

Epidemiologic Investigation of Cases of Acute Hepatitis
Among Troops of the Thanarat Army Base,
30 October - 2 November 1978

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OBJECTIVE : To conduct epidemiological studies of the etiology and mode of transmission of cases of acute hepatitis at the Thanarat Army Base, and, based on the findings, to make recommendations for hepatitis control.

BACKGROUND : On 3rd October 1978, COL Wittoon, Dr. Rapin and MAJ Burke met at AFRIMS to discuss collaborative laboratory and epidemiologic investigations aimed at curtailing an apparent epidemic of acute hepatitis at the Thanarat Army Base. After obtaining authorization for collaborative investigations, COL Wittoon invited a field research team to the Thanarat Army Base for the period 30 October - 2 November 1978.

The Thanarat Army Base is located in the town of Pranburi in the Province of Prachuap Khiri Khan, about 250 kilometers south of Bangkok on the Gulf of Thailand at the mouth of the Pranburi River. The civilian population of Amphur Pranburi is approximately 90,000. Income is derived from agriculture (growing pineapple, sugar cane, and coconuts) and from fishing.

Four battalion-sized units are billeted at the Thanarat Army Base. Three are infantry units, while one is a special school not within the Infantry Corps command structure (Figure 1). Although data in unit strength was made available to the epidemiologic team for purposes of analysis this information will not be reported here for reasons of security. The four units are :

I. Infantry Combat Battalion. This unit is comprised of men who have completed infantry training. This battalion is mobile and has spent most of the past two years in combat with insurgents in the southern provinces of Thailand.

II. Infantry NCO School. Until recently, this battalion-sized unit had the function of providing a one-year course of specialized infantry training for men who had already completed one year of general NCO training (2nd year students). However, due to a shortage of infantry NCO's, this year a special intensive course was implemented to train men in infantry skills who have had no previous NCO training. (1st year students). A support company is attached to this unit.

* Thanarat Army Base.

III. Infantry Center Support Battalion. This unit is comprised primarily of privates who provide non-skilled support services for the Infantry Center (guards, motor pool, headquarters, staff, etc.)

IV. Permanent NCO School. This unit has no specialized infantry function, and does not fall under the direct Infantry Corps command structure. The permanent NCO school is a base tenant organization that teaches cadets (80% directly from civilian life, 20% from the ranks of enlisted men throughout Thailand) basic NCO skills (math, language, basic firearms, etc.) The course lasts for one year, and graduates usually go to a special corps-specific NCO school for a second year of training. This unit has a support company.

These four major units turn over personnel at different rates and at different times of the year. Personnel in the Infantry Combat Battalion are rotated only sporadically; the second year Infantry NCO class changes 100% every May; the intensive first year course of the Infantry NCO school began with its first class in August 1978; the permanent NCO school turns over 100% each May; and the support companies and the Support Battalion, turn over approximately 25% of their personnel every May and November.

These personnel rotations are diagrammed in Figure 2.

Medical care facilities available at the Thanarat Army Base included the main hospital, with its two small satellite dispensaries, and an administratively separate dispensary at the permanent NCO School. Manpower and patient beds at each of the facilities are summarized in Table 1. Although soldiers at the base typically seek health care first at their own unit's dispensary, all facilities are open to all soldiers, so that Infantry School Students are occasionally hospitalized at the permanent NCO school dispensary, and permanent NCO school students are also occasionally admitted to the main hospital. The more seriously ill patients admitted to the permanent school dispensary are often transferred to the main hospital for more sophisticated treatment.

As the nearest provincial hospital is 30 kilometers from Pranburi, the military hospital serves as a major provider of health care of the civilian community as well as the military population. Nonetheless, the Pranburi military hospital's primary mission is to provide comprehensive health care for the active duty soldiers at the Base.

METHODS : Team description : The AFRIMS investigative team consisted of three physicians (two virologists and one public health specialist) and two field technicians. On-site support was provided by the medical staffs of the Infantry Center and the Infantry School. Laboratory support was provided by the Department of Virology, AFRIMS.

Personnel Interviewed: The following installation personnel contributed materially to the investigation :

- Post Commanding Officer
- Post Deputy Commanding Officer
- Assistant Chief of Staff-Intelligence
- Post Surgeon

Chief, Facilities Engineers
Infantry School Surgeon
Post Environmental Health Officer

Case Ascertainment : From the hospital and dispensary census registries a list was prepared of all patients admitted with a diagnosis of "viral hepatitis" (57 patients) or "jaundice" (5 patients). Currently hospitalized patients were examined. In addition, the records of 24 of these 62 patients were examined, and, with one exception, were all compatible with viral hepatitis. The single exception was the sole fatality, the autopsy diagnosis being "acute leukemia." This case will not be considered further in this report. Cases of "jaundice" were not hospitalized routinely. Mild cases, especially in officers, senior NCOs, and dependents, would probably not be hospitalized. Outpatients records were inadequate to ascertain the number of cases treated in this manner.

Control Selection : From the inpatient registries, controls were selected for each hepatitis patient. The control was selected as the next patient listed in the admission log book after a hepatitis patient. Dispensary controls were sought for dispensary admissions and hospital controls for hospital admissions. Where the nearest admission control was unavailable (TDY, transfer from post, etc.) the next closest admission was sought. Questionnaires and serum samples for these individuals were treated in the same manner as those of hepatitis cases.

