Prevalence Survey of Disease in Mae Sariang

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OBJECTIVE: To make a preliminary survey of the point prevalence of diseases in an ethnically mixed neighborhood in Amphur Mae Sariang, Mae Hongsorn province.

DESCRIPTION: This report presents the results of biomedical data, collected in June and July, 1969, as part of a larger multidisciplinary survey attempting to assess the functional relationship between migration, ethnic membership and ecologic experience and these biomedical variables. A total census was performed (by P.K.) beforehand of one area, Ban Phae Chom Chaeng, just east of Mae Sariang town (about 500 kilometers northwest of Bangkok). A cluster random sample (RS) of 50 of the 188 households present was selected for study. In addition all 14 households designated as being occupied by New Lua were similarly selected (but not included in random sample analyses). These were ethnically Lua who were of special interest in that they had migrated into Mae Sariang from the surrounding hills within the previous year. Three of these New Lua households were drawn in the RS. The major ethnic groups identified were Lua, North Thai and Karen. Each person received an identifying number and all data collected were transferred to punch cards for analysis. The following specimens were collected from the sampled population, on a voluntary basis – peripheral and venous blood, urine, and stool. Also performed were rectal and nasopharyngeal swabbing, chest X–ray, and measurement of height, weight and head size (up to age 6).

In addition, animal feces and blood were collected, rats were trapped, mosquito fauna was studied, and water and soil samples were analyzed. These non–human samplings were performed in the same area and during the same general time period as the human survey. A mass of behavioral and anthropologic data was also concurrently accumulated and there are plans to appropriately integrate such data with those presented here.

RESULTS: The main advantage of having had a total and accurate census on hand before drawing the sample was the opportunity thereby afforded to check the representativeness of the random sample. If the sample is truly representative of the target population, then obviously more credence is lent to the various prevalence determinations made on the sample collections as being precise estimates of population prevalences. Table I displays various characteristics of the target population and the cluster random sample, which includes 26.6% of the households present. The 95% confidence intervals bracket the true population value in each instance – total persons, number and proportion of males, and number and proportion of

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children. Adequate representativeness is further shown in the age–sex distributions of the population and sample (Tables II, III). Figure 1 shows the age distribution for the target population plotted on normal probability graph paper. The fairly close straight–line relationship (after age 10) indicates that the cumulative age distribution is approximately normally distributed and is a major reason why such a relatively small sample of households (and not of people) is so highly representative over these ages.

The proportion of males is about 50% in the sample population. It is of interest to know whether this is true for larger as well as smaller households. Table IV shows that the proportion of males is clearly independent of household size ($p > 0.50$).

Participation in the survey was generally very good and over 95% of the sample population was interviewed, had height and weight measured and gave a urine specimen. Although over 90% came to the examining area during the 3 days (4–6 June) of concentrated testing, participation in giving specimens ranged from 35% for stool to 70% for peripheral blood specimens (Table V). Over 80% of persons over age 3 received chest X–rays. Analysis of the missing and present distributions for hemoglobins failed to reveal any consistent pattern to seriously bias the data, although hidden errors may surely be masked and some caution must be used before extrapolating these data.

Tables VI and VII give the mean heights and weights for the random sample as well as for the 2 major ethnic groups present which account for 86.6% of the total persons in the RS. No marked differences are noted in these sex and age distributions, between the RS and ethnic group populations. The average adult in this area is approximately 5' 2" tall and weighs about 105 pounds. All the urine specimens were negative for glucose and phenylketones while 2% had significant proteinuria. Four persons (2.1%) were found to have active tuberculosis on chest X–ray. Two were male, and the ages were 35, 50, 55 and 60 years. One sputum was positive for acid-fast bacilli. The X–rays were not interpreted for presence of other abnormalities. Malaria slides were made on all finger-stick collections and all were negative. A somewhat surprising result was that there were no positive VDRL serologic tests of the 182 performed (150 in RS). This was checked by repeating.

Bacteriological evaluation of the water wells in the study area demonstrated high coliform counts, a finding consistent with the fact that all wells are uncovered and that privies are reportedly used by less than 50% of the households interviewed. During the 3 days in June, 21 persons complained of diarrhea, and of the 168 persons (64.4% of the RS) who gave swab or cup fecal samples, 8 had Shigella flexneri type 2, 2 had Sh. sonnei form 2, and 2 had Sh. dysenteriae. Tetracycline therapy (only Sh. sonnei was resistant) was made available to these and other symptomatic people thereafter.

