



INTERNATIONAL JOURNAL OF LEPROSY

VOL. 8

OCTOBER-DECEMBER, 1940

No. 4

EPIDEMIOLOGICAL LEPROSY SURVEY IN THE NEPOKO, KIBALI-ITURI DISTRICT, BELGIAN CONGO

By J. DEGOTTE

Congo Red Cross, Ibambi, Belgian Congo

WITH AN INTRODUCTION

By A. DUBOIS

Institute of Tropical Medicine, Antwerp, Belgium

TOPICAL SUMMARY

Introduction

Foreword

General data

- A. Geography
- B. Climatology
 - Temperature
 - Rainfall
- C. Population
- D. General social conditions
 - Religion
 - Marriage
 - Occupations and resources
- E. Alimentation
 - The Mabudu
 - The Pygmies
- F. Dwellings
 - The Mabudu
 - The Pygmies
- G. Hygiene
- H. Clothing
- I. Principal diseases

Special data

- A. Method of census
- B. Traditions regarding leprosy
- C. Frequency of leprosy
- D. Classification of cases
- E. Influence of race
- F. Influence of sex
- G. Influence of age
- H. Influence of heredity
- I. Contagiousness of the different types
 - Cases with abundant bacilli
 - Cases with few bacilli
- J. Effects of segregation
- K. Contacts and previous diseases

Conclusions

INTRODUCTION

As an introduction to the epidemiological study by Dr. Degotte, which follows, it is necessary to give a few indications regarding the methods of medical census work employed in the Congo.

These methods are based on those followed in the diagnosis and treatment of sleeping sickness in this region, perfected and codified in 1931 in a circular prepared by Dr. G. Trolli, *médecin-en-chef* at the time, which regulates the Native Medical Assistance Service (S.A.M.I.). The legal basis of that method is the "Ordonnance No. 74, Hyg., 10.X.1931" which stipulates that, by decision of the Provincial Commissioner, the natives are required to have medical certificates, and that the doctors are authorized to summon them to some place not exceeding 12 kilometers from their dwellings in order that they may be examined.

The ordinance also provides several measures of treatment and prophylaxis in the case of contagious diseases. The medical basis is founded on the fact that the natives either delay consulting the medical authorities or do not consult them at all in the case of diseases of slow evolution, as sleeping sickness or leprosy; consequently, the whole population has to be examined systematically. The technical basis is defined in the circular mentioned, and has been applied since 1931 by the Fonds Reine Elisabeth pour l'Assistance Médicale Indigène (FOREAMI). I could not do better than to refer to the reports of this organization, and partic-

ularly to the recent general study on the subject by Trolli.¹ This method has been employed, sometimes with slight variations, in various parts of the Belgian Congo, including the Nepoko district. During the period 1936-38 a total of more than 5,000,000 people have been examined each year for sleeping sickness, and very often for other diseases. In the Nepoko, the Congo Red Cross has developed considerable activity as regards the native medical service since 1925, with increasing attention to antileprosy work since 1927.

The S.A.M.I. survey method aims at a census and medical examination of the whole population. The census, which takes place every six months, is made in each *chefferie*, village by village and on a family basis. The records are kept in special registers and a medical certificate is given to each individual, the father being responsible for a minor's certificate. It seems that the administration of FOREAMI considers it possible to take the census hut by hut, but the dispersion of the population makes this method very tedious and in the Nepoko district the people have usually been gathered in various designated places of the *chefferies*. The individual epidemiological observations, however, have been made at the houses of the patients. In addition to the census-taking, treatment of the sick and improvement of hygienic conditions of the villages represent a large part of the activities of the native medical service. It is not necessary to speak of that here, however, especially since Degotte did not deal with medical treatment; he was in fact a full-time epidemiologist.

According to Trolli a medical team, comprising a doctor, a European sanitary agent, three native microscopists and various native dressers, is able to look after 30,000 individuals at the rate of two visits a year. Counting 15 days a month devoted to census-taking, with five months of work in the villages followed by one month at the medical center, 6,000 people have to be examined each month, or 400 a day. With an average of seven or eight hours of work a day (the total length of a day is 12 hours, but the natives are not always present very early), the average time that can be devoted to the examination of a nonsuspect individual does not exceed about one minute. I have often observed that that was the average time spent, it being enough to note the general state of the individual, the

¹TROLLI, G. *Bruxelles Médical* (1939) Nos. 7, 8, 9 and 10. It may be said that the FOREAMI is intended to combat endemo-epidemics and defective hygiene in districts where the conditions are especially bad. After a few years it hands over the district to the general service of the colony.

existence of suspicious signs of leprosy, yaws, venereal affections, sleeping sickness (glands), and splenomegaly among children.