Case and Control Investigations : Each case and control located had a serum specimen drawn for serologic studies. In addition, each case and control filled out a questionnaire (Appendix A). The questionnaire identified the study participant as to military unit of assignment, age, and rank. Questions, exposure to hepatitis patients, and activities which may have placed the individual at unusual risk of infection with hepatitis virus.

Laboratory Procedures : Serum specimens from cases and controls were tested as follows :

Anti-hepatitis A antibody: Sera were screened undiluted with a competitive solid phase radioimmunoassay (HAVAB, Abbott Laboratories).

Anti-HAV IgM: Sera were diluted 1:20 with PBS, absorbed twice with whole staph aureus and assayed for residual activity in the HAVAB assay.

Anti-HBs antibody: Sera were screened undiluted by solid phase radioimmunoassay (AUSAB, Abbott Laboratories) and undiluted by counterimmuno-electrophoresis (CIE).

Hepatitis B surface antigen: Sera were tested undiluted by AUSRIA-II (Abbott Laboratories) and CIE.

Specimens positive for antigen by CIE were typed by immunodiffusion against specific rabbit antisera.

Anti-leptospirosis antibody: Sera were screened in an immune hemolysis test with 12 serotypes of leptospira (*L. bataviae*, *icterohaemorrhagiae*, *hebdomadis*, *javanica*, *grippotyphosa*, *canicola*, *autumnalis*, *pomona*, *pyrogenes*, *australis*, *hyos* and *wolssi*). Leptospirosis serology was performed in the laboratory of Dr. Sansiri Sornmanee at the Faculty of Tropical Medicine, Mahidol University.

Review of referrals for drug abuse : Records of all referrals of active duty personnel to the post surgeon for drug abuse treatment and counselling during the preceding year were reviewed, with special attention to the type of drug abuse and unit assignment of the referred soldiers.

Red Cross Blood Donations : Results of Red Cross CIE HBsAg screening of blood donors, as recorded on individual donor cards at the Thanarat Army Base during the preceding year, were reviewed, and the proportion of donors positive tabulated for each company or battalion during each donation period.

Rosters of the order in which NCO permanent school students received immunizations on entrance into the school in May 1978 were obtained. Records of the August 1978 permanent NCO school blood donations were reviewed, the position on the immunization sequence roster of each HBsAg positive donor was noted, and an analysis for "clustering" of cases HBsAg positive donors was conducted.

RESULTS :

Distribution of Cases Over Time : Figure 3 presents the hospital (or dispensary) admissions for "viral hepatitis" or "jaundice" between November 1977 and October 1978. November 1977 through April 1978 showed a "baseline" level of 1-4 cases per month. May had a slight increase in cases, especially in the latter half of the month, and July-September 1978 had the highest three month total of cases seen on this post within the observation period.

In an effort to determine the variance of this seasonal distribution from normal, the distribution of cases for the previous 12 month period (Nov 76-Oct 77) was ascertained. Records prior to October 1976 were unavailable due to a change in medical facilities at that time.

As Figure 4 shows, a similar seasonal distribution was noted in 76-77, with relatively low levels during the cool and hot, dry seasons (Nov-Apr) with increased cases during the rainy season (May-Oct) and a year-high peak in the late rainy season. The 76-77 period did not have the magnitude of cases exhibited in 77-78, but the seasonal distribution was similar.

Distribution of Cases by Unit : For the purpose of this report, the post can be divided into six major units. There were some small units on post, but the sum of men assigned to them was less than 100 and they sustained no hepatitis hospitalizations, nor were controls selected from them.

During the course of the year November 1977 - October 1978, the hepatitis attack rates of five of the six units were approximately equal, ranging from

6.0 to 9.5 cases per 1000 men. The support troops for the Infantry School, however, sustained a rate of approximately 17 cases per 1000 men. The cases in this unit were moderately localized by the time, there being 1 case in December 1977, 1 in January, 2 in May, 1 in June, 2 in July, 3 in August, and 1 in September. While this unit represented slightly less than 10% of the post population, from December 1977 through January 1978, this unit contributed 25% of hepatitis cases and between May and August 1978, 33% of the cases occurring on post.

Admission for hepatitis by month for each major unit are graphed in Figure 5.

Clinical Description of Cases : Clinical hospital and laboratory charts of 24 patients were reviewed. Although not detailed, the charts contained sufficient information to reconstruct the following "typical patient."

Symptoms : Malaise, nausea, vomiting, abdominal distension
headache, dark urine.

Signs : Fever, jaundice, hepatomegaly and tenderness of
hypochondriac region.

Records of certain other important symptoms and signs with significance for establishing a differential diagnosis were sought, but not found.

Specifically lacking was mention of significant meningismus, sore throat, lymphadenopathy, rashes or conjunctivitis. Available liver function test data are summarized in Table 2. Of the 24 patients whose records were available for review, the mean SGOT was 101.9 SFU and mean total bilirubin was 6.7 mg %.

There were no deaths among the 62 cases of hepatitis. One case was diagnosed as progressing to hepatic pre-coma. Although exact data is lacking, the average soldier was discharged from the hospital or clinic within 9.5 days after the onset of clinical illness.