In addition, 4 persons had Salmonella welteverden and 5 persons had enteropathogenic Escherichia coli (3 different types) isolated from their stools. There was no clustering of these isolates by age, sex or household. Soil, water and human sera specimens were tested for prevalence of melioidosis. None of 9 soil samples were positive; 3 out of 23 (13%) water samples were positive. Only 6 persons in the RS out of 168 sera tested (3.6%) had a positive melioidosis titer and 3 of these were from the same household (ages 14, 18 and 40). Titers were 1:80, 1:40 and 1:16 respectively. Table VIII shows that 4/102 Old Lua sera were positive while no New Lua and North Thai sera were positive.

Hemoglobins were determined on 183 RS persons (70.1%). The distributions for males age 0–14 and females age 0–14 and 15+ are very similar (and approximately normal) and have similar means around 12 gm% (Figure 2). Using WHO criteria about 40% of the male and 35% of the female populations of this study area are anemic (Table IX). Closer inspection of the table reveals relatively less frequent anemia in young females but the numbers tested are small. There are no significant differences between the mean hemoglobins of the North Thai and Lua populations (Table VIII). These 3 distributions should probably be age–and sex–adjusted before stating the foregoing with good assurance. It should be mentioned that evidence of gross malnutrition and deficiency diseases was not observed in this area.

The presence of certain stool parasites is often incriminated as contributing to levels of moderate anemia such as seen in this area. Of 91 RS stool exams only 14 (15.4%) were negative while 15 had one, 25 had 2, 24 had 3, and 13 had 4 or more parasites present. By far the most prevalent parasites were nematode ova. Similar prevalences were found for hookworm (47.3%), Ascaris (52.7%) and Trichuris (44.1%) eggs. These 3 eggs were likewise similarly distributed by sex and age. However, they were differently distributed by ethnic group (Table VIII) where the New Lua group apparently has a much higher prevalence than the average. Three people (3.3%) had Taenia species eggs in their stool and adult worms were purged from 2 persons, one of which was identified as T. saginata. In addition Strongyloides stercoralis larvae, Entamoeba coli and Giardia lamblia cysts were recovered. No E. histolytica were found. Considering the drawbacks in collection and handling methods of the stools, and that only one specimen was examined, it is reasonable to presume that these prevalences represent the minimum. It is likewise not possible to estimate the worm load of these parasites.

It is still of interest to attempt to correlate the presence of a known red blood cell ingestor, hookworm, with hemoglobin levels and presence of eosinophilia. Significant eosinophilia ($\geq$15% of differential count) was present in 30% of the 192 RS specimens examined. Figure 3 shows that the age prevalence of eosinophilia is fairly constant except for a high prevalence early in life which would be expected as the response to the initial acquisitions of intestinal parasites and others. In contrast, the hookworm age prevalence curve fluctuates widely, although the large dip between ages 20—29 may reflect the small numbers examined (non—response rate was highest for this group). Table X shows the mean hemoglobins by age for those persons positive and negative for hookworm or Ascaris. Although the numbers are too small for statistical evaluation and the male/female ratios are not necessarily similar, there does seem to be a trend (especially in the younger age groups) for lower hemoglobin values in the presence of hookworm infestation, with much smaller differences noted with the presence of Ascaris.

The remaining serological tests performed revealed only minor recent experience with most of the antigens tested. Overall prevalences in the RS were: trichinosis (SAFA test) 7.9%, scrub typhus (IF test) 1.6%, murine typhus (CF test) 0.8%, and Q—fever (CF test) 0.0%. Scrub typhus exposure probably occurred in upland areas since, of 9 positive sera, 8 were in New Lua persons. Of particular interest was the experience with group B arboviruses. HI antibody titers $\geq$ 1:40 to dengue and Japanese encephalitis were detected in 14.0 and 14.5% respectively (179 sera tested). There was no sex difference and age prevalence revealed no consistent pattern for dengue, but JE antibody was absent until age 10 and then generally rose to a high of 58.3% for ages 50—59. Since the 2 viruses freely cross—react in the HI test, further inferences cannot be made other than being able to confidently state that no recent major exposure had occurred to these 2 agents in the study area. Two years earlier similar testing of sera of an upland village of New Lua revealed an absence of dengue antibody. The New Lua in the present study had migrated mostly from this same upland area and it is noteworthy that only one of 46 such sera tested reacted to dengue and JE whereas about 16% of the Old Lua and North Thai were positive (Table VIII). Only one serum (0.6%) was positive for Chikungunya, a 23 year—old male of Burmese and North Thai extraction.