It is necessary that the people present themselves naked (a woman may be permitted to wear a loin-cloth), and in consequence there must be suitable accommodations at the place where the examinations are made. In order to speed up the work it is advisable to have skin lesions suspicious of leprosy looked for by a male or female nurse. Subjects suspected of having sleeping sickness infection are submitted to a microscopic examination by the native microscopists, and, when necessary, examinations of feces are made by them. Persons suspected of leprosy or other disease requiring careful diagnosis are examined specially by the doctor.

It will be understood that it is essential that the survey team be trustworthy and competent, in order that the doctor may devote the necessary time to the diagnostic work. This is particularly true in case of leprosy. In the Nepoko district, where sleeping sickness is absent, leprosy is common; but as the epidemiologist is not obliged to look after dispensaries and treatment he is able to examine 3,500 or 4,000 individuals a month. On the other hand, with respect to the leprosy cases, because of the slow development of the disease it is not necessary to visit the whole population at very short intervals. Several successive examinations are necessary, however, to determine the significance of the rather numerous cases registered as suspects—to ascertain whether they are really leprosy or not, and if so whether they are abortive or progressive cases. It is hardly necessary to say that, in spite of all, the system requires a numerous staff, without taking into account the need of roads, dispensaries, etc.

The expenses of FOREAMI have varied, in the period 1931-39, from 6 to 9 millions of francs. With from 600,000 to 1,000,000 persons dealt with in a survey, the expense has averaged 11.33 francs per person per year, including the cost of drugs. Various colonial doctors have discussed the value of the S.A.M.I. method and its general applicability, but it would be out of place to go into that matter here. It is clear that in the case of a serious epidemic (sleeping sickness), or of epidemiological or demographic inquiries, this system would be most valuable, either from the viewpoint of prophylaxis or of research. It is estimated that three to four censuses are required to obtain a satisfactory demographic and medical understanding of a district.

With regard to the leprosy work in the Nepoko district, all cases, including even the suspects, are classified according to the system adopted by the Cairo congress. Experience has shown us that this obviates the necessity of making long clinical descriptions. It is necessary, however, to indicate on what part of the body a macule is to be found, and we record, for example: "S.L. Nt 1, deltoid (right)". This means that the person is a suspect, presenting a lesion of minor tuberculoid appearance on the part of the body noted, but that no sign of certitude has been noted; otherwise it would be recorded: "L Nt 1."²

It is the result of such a study by Degotte that follows.

—A. DUBOIS

* * * * *

FOREWORD

The contagiousness of leprosy, a question of utmost importance, is now a subject of investigation in the Belgian Congo. Any attempt at a systematic campaign aimed at the control of the disease must be based on a thorough knowledge of its epidemiology. This is all the more important where, in a new country such as the one in which we are working, there is a disparity between the objects to be attained and existing circumstances—referring to the very primitive population and the limited number of the European staff. For this reason the Congo Red Cross has attempted, within its zone of action in the Nepoko district—one in which leprosy is a rather serious problem—to collect all epidemiological data regarding the disease and to undertake a systematic experimental campaign based upon the knowledge so acquired. Here are published observations collected among 38,000 natives in this district.

A joint medical census and epidemiological survey is a considerable task, one beyond the capabilities of any individual worker. This survey would necessarily have been incomplete if I had not been able to rely upon those working with me. This opportunity is taken to express my deepest gratitude to the administration of the Red Cross, for the opportunity which it has given me to pursue this study so freely. The work was made possible largely because of the experience of Professor Dubois, who advised with me at length when he last came to Pawa, in

²Personally I prefer the symbol S.H., meaning "suspect Hansen" to S.L., since the use of the letter L. in this connection may be confused with the symbol L which refers to the lepromatous type of the disease.

1938. Many conversations with Dr. Zanetti, who has studied especially the question of isolation, have served to broaden my outlook on general epidemiology. The climatological data here included were kindly supplied by the Société Cotonnière du Népoko.

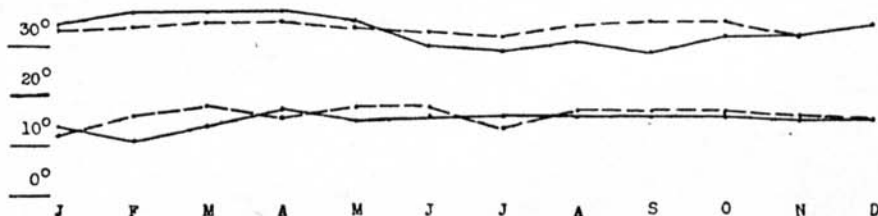
GENERAL DATA

A. GEOGRAPHY

The longitude of the Nepoko district is about 27° East of Greenwich, the latitude 2°30' North. The average altitude is 800 meters ($\pm 2,500$ feet). To the north there is a chain of hills rising 100 meters above the general level of the country. From north to south, approximately along the route of the highway, is a water-shed. The streams are more or less direct tributaries of the Nepoko River. The valleys are everywhere marshy. In the northern section the heights are covered with savannahs; the lower parts are woodland country. The south is covered with the equatorial forest. The soil is formed of more or less decomposed limonite, which covers granitic rocks that appear in many places.