Serology : Results of 37 patients and 36 paired controls are summarized in Table 3. Hepatitis B surface antigen was detected in 11% of patients and 9% of controls; two patient's and one control sera contained sufficient HBsAg for subtyping; all three were subtype adr. Anti-hepatitis B antibody was detected in 25% of patients and 42% of controls. Anti-leptospirosis antibody was not detected in any member of either the patient or the control populations. Anti-hepatitis A virus antibody (anti-HAV) was detected in 100% of patients and 42% of controls. Of 34 case control pairs in which sufficient serum was available to test for anti-HAV IgM by the staph absorption modification of the HAVAB (R), anti-HAV IgM was found in serum from 10 cases but only 1 control ($X^2 = 8.78$ $p = .003$). Of 17 case sera from patients who had been ill during the period July through September 1978, 7 were positive for anti-HAV IgM, while only 3 of 19 drawn from patients who had been ill before July were positive.

Paired blood specimens were available from three hepatitis patients. One (pt #39) contained HBsAg in both acute and convalescent sera with no anti-HAV titer rise, while two patients (#56 and #76) were negative for HBsAg and anti-HBs, and showed non-diagnostic (0.5 log) rises between acute and convalescent anti-HAV titers.

Red Cross HBsAg screening of blood donors : Results of Red Cross HBsAg screening of active duty blood donors at the Thanarat Army Base during the preceding year are summarized in Table 4. Unit prevalence ranged from 0.029 to 0.121. Prevalence among the permanent NCO school students varied considerably through the year; rates in October 1977 and August 1978 (0.087 and 0.089) were significantly higher than in December 1977 (0.029), $p < 0.05$ by chi-square test with Yates correction.

Of the 91 HBsAg positive permanent NCO school donors in August 1978, 79 were located on the May 1978 immunization sequence rosters. On the assumption that the 79 HBsAg-positive blood donors were randomly distributed among the total of 1714 personnel, a normal distribution of the "distance"* between individuals was set up with $X = 21.4$ and $u = 18.24$. Table 5 presents the expected and observed frequency of the various "distances." The distribution of observed frequencies does not fit a normal distribution (Goodness of fit $X^2 = 11.03$ $df = 1$ $p < 0.005$) because of the excess case in the 5-7 person class. As immunization practices usually involve 10 persons/needle change, the above excess is compatible with (but not necessarily demonstrative of) person-to-person spread of HBsAg positive blood through contaminated needles.

Drug Abuse Referrals : Eighteen active duty troops were referred to the Post Surgeon during the preceding year for treatment and counseling of drug abuse. All cases involved illicit intravenous injection of heroin. Table 6 summarizes the rate of referrals from each of the six main units on post. Rates ranged from referrals among the permanent NCO school students to 11 referrals per 1000 men per year among the personnel of the support company of the Infantry School.

Questionnaire Results : A total of 37 hepatitis patients were found and 32 matched case control pairs were identified.

Of the 32 pairs, the controls were slightly older (avg. 24.4 years vs 22.3 years) and had been stationed at Pranburi for slightly longer (avg. 2.94 years vs 2.02 years). The controls had been in the Army significantly longer than the hepatitis cases (avg. 4.75 years vs 2.02 years). Only two of the cases had been on active duty for more than 2 years compared to seven of the identified controls. In all cases, the hepatitis patients had spent their total time in service at this one post. The distribution of home provinces between the two groups was similar.

* Distance, for the purposes of this investigation, is defined as the number of personnel between two HBsAg-positive individuals.

Between cases and controls no differences were found in total hospitalizations, medications taken, incidence of blood transfusion, medical injections, dental work, tattooing or promiscuous razor use. No statistical difference was noted in the frequency with which cases and controls had contact with another person with jaundice, but cases consistently had slightly higher rates of unit, barracks and family contacts with other jaundiced individuals.

In two areas a difference between cases and controls was evident. Over 50% (17/32) of patients admitted extramarital sexual relationships. This was more than twice the rate of the control group (8/32). Controls donated blood more frequently (13/32) than cases (7/32).

Interviews and Observations :

Interview with Chief Facilities Engineer : The Pranburi installation was designed and built approximately 20 years ago. Since then the post population has increased three-fold without a change in either the water supply or sewage treatment facilities except as noted below.

Water for all uses is derived from the Pranburi river which abutts the post to the south. The water treatment systems was designed for immediate chlorination and subsequent holding in a settling tank for at least 48 hours. Current demand is such that the water tank is bypassed and water flows directly from the treatment plant into the water mains. Chlorine is added based on the estimated flow, which is intermittent; derived as it is, from irregular user demand. Examinations of the water either for chlorine residual or BOD level are not performed.

A sewage treatment plant was built when the camp was originated, but due to local civilian demand, a trickling sand filter method was adopted soon after the camp opened. The single acre of land set aside for the filter is both inadequate to safely decontaminate the sewage from the post population and too close to the river which provides water for much of the local civilian community.

The camp does draw its water upstream from the slow filter; however, the degree of tidal mixing is unknown.

Since the camp has opened, much of the unused land upstream from the camp has been planted in pineapple and sugar cane, and residences have been established directly upstream from the camp.