Animal collections were made in the study area during this time period, in nonrandom fashion. Three trap—nights produced 15 rats (5 male), 3 Rattus rattus, and 12 R. exulans. Only one was flea—infested and none of the 9 sera tested was positive for plague HA antibodies. Twenty (20) dogs were investigated. One dog had a 26% eosinophil count and one had a 1:40 melioidosis titer. Only 2 out of 19 dogs had negative stools; 8 had hookworm ova, 4 had Ascaris ova, 2 had Spirocerca ova and one each had Dirofilaria mansoni and Trichuris ova. Twelve (12) cows were bled; all were negative for melioidosis, dengue 1 and Chikungunya but 2 had 1:1280 and 6 others had 1:40 titers to JE. Of the 24 cow stools examined, 6 were negative and 16 of the remaining 18 had Fasciola ova exclusively. Six (6) out of 15 water buffalo stools were negative and 7 out of the remaining 9 had Fasciola ova.

Twelve (12) pigs were bled; one had a 1:40 melioidosis titer and 9 had significant JE titers (some were 1:1280 and 1:2560). Dengue 1 reactivity paralleled the JE, but to a high titer of only 1:80. Only 5

of 54 pig stools were negative. Parasites present were hookworm, Ascaris, Trichuris, Spirocerca and Fasciolopsis buski ova, Strongyloides larvae, E. coli cysts, Balantidium coli and Coccidia.

Adult mosquito and larval collections were made in the study area (Ban Phae) at the start of the rainy season (May), during the peak of the rainy season (end of July), and 9 months later (April 1970) during the hot, dry season. Similar collections were made at these times in an area just north of town (Ban Pong) as well as in Mae Sariang town proper. In May 1969, both Culex gelidus and C. tritaeniorhynchus, proven vectors of Japanese encephalitis, were collected biting man. The most common domestic mosquito was Culex quinquefasciatus, which was often found breeding in domestic water containers inside houses.

Inspection was made of artificial containers in 30—60 houses in both Ban Phae and Ban Pong each survey. No Aedes aegypti larvae were found. In contrast, about 5% of the houses in the town center had A. aegypti larvae in the 2 dry—weather periods and 59/100 houses (59%) were positive in the rainy season collection. Four houses were also positive for A. albopictus larvae. At that time (28—30 July) houses in town had an average of 9.9 water storage containers while there were 7.6 per house in Ban Pong and only 4.2 per house in Ban Phae. The water containers used in Ban Phae are generally smaller (5—10 gallons) than those used in the town (30—60 gallons), and the people in Ban Phae usually refill the jars from nearby wells daily while the larger jars in town are usually used to store rain water. The availability of fewer breeding sites in Ban Pong and Ban Phae, plus the fact that aegypti larvae are unlikely to reach maturity in jars that are emptied every 24—72 hours may be part of the explanation for their absence in these 2 areas. This finding may also explain the relatively low prevalence of dengue antibodies in the Ban Phae sera although these people frequently visit the nearby town center and marketplace in the daytime. Although previous information is lacking, transmission of dengue virus was documented during July (when the aegypti larvae index had risen dramatically in the town) by serologic diagnosis of several town residents admitted to the local Mission Hospital with the clinical diagnosis of hemorrhagic fever. No patients from Ban Phae were similarly encountered.

Table I. Population and Sample Characteristics and Sample Representativeness.

