STUDIES OF THE MALARIA PROBLEM IN PORTO RICO

PAPER IV

SPLEEN INDEX

No age limit was placed on those taken in the index but it was found convenient to examine up to the age of 18 to 19 years.

The examinations were done at the homes and at the schools and no difficulty was encountered in examining both boys and girls in the latter. The address and house number of child was obtained at school so that spleen percentages could be calculated by the district in which children actually lived.

All examinations except a few in infants and young children were done with the child lying down and with knees flexed. Clothing was removed from abdomen or so loosened that the hand could be splipped under to obtain free access to the left upper quadrant of the abdomen. In case spleen was not readily palpable, the child was instructed to breathe deeply to try and bring down a slightly enlarged spleen.

CLASSIFICATION OF SPLEENS

Spleen not palpable	0
Palpable on deep inspiration	1
Palpable at costal margin	2
One finger's breadth below costal margin	3
Two fingers' breadth below costal margin	4
Three or more fingers' breadth below costal margin	5

Nine hundred and eighty children were examined of whom 22.2 per cent were found with palpable spleens. Reference to Table VIII shows a slightly higher rate in males than in females. In both sexes a low rate is found in the first five years of life. The highest rate was apparently reached in the age group ten to fourteen, though in boys the rates were highest at eight to nine. The rates were more or less the same between six to thirteen.

TABLE VIII

RESULTS OF FIRST SPLEEN INDEX BY AGE AND SEX GROUPS

Age Groups	Male			Female			Total		
	Total exam.	Pal.	Per cent Pal.	Total exam.	Pal.	Per cent Pal.	Total exam.	Pal.	Per cent Pal.
0–4	106	13	12.3	77	7	9.1	183	20	10.9
5–9	215	63	29.3	202	29	14.4	417	92	22.1
10–14	180	53	29.4	151	41	27.0	331	94	28.4
15–19	34	8	23.5	15	4	26.6	49	12	24.5
Total	535	137	25.6	445	81	18.2	980	218	22.2

Pal. = Palpable.

Only nine per cent of palpable spleens extend to below the costal margin (Table IX). The largest spleens were found in the age group five to nine but the highest percent of spleens larger than just palpable on deep inspiration are found in the age group 0 to four possibly because cooperation in breathing could not be obtained to bring down small spleens.

Thus far both clinical history and spleen indexes indicate a lower rate of infection in the first few years of life.

TABLE IX

RESULTS OF FIRST SPLEEN INDEX BY AGE GROUPS AND ACCORDING TO SIZE OF SPLEEN

Age Groups	Total exam.	Spleen Size						Total Palpable
		0	1	2	3	4	5	
0–4	183	163	8	7	5	.....	.....	20
5–9	417	325	61	21	5	3	2	92
10–14	331	237	72	18	4	.....	.....	94
15–19	49	37	8	3	1	.....	.....	12
Total	980	762	149	49	15	3	2	218

PARASITE INDEX

The number of blood smears that could be examined was limited, but an attempt was made to obtain samples from all ages, both sexes, and from people living under all conditions in various parts of the area under study. In all, 622 blood smears were examined or about one-tenth of the population. More females than males were examined because it was found that the male population was away in the fields working. More of the men were included in the second index.

Thin smears were used entirely as it was felt that more consistent results could be expected with native microscopists. The majority of this work was done by a microscopist who had had several years' experience previously in the work.

The staining technique was that suggested by Dr. Russell, using Wright's stain and then a borax methylene blue stain. Very consistent and good results were obtained. At first it was planned to examine each slide long enough to count 100 leucocytes. Only such slides as showed even, this distribution of red cells were examined and as counting leucocytes tend to detract ones attention from the search for parasites a period of 25 minutes was chosen for examination of all slides.

This was the average time found necessary to count 100 leucocytes. In case bodies were found which were suspected of being parasites, search was continued sometimes longer than twenty five minutes, but no slide was called positive unless definite characteristic parasites were found. Mixed infections were recorded if found, but as a rule no extended search was made after one type had been seen.

Results of Examination.

An index of 27 per cent was found for the entire population. Slightly higher rates were found in males than in females (see Table X). The highest rates were found in the age group 15–19, though little difference is noted from five to twenty-four. The rate is low in the first five years of life and is comparatively low in the older adults.

DISTRIBUTION OF MALARIA AND RELATION TO BREEDING AREAS

It will be remembered that the population was found—

(1) On a narrow strip of land on the beach
(2–3) About the central and in the town
(4–5) In certain colonies in the center of cane fields
(6) On hills bordering cane fields away from the ocean
(7) Back in the hills away from the cane fields
(8) In a group of houses bordering cane fields on highland south of town (houses are to west of fields)
(9) On the rising ground to east of cane fields which extend acros from beach to hill section.