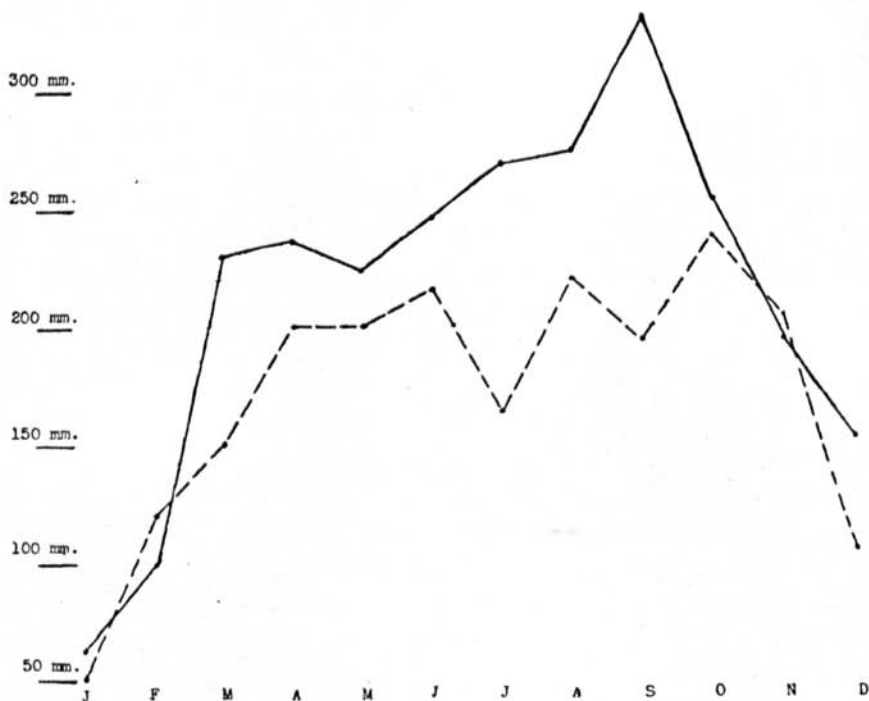
B. CLIMATOLOGY

Temperature.—The climate is tropical, and the variations of temperature in the course of the year are of little importance. The daily variations, on the contrary, are very marked. This fact is to be seen from Text-fig. 1, in which are shown the average daily maximum and minimum temperatures throughout the year for two locations, Abiengama and Ibambi.



TEXT-FIG. 1. Average maximum and minimum temperatures in the Nepoko district, by months. Solid lines, Abiengama; broken lines, Ibambi.

Rainfall.—Rain is abundant through most of the year, especially from March-April to September-October (Text-fig. 2), with a marked diminution in January and February. The average rainfall over an eight-year period was 2,575 mm. (101 inches) at Abiengama, and 2,077 mm. (81 inches) at Ibambi.



TEXT-FIG. 2. Average rainfall in the Nepoko district over an eight-year period. Solid line, Abiengama; broken line, Ibambi.

C. POPULATION

In total 38,120 individuals were examined in this area. Since its extent is about 1,120 square kilometers, the average density of population is about 34 per square kilometer.

Of these people, 37,442 were Mabudu, of the Bantu race, and 678 were Pygmies. The latter, probably aboriginals, are hunters and live in small groups dispersed in the forest. The Mabudu have been established in this country for about three centuries. They assert they came from the region of the Great Lakes, where they used to be cattle-raising people. Since their arrival in this country they have adapted themselves to agriculture and live in more or less important villages or scattered in little groups, each consisting of a few huts.

D. GENERAL SOCIAL CONDITIONS

Religion.—The Mabudu are in general fetishists, whose religious observances are very vague. They believe especially in good and evil spells. Formerly their religious chiefs were also political and military leaders. These chiefs possess prerogatives

so far as food is concerned: certain animals or parts of animals are reserved exclusively for their use.

Marriage.—The general mode of marriage is that which has been established by tradition and must always precede civil or Christian marriage. It consists essentially in the fact that the husband is bound to pay a dowry to his father-in-law. Polygamy exists, but tends to decline.

* *Occupation and resources.*—As stated, the Pygmies are hunters, and they have little contact with the Mabudu. The principal economic products of the latter, who till the soil, are cotton, palm-oil, peanuts and mountain rice. The system of land tenure is patriarchal. In the southeast are to be found many fishermen among the Bamodu group, in chefferie Timoniko.