Variable of Interest	Sample Value	Population Value	Population Total Estimated from Sample Value	95% Confidence Interval of Population Value	Standard Error
Number of people	261	908	981	879 —1,083	50.81
Number of households (clusters)*	50	188	—	—	—
Average number of people per household	5.2	4.8	—	—	—
Number of males	130	439	489	420 —558	34.50
Proportion of males (%)	49.8	48.3	—	44.7— 54.9	.0257
Number less than age 15 years	125	410	470	395 —545	37.41
Proportion less than age 15 years (%)	47.9	45.2	—	44.0— 51.8	.0193

* Sampling fraction (f) = 50/188 = 26.6 % of households.

Table II. Age–sex Distribution of Target Population and Comparison with Random Sample (RS) Cumulative* Percentage Distribution.

Age (Yrs)	MALE				FEMALE				TOTAL			
	No.	%	Cumul. %	Cumul. % in RS	No.	%	Cumul. %	Cumul. % in RS	No.	%	Cumul. %	Cumul. % in RS
0–	79	18.0	–	–	77	16.4	–	–	156	17.2	–	–
5–	66	15.0	18.0	16.9	70	15.0	16.4	16.0	136	15.0	17.2	16.5
10–	57	13.0	33.0	31.5	65	13.9	31.4	30.5	122	13.4	32.2	31.0
15–	40	9.1	46.0	46.2	33	7.0	45.3	49.6	73	8.0	45.6	47.9
20–	26	5.9	55.1	57.7	32	6.8	52.3	57.2	58	6.4	53.6	57.5
25–	25	5.7	61.0	62.3	37	7.9	59.1	61.1	62	6.8	60.0	61.7
30–	65	14.8	66.7	66.9	65	13.9	67.0	69.5	130	14.3	66.8	68.2
40–	37	8.4	81.5	81.6	41	8.7	80.9	82.4	78	8.6	81.1	82.0
50–	27	6.1	89.9	90.0	28	6.0	89.6	93.1	55	6.0	89.7	91.6
60–	17	3.9	96.0	96.9	21	4.5	95.6	96.2	38	4.2	95.7	96.6
Total	439	99.9	99.9	100.0	469	100.1	100.1	100.0	908	99.9	99.9	100.0

* Less than (<) cumulative distribution.

Table III. Comparison of Target Population and Random Sample (RS) Age Distributions.

Age (Years.)	Number		%		Cumulative %	
	Population	RS	Population	RS	Population	RS
0—	292	81	32.2	31.0	—	—
10—	195	69	21.5	26.4	32.2	31.0
20—	120	28	13.2	10.7	53.7	57.4
30—	130	36	14.3	13.8	66.9	68.1
40—	78	25	8.6	9.6	81.2	81.9
50—	55	13	6.1	5.0	89.8	91.5
60—	26	6	2.9	2.3	95.9	96.5
70—	12	3	1.3	1.2	98.8	98.8
Total	908	261	100.1	100.1	100.1	100.0

	Median Age (Yrs.)	
	Population	RS
Male	17.7	17.4
Female	18.9	17.3
Total	18.3	17.2

Table IV. Proportion of Males in Larger vs. Smaller Households

Household Size	Proportion of Males*		Total
	> 50%	< 50%	
2—5	11	14	25
> 5	7	5	12
Total	18	19	37

*Excluding the 13 households containing 50% males.
X^2 (1) = 0.22 (with Yates correction)

Table V. Participation by the Sample Population for Specified Test Procedures, by Age.

Age (Years)	No. in RS	Height, Weight		Blood, finger		Blood, venous		Stool		Chest X—ray	
		No.	%	No.	%	No.	%	No.	%	No.	%
0—	43	43	100.0	24	55.8	19	44.2	15	34.9	21	48.8
5—	38	38	100.0	24	63.2	24	63.2	16	42.1	33	86.8
10—	44	42	95.4	32	76.2	32	76.2	14	31.8	35	79.5
15—	25	22	88.5	16	64.0	16	64.0	8	32.0	16	64.0
20—	11	10	90.9	10	90.9	10	90.9	3	27.3	10	90.9
25—	17	17	100	14	82.4	14	82.4	4	23.5	14	82.4
30—	36	32	88.9	26	72.2	26	72.2	12	33.3	26	72.2
40—	25	23	92.0	20	80.0	21	84.0	9	36.0	20	80
50—	13	13	100	11	84.6	12	92.3	8	61.5	11	84.6
60+	9	9	100	6	66.7	5	55.6	4	44.4	7	77.8
Total	261	249	95.4	183	70.1	179	68.6	93	55.6	193	73.9

Table VI. Average Heights (cm) for Random Sample (RS) and Ethnic Categories, by Age and Sex.