Interview with Immunization Clinic Personnel : Immunizations are administered at the Infantry School dispensary according to the following schedule :

	Cholera	Tetanus	Smallpox	Bloodtyping
On reporting to base	X	X	X	X
30 days		X		
60 days		X		
180 days	X			
365 days			X	

In May and November of each year, the soldiers are immunized by company, usually 500-750 men per day for two or three days. Usual practices for each injection follow :

Tetanus : The vaccine is drawn up in a 20 ml syringe. After the needle punctures the skin of first vaccinees, the syringe barrel pulled back, and the syringe contents examined for blood reflux. Two ml of vaccine are injected. If no blood was seen to reflux into the syringe, the needle is changed, and the procedure repeated for the next man until ten men have been vaccinated per syringe. If at any time blood is seen to reflux into the syringe, the remaining vaccine is discarded and the syringe resterilized. (Disposable syringes are not available). Cholera : The procedures used are identical to those used for tetanus. Smallpox : The vaccine is administered with several scratches of a small scarification knife. Between vaccinations the blade is wiped clean with alcohol, and then the procedure is repeated. A blade is used until it becomes dull, usually after five to ten men.

Bloodtyping : A lancet is used to puncture the finger of each soldier. Usually there are enough lancets for each soldier; on some occasions, when lancets are in short supply, they are cleaned with alcohol swabs and reused. The usual stock of needles is three to four dozen. Standard procedure on immunization days is to collect needles as soon as they have been used for one man and boil them for 10 to 15 minutes.

At the permanent NCO school dispensary, only cholera vaccination and blood typing are performed, and the clinic is active only in May (as a result of the annual rotation of personnel). Procedures used are virtually identical to those described above.

CONCLUSIONS :

1. At the Thanarat Army Base incidence of hospitalizations for a diagnosis of acute hepatitis probably peaks each year during the months of August through October.
2. A peak incidence of cases of 16 during the month of September, 1978, was sufficiently above the baseline rate to be recognized.
3. Although excess cases were not confined to one battalion or company, the attack rate was highest among the support troops of the Infantry School.
4. The excess of cases during the 1978 rainy season was probably caused in large part by the hepatitis A virus. Some smaller proportion of cases was probably caused by the hepatitis B virus. Leptospirosis can be excluded with reasonable certainty.
5. The high (>10%) carrier rates for hepatitis B surface antigen observed in some units during blood donations cannot be clearly related to the excess of hepatitis cases as most patients did not show evidence of previous hepatitis B infection.

6. At present several mechanisms known to be associated with the spread of viral hepatitis exist at the Thanarat Army Base, including an outdated water supply systems, illicit drug abuse, sub-optimal immunization practices, and transfusion of blood without screening for hepatitis B virus surface antigen.

7. There is a statistical clustering of hepatitis B surface antigen positive blood donors according to the sequence in which soldiers were immunized. This suggests but does not prove a causal relationship immunization practices and infection with HBV.

8. Actions which are likely to decrease the incidence of acute hepatitis and decrease infections with the hepatitis viruses in order of priority, are as follows :

- A. Purchase extra syringes and needles so that mass immunizations can be carried out with meticulously sterilized equipment.
- B. Complete scheduled replacement of water supply system.
- C. Conduct an education campaign of medical personnel on the potential hazards associated with immunizations.
- D. Monitor and carefully maintain sterilization equipment to insure that boiling temperatures are achieved and maintained.
- E. Establish a program for screening all units of blood to be transfused for the presence of hepatitis B virus.
- F. Continue to maintain a tight control on drug abuse. The highest hepatitis attack rates were in the unit with the highest drug abuse referral rate.

Table 1. Medical care facilities and personnel at the Thanarat Army Base.

	Physicians	Nurses	Nurses aides	Officers	NCO's	Inpatient beds
Main hospital	7	15	25	40	70	200
Infantry Combat Battalion dispensary	0*	0	0	1	6	0
Infantry School Dispensary	0*	0	0	1	6	0

Permanent NCO School Dispensary	1	3	0	2	10	50

* Physicians assigned to main hospital provide health care at these dispensaries on a rotating basis.

Table 2. Summary of liver function tests of hepatitis patients

Total Bilirubin	Number of patients	SGOT	Number of patients
Less than 2 mg%	2	Less than 35 SFU	5
2-5 mg%	9	35-100 SFU	10
5-15 mg%	11	100-200 SFU	4
More than 15 mg%	1	200-500 SFU	5
Total	23	Total	24
Total Bilirubin \bar{x}	6.7 mg%	SGOT \bar{x}	= 102 SFU

Table 3. Results of serology tests for hepatitis A and hepatitis B.

Pranburi							
Patients Study No.	Acc. No.	HBsAg		Anti-HBs		Subtype	HAVAB
		IEOP	RIA	IEOP	AUSAB		
001	62981	-	-	-	-		+
006	62986	-	-	-	-		+
008	62988	-	-	-	+		+
009	62989	-	-	-	-		+
012	62992	-	-	-	-		+
013	62993	-	-	-	+		+
015	62995	-	-	-	+		+
016	62996	-	-	-	-		+
017	62997	-	+	-	-		+
018	62998	+	+	-	-	adr+eAg	+
019	62999	-	-	-	-		+
020	63000	-	-	-	+		+
021	63001	-	-	-	+		+
022	63002	-	-	-	-		+
025	63005	-	-	-	-		+
026	63006	+	+	-	-	weak Ag+anti e	+
027	63007	-	-	-	-		+
028	63008	-	-	-	-		+
029	63009	-	-	-	+		+
030	63010	-	-	-	+		+
031	63011	-	-	-	-		+
032	63012	-	-	-	-		+
033	63013	-	-	-	-		+
034	63014	-	-	-	-		+
035	63015	-	-	-	-		+
036	63016	-	-	-	+		+
038	63018	-	-	-	-		+
039	63019	+	+	-	-	adr, eAg	+
040	63020	-	-	-	+		+
041	63021	-	-	-	-		+
045	63025	-	-	-	-		+
047	63027	-	-	+	+		+
048	63028	-	-	-	-		+
050	63030	-	-	-	-		+
076	63082	-	-	-	-		+
077	63132	-	-	-	-		ND
056	63036	-	-	-	-		ND