E. ALIMENTATION

The Mabudu.—In the dietary of the Mabudu carbohydrates are supplied especially by plantains, manioc, maize, rice, peanuts, sweet potatoes and yams. Plantains are the principal product, the others being used to vary the diet. Proteins play but a small part in their alimentation, derived mostly from the vegetables used as the source of carbohydrates. Proteins of animal origin are found in white ants, caterpillars and eggs of fowl. Game is rare, and a few goats and hens are the only livestock. In consequence, the natives eat practically any animal they are able to capture: fish, small rodents and reptiles. As preserved food may be mentioned white ants, caterpillars, smoked meat and fish—in fact all of the protein-rich foods. Fat is supplied by palm oil and groundnuts, of which large quantities are consumed. Water is the usual drink. Palm wine is a favorite alcoholic drink.

With regard to mineral elements, the trade in coarse salt has for a long time provided the natives with sufficient sodium chloride for their food. Salt extracted from aquatic plants (papyrus, etc.) is now seldom met with. Potassium, calcium and phosphorus come from plantains, maize and rice.

Infants are nourished solely by breast feeding. The mother may not resume sexual intercourse before the child is able to walk, probably to avoid interference with lactation by a new pregnancy.

The quantity of food is sufficient, for no marked under-feeding is to be observed. However, the absence of any fixed hours for the meals, and the habit the natives have of always complaining, might make one believe they are not sufficiently nourished.

The Pygmies.—The diet of the Pygmies is very similar, but richer in proteins of animal origin. They also consume roots, mushrooms and various fruits which they find in the forest. They obtain plantains and palm oil by bartering game for these products.

F. DWELLINGS

The Mabudu.—These people, the more sedentary element of the population, live in huts made of mud or palm-leaf stems. There are no windows, and a simple opening used as a door allows for the entrance of air and light. In front of the house there is a veranda, on which the people live. Cooking is done outside, or in a little kitchen. At night the fire is carried inside and fills the hut with smoke. As a rule the huts are dilapidated, because the Negroes do not bother to repair them; they prefer to wait until they fall to pieces and then build new ones. Sanitary arrangements are everywhere defective. There are no clearings and practically no latrines or cemeteries.

The Pygmies.—These people build dome-shaped shelters of thin branches and leaves, one to one and one-half meters high.

G. HYGIENE

Bodily cleanliness is very greatly neglected. On the other hand buccal hygiene receives much attention. The natives brush their teeth several times a day and rinse out their mouths frequently. Circumcision is practised by both the Pygmies and the Mabudu. The latter deform their skulls by tightly bandaging the heads of the new-born babies. With the exception of fruit (pineapples, etc.), all of the food used is thoroughly cooked.

H. CLOTHING

The natives generally wear a loin-cloth made of beaten bark. These very rough garments cannot be washed. The men slip this square of tissue between their thighs and keep it up in front and behind by means of a string knotted around their hips; the trunk is naked. The women wear even less; they cover the pubic area by means of a very small square of bark material, and the buttocks with a few dried banana leaves.

I. PRINCIPAL DISEASES

The diseases other than leprosy noticed in the course of the survey, together with the numbers of cases, are shown in Table 1. As may be seen, syphilis and yaws have practically disappeared from among the Mabudu. There was not observed any ailment ascribable to defective alimentation (for instance, avitaminosis).

TABLE 1. *Diseases other than leprosy observed in the survey, with numbers of cases.*

Diseases	Mabudu (37,442 cases)	Pygmies (678 cases)
Syphilis I, old cases.....	95	—
Syphilis II, old cases.....	125	—
Syphilis II, new cases.....	11	—
Syphilis, hereditary, old.....	1	—
Syphilis, hereditary, new.....	1	—
Yaws I, old cases.....	1	—
Yaws II, old cases.....	8	—
Yaws II, new cases.....	6	16
Yaws III, old cases.....	29	—
Yaws III, new cases.....	24	—
Pulmonary tuberculosis.....	2	—
Blennorrhoea.....	703	—
Splenomegaly.....	1,618	7
Itch.....	2,858	24

Among the Pygmies, on the other hand, yaws is still relatively frequent (2.36 percent of secondary yaws). These people have never received the slightest treatment for that disease, and it is inevitable that a high percentage of positive serological reactions would be obtained among them. Dr. Zanetti says that, according to his findings in the laboratory of Pawa, 85 percent of them give positive Kahn reactions.

SPECIAL DATA

A. METHOD OF CENSUS

In this work all of the natives were summoned to gather in selected places, where temporary premises for the examinations were arranged. The administrative matters were taken care of by a staff especially provided for that purpose. All of the patients were examined by me, unclothed, as related by Dubois in his introduction to this report.

B. TRADITIONS REGARDING LEPROSY

The old people of the Mabudu tribe assert that their ancestors brought leprosy with them when they came from the region of the Great Lakes. As regards the Pygmies, their degree of intelligence is not sufficiently high for them to have any tradition concerning diseases.