Age (Years)	RS		North Thai		Old Lua		New Lua	
	M n=118	F n=131	M m=34	F n=31	M n=58	F n=79	M n=34	F n=41
0—4	83.9	79.2	82.2	76.7	89.4	80.9	78.0	76.1
5—9	106.1	106.3	106.0	*107.9	100.5	107.1	100.5	110.6
10—14	134.8	129.8	135.7	132.5	134.2	128.4	*144.7	133.0
15—19	154.7	147.4	*153.3	*146.9	154.3	146.8	*136.5	136.2
20+	158.1	149.1	161.4	150.8	157.3	148.5	157.9	145.4

* Includes less than 4 persons.

Table VII. Average Weights (kg) for Random Sample (RS) and Ethnic Categories, by Age and Sex.

Age (Years)	RS		North Thai		Old Lua		New Lua	
	M n=117	F n=131	M n=34	F n=31	M n=58	F n=79	M n=34	F n=41
0—4	11.4	10.0	10.1	9.1	12.8	10.7	10.5	9.1
5—9	16.8	16.8	16.3	16.2*	17.0	17.4	16.4	18.8
10—14	25.2	27.7	36.8	29.2	28.6	26.9	*39.0	30.3
15—19	48.5	44.4	44.7*	44.5*	49.4	44.3	*33.4	40.5
20+	48.9	45.0	42.9	45.4	48.0	45.3	48.9	45.6

* Includes less than 4 persons.

Table VIII. Prevalence of Various Test Results in the Lua and North Thai Populations*.

Ethnic Group	Arbovirus Serology			Melioidosis		Eosinophils		Hookworm Ova		Hemoglobin (Gm%)			
		% HI ≥ 1 : 40								MALE		FEMALE	
	No. Tested	Dengue	JE	No. Tested	% HA ≥ 1 : 40	No. Tested	% ≥ 15%	No. Tested	% (+)	No. Tested	Mean	No. Tested	Mean
North Thai	40	15.0	17.5	40	0.0	43	27.9	18	27.8	17	12.4	22	12.3
Old Lua	113	15.9	15.9	102	3.9	113	28.3	58	55.2	52	12.1	61	12.3
New Lua**	46	2.2	2.2	40	0.0	53	25.4	29	72.2	26	11.8	20	11.4
TOTAL	199	12.6	13.1	182	2.2	209	28.2	105	60.0	95	12.1	103	12.1

* Data not adjusted for differences present between the age and sex distributions of the 3 groups.

** New Lua represents Lua having moved into study area < 1 year. Includes all 14 New Lua households, 3 of which were drawn in the RS.

Table IX. Frequency of Anemia* in Random Sample, Mae Sariang, June 1969.

Age (years)	Critical Hemoglobin Value* (Gm%)	Hemoglobins less than critical values					
		MALE		FEMALE		TOTAL	
		No.	%	No.	%	No.	%
0—4	10.8	3/11	27.3	0/13	0.0	3/24	12.5
5—9	11.5	3/11	27.3	2/13	15.4	5/24	20.8
10—14	12.5	4/14	28.6	8/18	44.4	12/32	37.5
Adults	Male 14.0 Female 12.0	25/50	50.0	24/53	45.3	49/103	46.7
Total	—	35/86	40.7	34/97	35.1	69/183	37.7

* WHO criteria, in WHO Technical Report Series 182, Geneva, 1959.

Table X. Relation of Stool Parasites to Mean Hemoglobin Values in RS.

Age* (Years)		Hookworm			Ascaris		
		No. (Males)	Mean Hgb Gm %	Mean Hgb Diff.	No. (Males)	Mean Hgb Gm %	Mean Hgb Diff.
0—9	Pos	6 (3)	11.6	1.3	15 (7)	12.1	0.5
	Neg	15 (7)	12.9		6 (3)	12.6	
10—14	Pos	5 (3)	10.4	1.7	9 (6)	12.1	0.8
	Neg	6 (5)	12.1		2 (2)	12.9	
15—44	Pos	18 (9)	12.4	0.6	15 (6)	12.6	0.2
	Neg	15 (3)	13.0		18 (5)	12.8	
45+	Pos	9 (3)	11.9	0.3	5 (2)	10.6	2.3
	Neg	4 (2)	12.2		8 (3)	12.9	
Total		78 (35)			78 (34)		

* Not adjusted for differences in distribution of males and females in both the positive and negative groups.