Table 3. (Continued)

Controls		Pranburi					
Study No.	Acc. No.	HBsAg		Anti-HBs		Subtype	HAVAB
		IEOP	RIA	IEOP	AUSAB		
023	(P1)	63003	-	-	-	-	+
05	(P6)	62985	-	-	+	+	-
011	(P8)	62991	-	-	-	-	+
03	(P9)	62983	-	-	+	+	+
62	(P12)	63042	-	-	-	-	+
55	(P13)	63035	-	-	-	+	+
72	(P15)	63051	-	-	-	-	+
53	(P16)	63033	-	-	-	+	+
73	(P17)	63052	-	-	-	+	+
100	(P18)	63057	-	-	-	-	-
07	(P19)	62987	-	-	-	+	+
99	(P20)	63056	-	-	-	-	+
04	(P21)	62784	-	-	-	-	+
102	(P22)	63059	-	-	-	+	+
51	(P25)	63031	-	-	-	+	+
2	(P26)	62982	-	-	-	-	+
70	(P28)	63049	-	-	-	-	+
24	(P30)	63004	+	+	-	-	+
71	(P31)	63050	-	-	-	+	+
42	(P32)	63022	-	-	-	-	+
66	(P33)	63045	-	-	-	-	+
60	(P34)	63040	-	-	-	+	+
67	(P35)	63046	-	-	-	+	+
59	(P29)	63039	-	-	-	-	+
58	(P36)	63038	+	+	-	-	+
98	(P38)	63055	-	-	-	-	+
44	(P39)	63024	-	-	-	-	+
10	(P40)	62990	-	-	-	-	+
52	(P41)	63032	-	-	-	+	+
43	(P45)	63023	+	+	-	-	+
69	(P47)	63048	-	-	-	-	+
37	(P48)	63017	-	-	-	+	+
46	(P50)	63026	-	-	-	-	+
61	(P76)	63041	-	-	-	-	+
68	(P77)	63047	-	-	-	+	+
57	(P56)	63036	-	-	-	+	+

Table 4. Summary of Red Cross HBsAg Screening of Donor Blood of Thanarat Army Base During the Past Year (Oct-77-to Present) Numbers in the Table Represent the Proportion of Donors Positive; Numbers in parantheses Give Actual Data (# Positive/ # Tested).

	Oct 77	Dec 77	Jan 78	Apr 78	Aug 78
Permanent NCO School Students	.087(44/502)	.029(21/701)	-	-	.089(91/1025)
Permanent NCO Support Company	-	-	-	-	.114(10/880)
Infantry School Students, 1st year	-	-	-	-	-
Infantry School Students, 2nd year	-	-	-	-	-
Infantry School Support Company	-	-	.051(5/88)	-	-
Infantry Center Support Battalion	-	-	.045(6/134)	.042(7/168)	-
Infantry Combat Battalion	-	-	.121(18/148)	-	-

* Used exclusively as donors to hospital blood bank; blood not tested for HBsAg.

Table 5. Frequency Distribution of 80 "Distances" Between HBsAg Positive Individuals. Pranburi, Thailand, August 1978.

Class Limits (persons)	Observed Frequency	Theoretical Frequency
<u><</u> 4	12	14.7
5-7	7	2.5
8-9	6	2.6
<u>></u> 10	55	60.2

Table 6. Drug Abuse Referrals.

Unit Designation	Rate (referrals/man/year)
NCO Permanent School	.0000
NCO Permanent School Support Company	.0014
Infantry School	.0033
Infantry School Support Company	.0108
Infantry Center Support Battalion	.0030
Infantry Combat Battalion	.0031

Figure 1. Command Structure Diagram of Units at the Thanarat Army Base.

