season, large numbers of all three vector mosquitoes were present; night duty, night-time outdoor movies, and night-time outdoor showers all contributed to exposing the men to the vector mosquitoes.

None of the villagers in the surrounding Thai villages reported clinical encephalitis. The villages did contain pig herds with 60–80% of the pigs having JEV antibody. In one village, 80% of the pigs under 5 months of age had antibody, indicating transmission in the recent past months. Almost certainly the large number of susceptible pigs, within easy flight range of the vector mosquitoes, performed their now familiar role as an amplifying host.

Table 1.
Units Submitting Serum Specimens

Unit Name	Approximate No. in Unit	No. Bled 1st Bleed	No. Re – Bled	% of Unit Re – bled
Security	350	67	54	15 %
MABS – 15	357	111	76	21 %
HAMS – 15	588	79	60	10 %
LSG	300	54	39	13 %
MCB – 5	506	125	103	20 %
Total	1801	436	332	18 %

Table 2.
JEV Infections by Unit

Unit	No. in Unit	Percent of Men Tested with JEV Infection	Number Estimated JEV Infection	No. Cases	I/A
Security	350	48%	168	1	168/1
MABS–15	357	28%	100	2	50/1
HAMS–15	588	15%	87	1	87/1
LSG	300	43%	130	2	65/1
MCB–5	506	17%	86	3	28/1
Total	1801	26.7%	571	9	63/1

Table 3.
Night Exposure by Units

Unit	% with JEV	Average Nites Exposed per Man
Security	48	6.65
MABS-15	28	0.68
HAMS-15	15	0.16
LSG	43	1.26
MCB-5	17	0.98

Table 4.
Reports of Illness Among Persons Included in Serologic Survey

Symptoms	With JEV Antibody		Without JEV Antibody	
	#	%	#	%
Total	88	100	246	100
Visits to dispensary in last month	4	4.5	11	4.5
With some complaint	25	28.4	83	33.7
Headache	14	15.9	48	19.5
Cold	10	11.3	37	15.0
Fever	5	5.7	16	6.5
Stiff neck	4	4.5	18	7.3
Headache & Fever	3	3.4	10	4.1

Figure 1

Nham Phong Marine Air Base