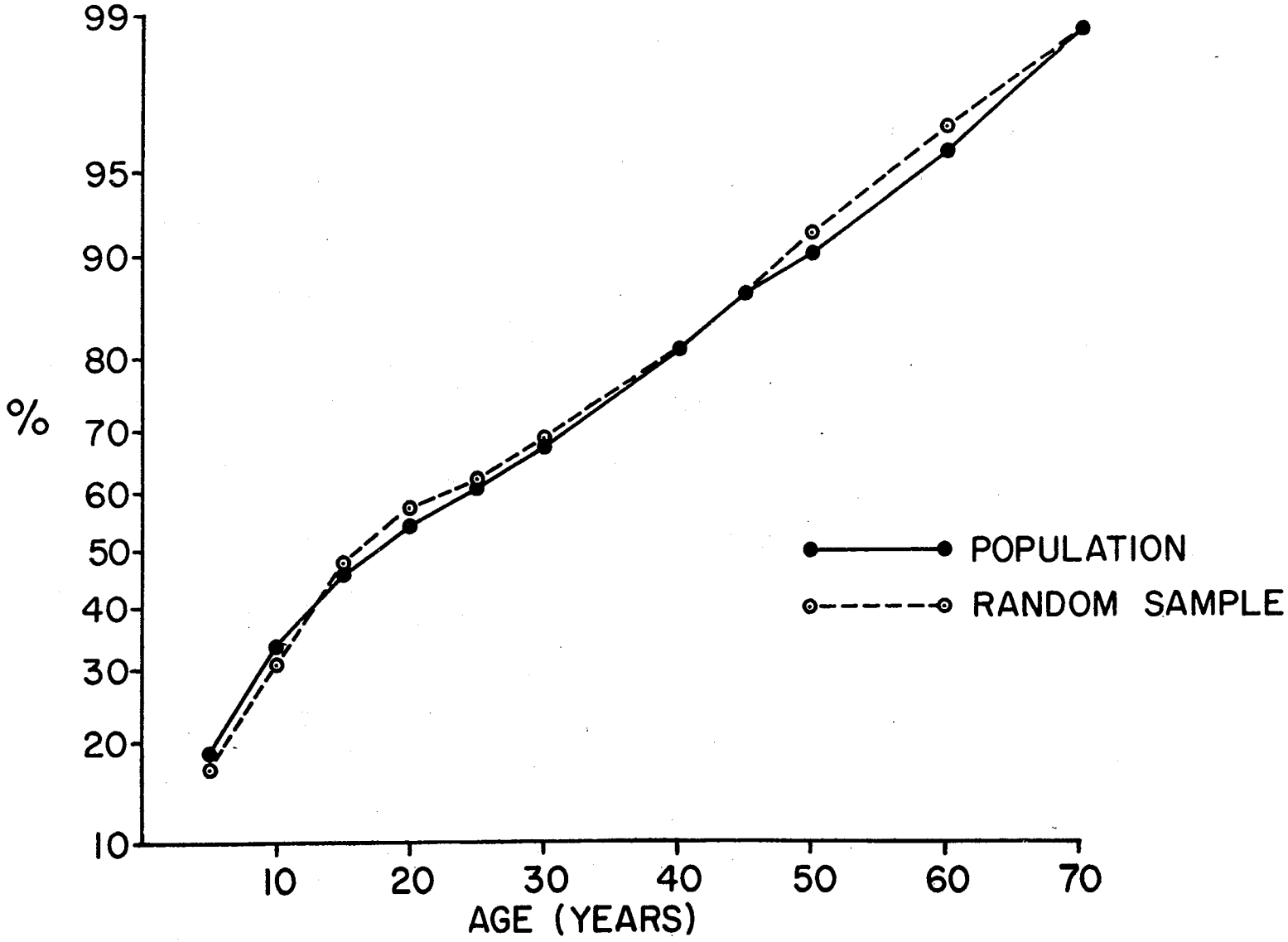

FIGURE 1. POPULATION AND SAMPLE CUMULATIVE PERCENTAGE AGE DISTRIBUTION, BAN PHAE CHOM CHAENG, MAE SARIANG, JUNE, 1969.