TABLE X

RESULTS OF FIRST PARASITE INDEX BY AGE AND SEX GROUPS

	Male			Female			Total		
	Total exam.	Pos.	Per cent Pos.	Total exam.	Pos.	Per cent Pos.	Total exam.	Pos.	Per cent Pos.
0–4	30	7	23.3	21	2	9.5	51	9	17.6
5–9	81	26	32.0	49	11	22.4	130	37	28.5
10–14	61	15	24.6	78	26	33.3	139	41	29.5
15–19	20	7	35.0	59	19	32.2	79	26	33.0
20–24	24	10	41.7	45	12	26.6	69	22	32.0
25–39	.....	.....	.....	.....	.....	.....	100	21	21.0
40–59	41	7	17.0	135	25	22.0	44	9	20.2
60 over	.....	.....	.....	.....	.....	.....	10	2	20.0
Total	257	72	28.0	365	95	26.0	622	167	26.8

The wind blows almost parallel with the beach from the east, though often slightly toward inland. Mosquitoes must fly against the wind, to reach the population to the east; with it, to reach it to the west, and across it, to beach or hill population.

Relation of Breeding to Regions of High and Low Incidence.

Study of Table XI showing indexes for these regions shows practically no correlation between clinical history and spleen or blood indexes. In general, however, spleen and blood indexes follow each other. The highest spleen rate was found in a small colony (Esperanza) in the center of the fields and surrounded by permanent wet areas on two sides and rain water deposits on another two.

TABLE XI

DISTRIBUTION OF MALARIA
(as shown by the three indexes)

Area No. Location	Census	Histories		Spleens			Blood		
		Pos.	Per cent Pos.	Total exam	Pal.	Per cent Pal.	Total exam.	Pos	Per cent Pos.
Beach	1,147	59	5.2	179	40	22.4	169	51	30.0
Piche	729	47	6.4	118	27	23.0	74	26	35.0
Town	1,136	128	11.3	198	31	15.6	91	19	21 0
Pajas	49	0	0.0	.....	.....	.....	23	1	4.3
Esperanza	92	27	29.3	19	10	52.6	7	5	71.4
Border Hills	1,149	104	9.0	169	57	33.6	112	30	27.0
Island	389	23	8.0	34	6	17.6	13	2	15.4
Road to Manati	1,086	137	12 5	182	28	15.4	85	17	20.0
East of Cane	562	24	4.3	99	21	21.2	42	15	35.6
Total	6,239	549	8.8	998	220	22.0	616	166	7 0

A spleen rate of 53 was found here. The population of the hills bordering the cane fields (6) showed next highest rate of 34 and

practically none of this population was more than one-half kilometer away from breeding areas and most of it was nearer.

The beach population (1) showed higher blood rates than the hill population but lower spleen rates. The average distance from permanent breeding was slightly over one-half kilometer, but during rainy seasons the breeding areas were much closer.

The portion back in the hills (7) even though near temporary breeding areas, but 1 and 2 kilometers from permanent breeding areas, showed lowest rates of all. In general it may be said that malaria is widely distributed throughout the area and back into the bordering hill section but that definitely higher rates are found adjacent to permanent breeding areas. Whether the malaria in the section one-half kilometer from low lands is due to flight from those low lands or not is difficult to say. The people move about a great deal, go to visit other regions often and there is a great change of population with neighboring districts. In all those regions there are always a few temporary water deposits close at hand, the importance of which is difficult to estimate. These deposits also are found in other regions with low malaria incidence, but in the area under study where carriers are more numerous they may be of some importance in maintaining a higher rate.

LOW SPLEEN-HIGH PARASITE INDEXES

It is quite striking, the difference in the two rates, the relatively low spleen rate and high parasite rate. Large spleens were not numerous. In work done in other countries as a rule the spleen rates are reported much higher than the blood rates. The relation of low spleen and high parasite rate was found quite constantly throughout the Island and would seem to be more than a mere casual occurrence. It is difficult to say what effect the general use of quinine may have had on these rates, but it is the factor that stands out most prominently.

HEMOGLOBIN

With the aid of a Dare Hemoglobinometer 2,331 determinations were made. An average of 81.5 was found for per cent of hæmoglobin. No correlation between blood and spleen rates and hæmoglobin percentage could be clearly made out.

SUMMARY OF INDEXES

(1) An area with a population of slightly more than 6,000 people was studied.

(2) A clinical history rate of nine per cent, a spleen rate of 22 per cent and parasite rate of 27 per cent was found.

(3) Rates were lowest in the first five years of life.

(4) Spleen rates were highest between ages of ten to fourteen.

(5) Blood rates were highest in the group fifteen to nineteen years.

(6) The highest rates were found in the population within one-half kilometer of permanent breeding areas.

(7) A comparatively low spleen rate was found with a comparatively high blood rate.