Consanguine marriages are prohibited by custom, because the natives believe that the children would necessarily become leprous, as would also, frequently, the husbands and wives themselves. The natives seem to have observed a certain degenera-

tion, or at least a lesser resistance, in the descendants of such unions, and that children having the disease may infect their parents; they would also have noticed more frequent cases of the disease in certain lineages. Some natives believe that in order to avoid infection they should not eat certain foods, which, however, are not forbidden to their relatives.

The establishment of isolation villages goes back to about 1922, when they were founded by the territorial administration. Nevertheless, for a long while these villages sheltered only a limited number of lepers. The natives seem never to have been repelled by cases of leprosy, except those with grave mutilations.

C. FREQUENCY OF LEPROSY

As regards the Mabudu the region comprises three "chefferies," Makoda, Wadimbisa and Timoniko, each of which is divided into "notabilities." It would not be practicable to present here the detailed tabulation showing the numbers of persons examined and the numbers of cases of leprosy found in each of these localities, but the percentages so arrived at are shown on the map reproduced herewith (Text-fig. 3), and the data are summarized in Table 2. It may, however, be said regarding the *Makoda* chefferie that in the 14 notabilities, with populations varying from 320 to 2,106, the local rates varied from 1.39 to 6.43 percent. In the total of 15,526 persons examined, 673 cases were found; the rate, 4.39 percent, is lower than in the two other chefferies. In *Wadimbisa*, also with 14 "notabilities" but a total population of only 6,138 (two of the subdivisions had less than 100—66 and 74, respectively—and the largest 1,586), the 325 cases found gave the relatively high total rate of 5.29 percent; the lowest was 2.90 and the highest 12.21. In *Timoniko* there are no less than 38 notabilities, though with populations averaging only 414 the total was but 15,778 persons. Here the leprosy rate is the highest for these people, the 974 cases found amounting to 6.17 percent. The highest local rate was only 10.39 percent, the lowest 3.22 percent.

Among the Pygmies, of which there are four groups, the leprosy rate is still higher; with 48 cases among 678 people it is 7.07 percent.

As has been pointed out in an earlier report (1), the distribution of the disease is very irregular. This is evident from the rates shown on the map, but is more striking when the data are examined more closely. Cases are scattered in small foci of

TABLE 2. *Frequency of cases of leprosy among the Mabudu "chefferies" and the four groups of Pygmies examined.*

Chefferies and groups	Numbers of people examined	Cases of leprosy	
		Number	Percent
Makoda.....	15,526	673	4.39
Wadimbisa.....	6,138	325	5.29
Timoniko.....	15,778	974	6.17
Pygmies.....			
Babesiambe.....	160	6	3.75
Badabu.....	245	18	7.34
Batugba.....	258	23	8.91
Bamako.....	15 678	1 48	6.66 7.07
TOTALS.....	38,120	2,020	5.29

more or less importance, and certain hamlets are completely free from the disease. For instance in Inguonguo, chefferie Timoniko, no cases were found among the 44 inhabitants examined.

D. CLASSIFICATION OF CASES

For the purposes of survey of the classification proposed at the Cairo leprosy congress (March, 1938) was used, the patients being divided into two main categories: L and N.

Cases belonging to the lepromatous (L) category show under the microscope very numerous bacilli, often with globi. The letter L was used for those with evident lepromata, while those in which the condition was diffuse and not well defined were classed as Ld.

The N type is divided into three subtypes, Na, Ns and Nt. Na represents the pure anesthetic cases, without macules, Ns the simple neuromacular cases, with flat macules. Cases of the Nt subtype of the Cairo classification, with elevated macular lesions (leprids), were encountered so frequently that it was decided to divide the group further, Nt representing the cases with small lesions and NT those with large ones. These two forms are particularly poor in bacilli. Having to deal with cases intermediate between Ns and Nt, we classified them as Nst (signifying neural, subtuberculoid).

The degree of progression of the disease was noted by adding to the symbol the figure 1, 2 or 3. The mixed types, as well as those in which two subtypes were combined, were represented by two or more symbols.

This classification has seemed to us very simple and, from the epidemiological point of view, practical, as it quickly gives an idea of the danger which a patient offers. Moreover, during a subsequent examination it will certainly be possible to study the evolution of this disease on a large scale.

The detailed tabulation of cases under this classification, with its various divisions and combinations, shows for the Mabudu cases no less than 32 groups of lepromatous cases, 20

groups of tuberculoid cases, and 32 groups of the other cases of the neural type. Of the cases among the Pygmies there are 6 neural groups (Ns and Nt), and only one lepromatous case. This distribution is summarized in Table 3. The extremely small proportion of lepromatous cases found is particularly noteworthy.