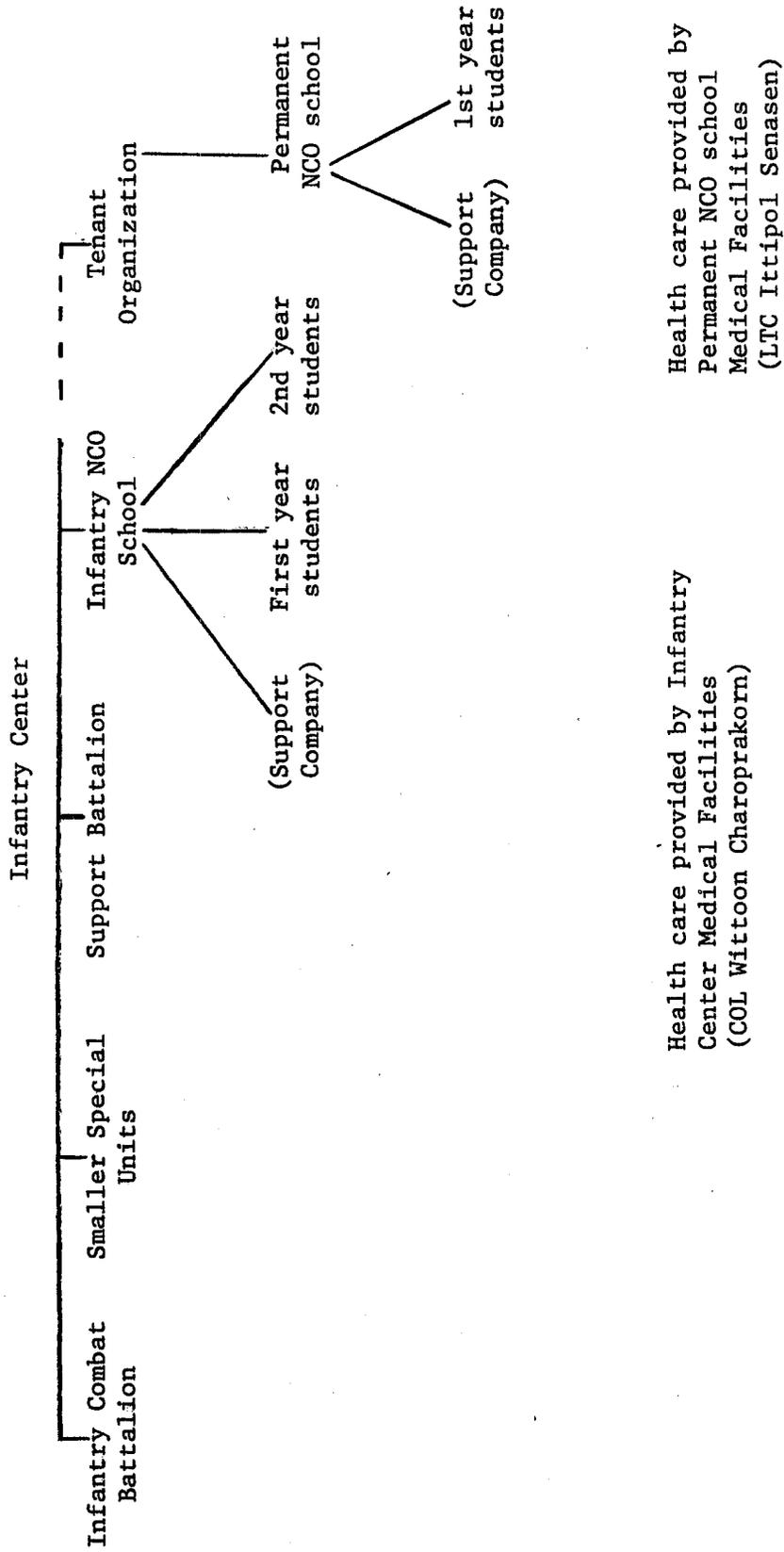
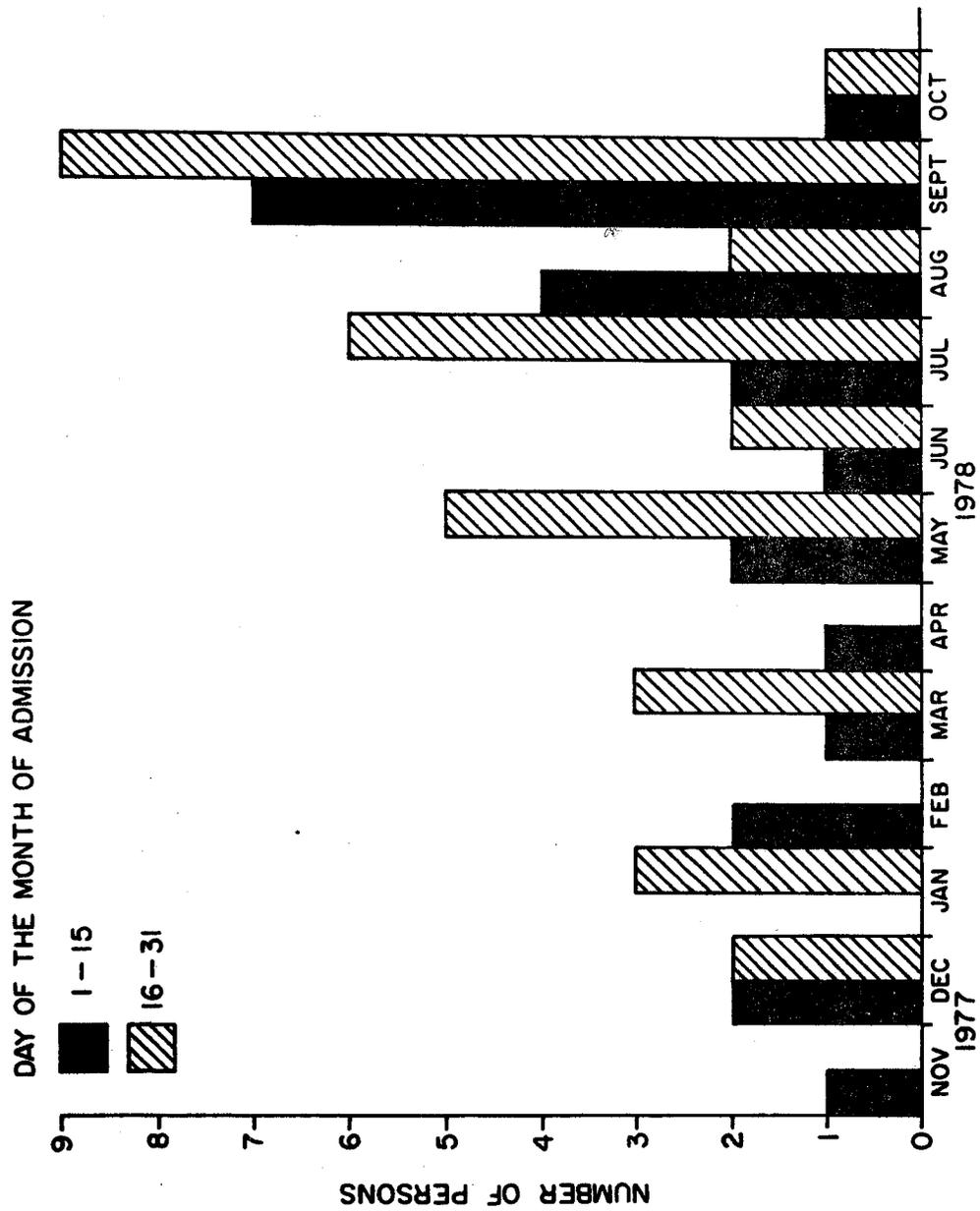