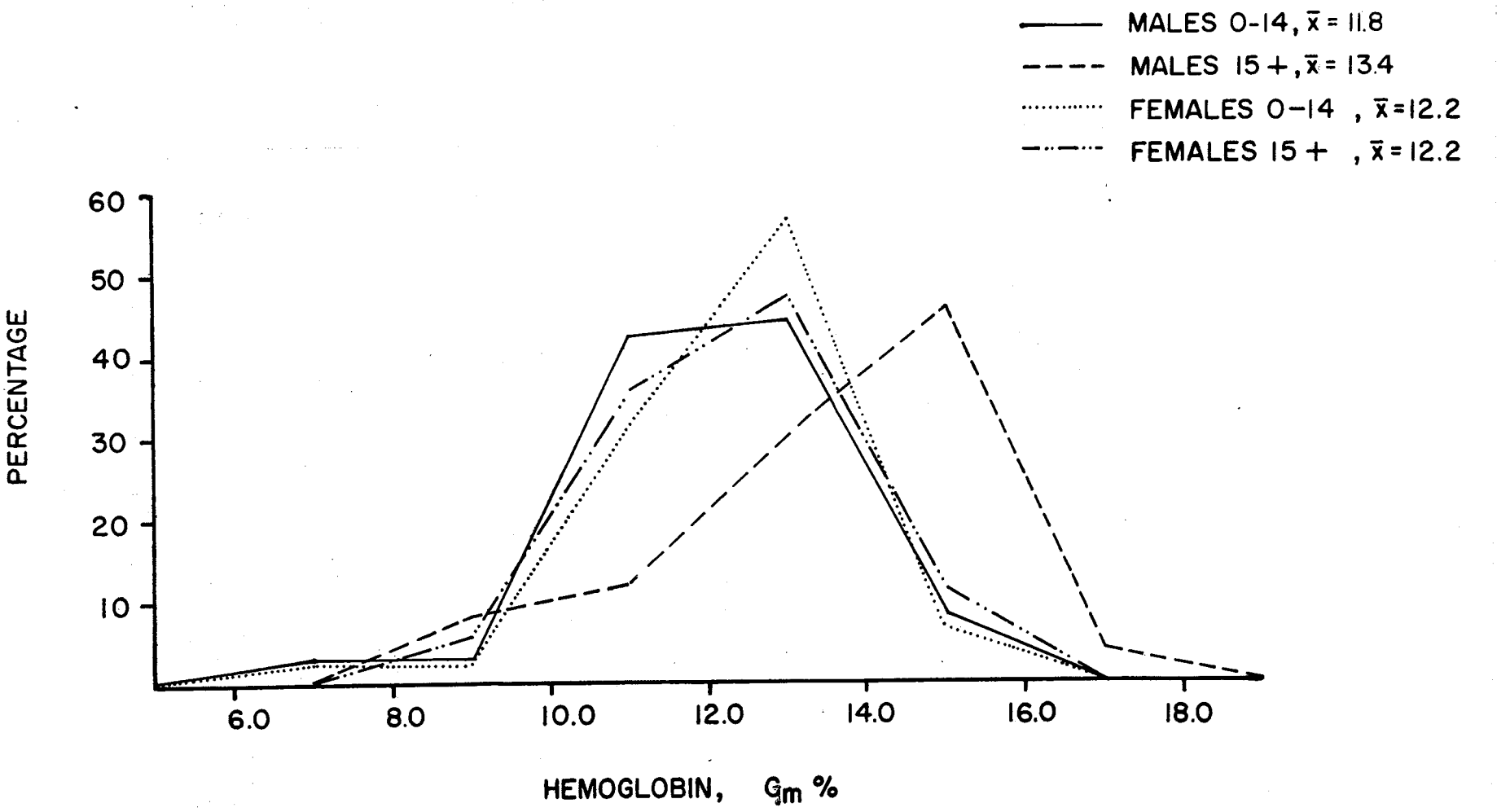

FIGURE 2. FREQUENCY OF HEMOGLOBIN VALUES

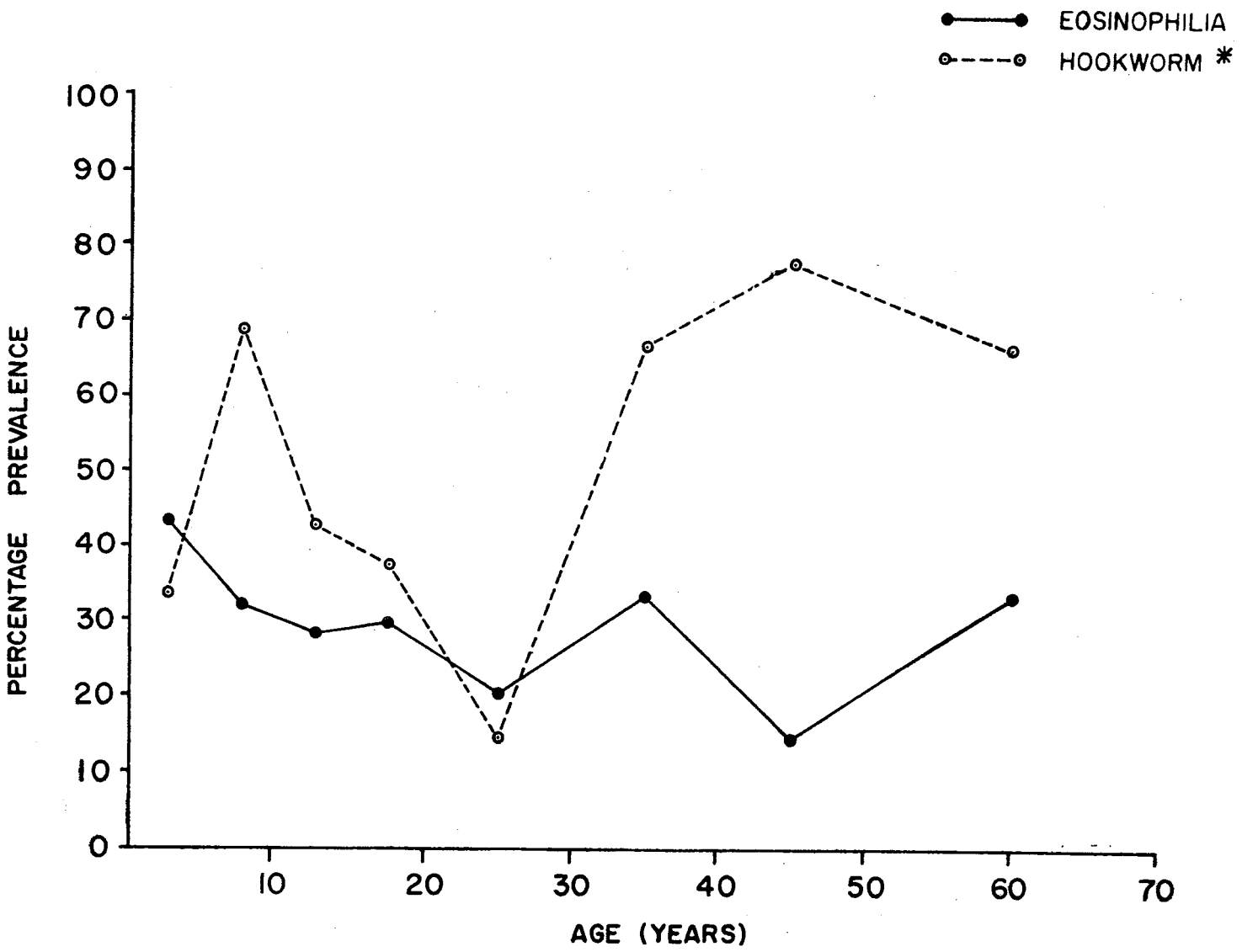

FIGURE 3. AGE-PREVALENCE OF HOOKWORM OVA AND EOSINOPHILIA

* DISTRIBUTION OF ASCARIS AND TRICHURIS OVA PREVALENCES ARE SIMILAR.