TABLE 3. *Type distribution of cases.*

Type groups	Mabudu cases		Pygmic cases		Total cases	
	Number	Percent	Number	Percent	Number	Percent
L1 (or Ld1) and mixed.....	33		—		33	
L2 (or Ld2) and mixed.....	93		1		94	
L3 (or Ld3) and mixed.....	47		—		47	
Total L cases.....	173	8.77	1	2.09	174	8.61
Nt 1 and combinations.....	160		9		169	
Nt 2 and combinations.....	50		3		53	
Nt 3 and combinations.....	20		—		20	
NT 1 and combinations.....	25		—		25	
NT 2 and combinations.....	26		—		26	
NT 3 and combinations.....	9		—		9	
Total Nt cases.....	290	14.71	12	25.00	302	14.95
Na 1.....	39		—		39	
Na 2.....	121		—		121	
Na 3.....	65		—		65	
Ns 1 and combinations.....	389		19		408	
Ns 2 and combinations.....	558		11		569	
Ns 3 and combinations.....	337		5		342	
Total N cases.....	1,509	76.52	35	72.91	1,544	76.44
TOTALS.....	1,972	100.00	48	100.00	2,020	100.00

E. INFLUENCE OF RACE

It is certain that not all of the Pygmies of the district were seen in this survey, but according to the assertions of the less timid of them there were not many left to be examined. There are presumably sick people among them, an assumption that seems to be confirmed by the fact we found only one case with Na symptoms (classified Ns2-Na), and that all of the types of leprosy observed were more or less mild. Thus it is not possible to draw any conclusions from the percentages established.

It is noteworthy, however, that the percentages differ very little from those established for the Timoniko. This fact might induce us to believe that under similar conditions the disease would make no distinction of race. As has been said, the Pygmies dealt with lead a different kind of life from that of the taller Negroes, but they do not observe better the rules of hygiene.

F. INFLUENCE OF SEX

Analyzing our data with regard to the sex incidence, it is found

that males are affected somewhat more frequently than females. The figures, according to type and in total, are given in Table 4.

TABLE 4. *Sex incidence in the cases found.*

Type	Mabudu cases		Pygmie cases	
	Males	Females	Males	Females
Lepromatous (L).....	93	80	0	1
Tuberculoid (Nt and NT)....	179	111	8	4
Other neural (Na and Ns) ...	755	754	20	15
TOTALS.....	1,027	945	28	20

On the basis of the total populations dealt with, the sex rates among Mabudu work out as follows:

$$\frac{1,027 \text{ males}}{37,442 \text{ inhabitants}} \text{ or, per thousand, } 27.42 \text{ for males}$$

$$\frac{945 \text{ females}}{37,442 \text{ inhabitants}} \text{ or, per thousand, } 25.23 \text{ for females}$$

On the same basis, for the Pygmies examined the rates would be:

$$\frac{28 \text{ males}}{678 \text{ inhabitants}} \text{ or, per thousand, } 41.29 \text{ for males}$$

$$\frac{20 \text{ females}}{678 \text{ inhabitants}} \text{ or, per thousand, } 29.49 \text{ for females}$$

At first sight it would appear that among the Pygmies the difference in rates between the two sexes is large, and on the contrary very small among the Mabudu. To explain these differences we must consult the demographical data obtained during the census. There were enumerated, among the Mabudu, 18,313 males and 19,129 females, and among the Pygmies, 403 males and only 275 females. From this it is seen that the sex ratio is very different among the Mabudu from that among the Pygmies. Calculating the sex incidence of leprosy by taking as the denominator the number of persons of the sex dealt with instead of that of the whole population (Cairo congress), the proportions for the Mabudu are as follows:

$$\frac{1,027 \text{ male cases}}{18,313 \text{ males examined}} = 56.08 \text{ per thousand males}$$

$$\frac{945 \text{ female cases}}{19,129 \text{ females examined}} = 49.40 \text{ per thousand females}$$

For the Pygmies the rates on this basis are:

$$\frac{28 \text{ male cases}}{403 \text{ males examined}} = 69.47 \text{ per thousand males}$$

$$\frac{20 \text{ female case}}{275 \text{ females examined}} = 72.72 \text{ per thousand females}$$

This method of establishing the sex incidence involves very little change in the numerical relation for the Mabudu, but among the Pygmies, on the contrary, there is an inversion of the fraction, which approaches unity. In districts such as ours, where there is no registration of the native population, it is impossible to know how many escaped attention in the survey. It seems, therefore, best to calculate the sex incidence on the basis of the actual number of the representatives of the sex under consideration that were seen.