Figure 2. Rotation of Personnel at the Thanarat Army Base.

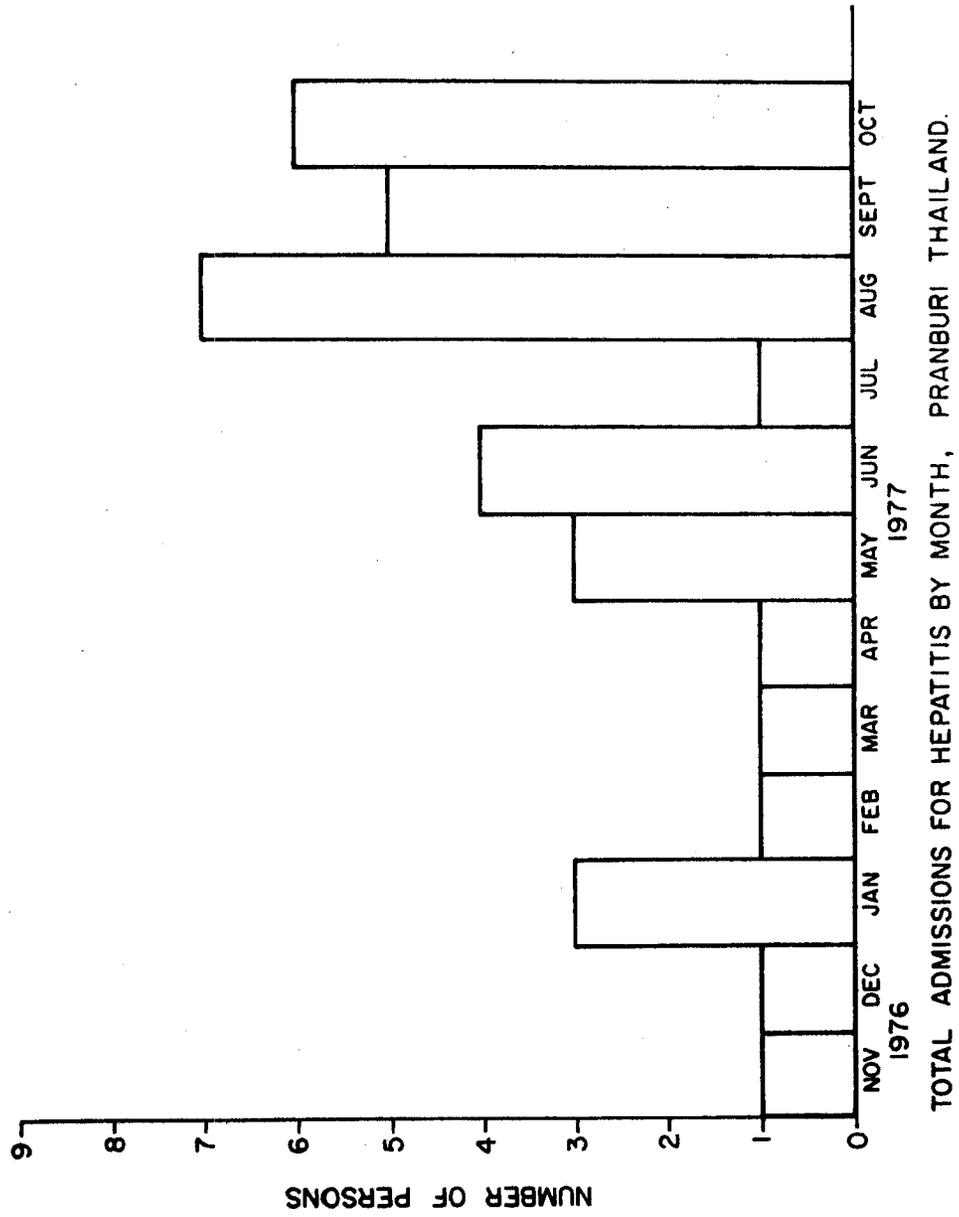
	1977	1978
Infantry Combat Battalion		
Infantry NCO School 2nd year	May 100%	May 100%
Infantry NCO School 1st year	No Class	August
Permanent NCO School	May 100%	May 100%
Support Companies and Support Battalion	May 25%	Nov 25%
		May 25%

FIGURE 3.



TOTAL ADMISSIONS FOR HEPATITIS BY HALF-MONTH, PRANBURI THAILAND.

FIGURE 4.



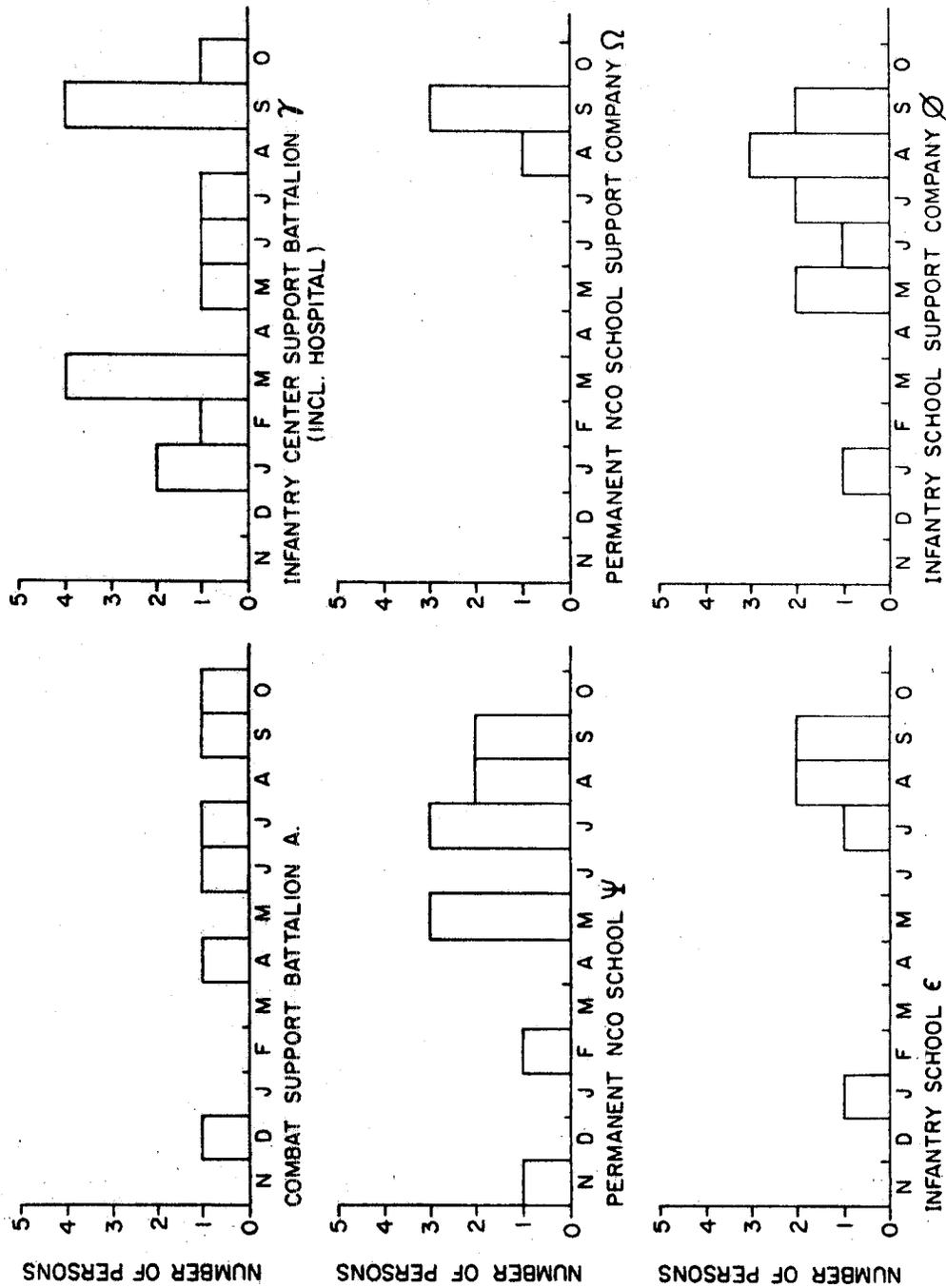


FIGURE 5 ADMISSIONS FOR HERATITIS BY MONTH FOR EACH MAJOR UNIT, PRANBURI THAILAND. NOV. 1977 - OCT. 1978

APPENDIX A

STUDY NO.

Name

Military Unit: Company Battalion Division

Home Province Age Rank Sex Race

Occupation: Before coming into the Army In the Army

How long have you been in the Army? How long have you been stationed

Pranburi? Where were you before (Changwat)?

(1) How many times have been admitted to the Hospital at Pranburi in the last
year?

For what reasons: Date

..... Date

..... Date

(2) Have you been admitted to any other hospital in the last year? If so,
Where?

(3) Do you take any medicine regularly (including anti-malarials)? If so,
What?

(4) Have you ever had a blood transfusion? If so, when?

(5) Have you ever had hepatitis? If so, when?

(6) Have you had medical injections in the previous 12 mo? If so, how many
times?

(7) Have you had dental work in the previous 12 mo? ... If so, how many times?...

(8) Have you had a tattoo in the previous 12 mo?

(9) Non-wife

(10) Razor use

- (11) Have you donated blood in the previous 12 mo? If so, how many times?...
- (12) Has anyone in your barracks had Jaundice in the previous 12 mo? If so,
How many?
- (13) Has anyone in your Squad had Jaundice in the previous 12 mo? If so,
how many
- (14) Has anyone in your Platoon had Jaundice in the previous 12 mo? If so,
how many
- (15) Has anyone in your family had Jaundice in the previous 12 mo? If so,
how many