By either system of calculation there is a predominance of males in the leper population among the Mabudu. Among the Pygmies, according to the second system of calculation, the difference is very slight. These facts may perhaps be attributed to a matter of custom; among the Mabudu the men and women live more or less separated, which is not the case with the Pygmies. Nevertheless, I believe that the slight predominance of males among the Mabudu lepers is quite accidental. Out of 258 small foci studied separately, it was found that sometimes there was a clear predominance of one or the other sex, depending upon the sex of the patient who seemed to be the original cause of the particular small disease focus; some foci, indeed, had lepers of only one sex.

In one region, however, the predominance of males can be attributed to another reason than custom. There (referring to the Bamodu group, Timoniko chefferie, Awese, Abaya and Matete notabilities), 69 out of 118 patients are males. This is due to the fact that fishing is organized in this region and a large number of men are employed, who for several months of the year live under conditions of indescribable promiscuity. They sometimes remain in the water for several hours at a time and they are the prey of the leeches, which are particularly numerous, and at night they are tormented by mosquitoes. General weakening of the organism and the many opportunities for contagion seems to be a simple explanation of the difference of sex incidence observed here.

It seems logical to conclude that sex does not seem to play an appreciable part in the appearance of leprosy among the peoples under consideration.

G. INFLUENCE OF AGE

In connection with the question of the approximate ages of the leprosy cases, it seemed of interest first to determine the age

distribution of the entire population. The results of this demographic inquiry are given in Table 5 (together with the related data concerning the leprous persons), and in Text-fig. 4, A. From these exhibits it is seen that there is a certain lack of people in the 10-19 year group.

TABLE 5. *Age distribution (approximate ages) of the population examined and of the leprous persons.*

Approximate ages	Persons examined		Cases of leprosy		
	Number	Percent	Number of cases	Percent of age group	Percent of total cases
0 to 9 years.....	9,459	24.82	67	0.70	3.32
10 to 19 years.....	4,658	12.22	142	3.04	7.03
20 to 29 years.....	7,529	19.75	455	6.04	22.51
30 to 39 years.....	7,337	19.24	579	7.89	28.67
40 to 49 years.....	5,768	15.13	440	7.78	22.23
50 to 59 years.....	2,313	6.07	182	7.86	9.02
60 years and over.....	1,056	2.77	146	13.82	7.22
TOTALS.....	38,120	100.00	2,020	5.29	100.00

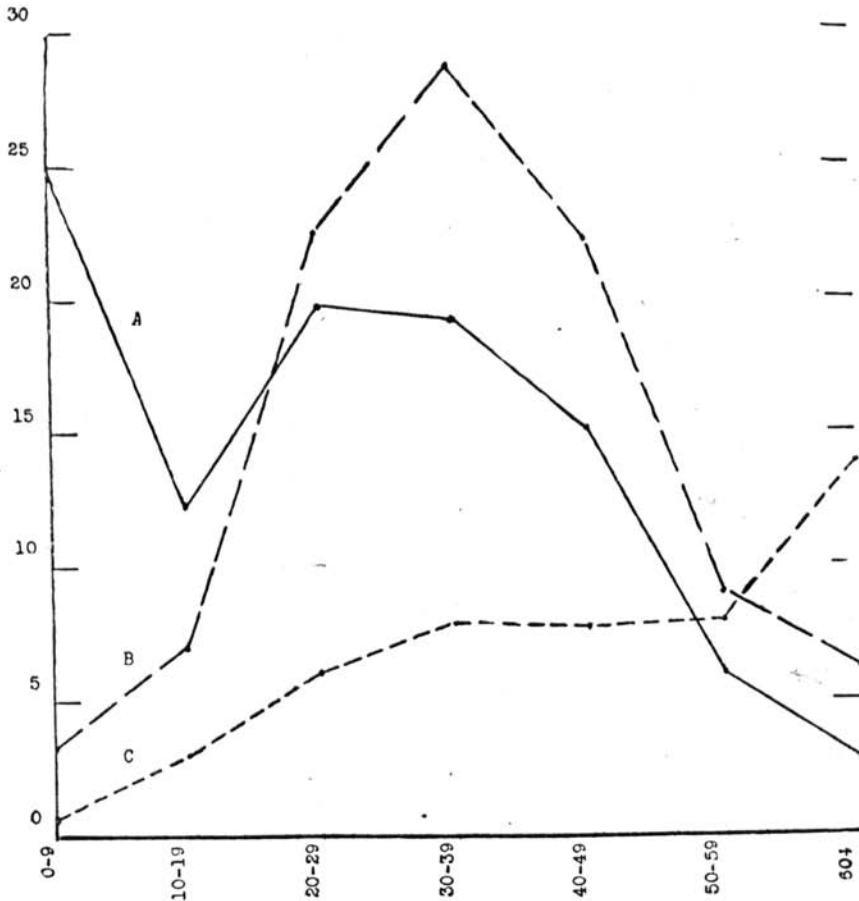
With regard to the leprous population, it is evident from Text-fig. 4, B, that the disease in this region seems to be one chiefly of middle-aged adults. This appears even more clearly if we calculate the percentages of frequency of the disease by taking as the denominator the number of individuals belonging to each of the age categories considered (Text-fig. 4, C). The relatively high frequency observed after sixty may perhaps be explained on the ground of diminution of the resistance of the organism.

The age distribution of the cases of each of the type groups as discussed herein is shown in Text-fig. 5. The peaks of the curves for the L type and the Na and Ns subtypes are in the 30-39-year group, that of the tuberculoid group in the next decade. It is evident that the prognosis of leprosy *quo ad vitam* in this district is favorable.

H. INFLUENCE OF HEREDITY

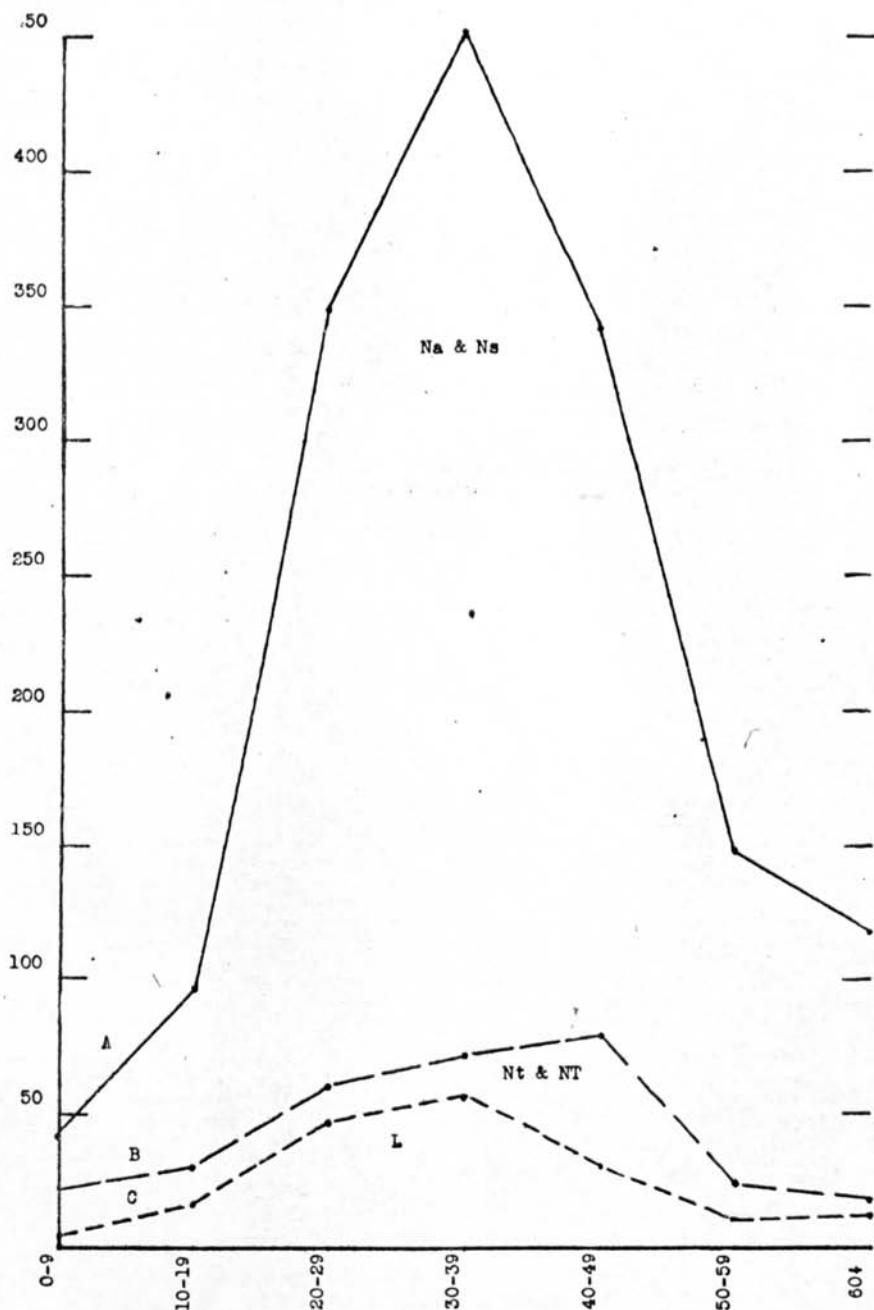
In a preceding section it has been said that the natives believe in leprous families. To verify this belief, we have examined the genealogy of different families, descendants of leprous ancestors.

The genealogical chart shown herewith (Text-fig. 6) is that of the Gboya notability, the clan of which we found to be 8.35 percent leprous. The investigation applied equally to the masculine and feminine lines of descent, so not all of the individuals

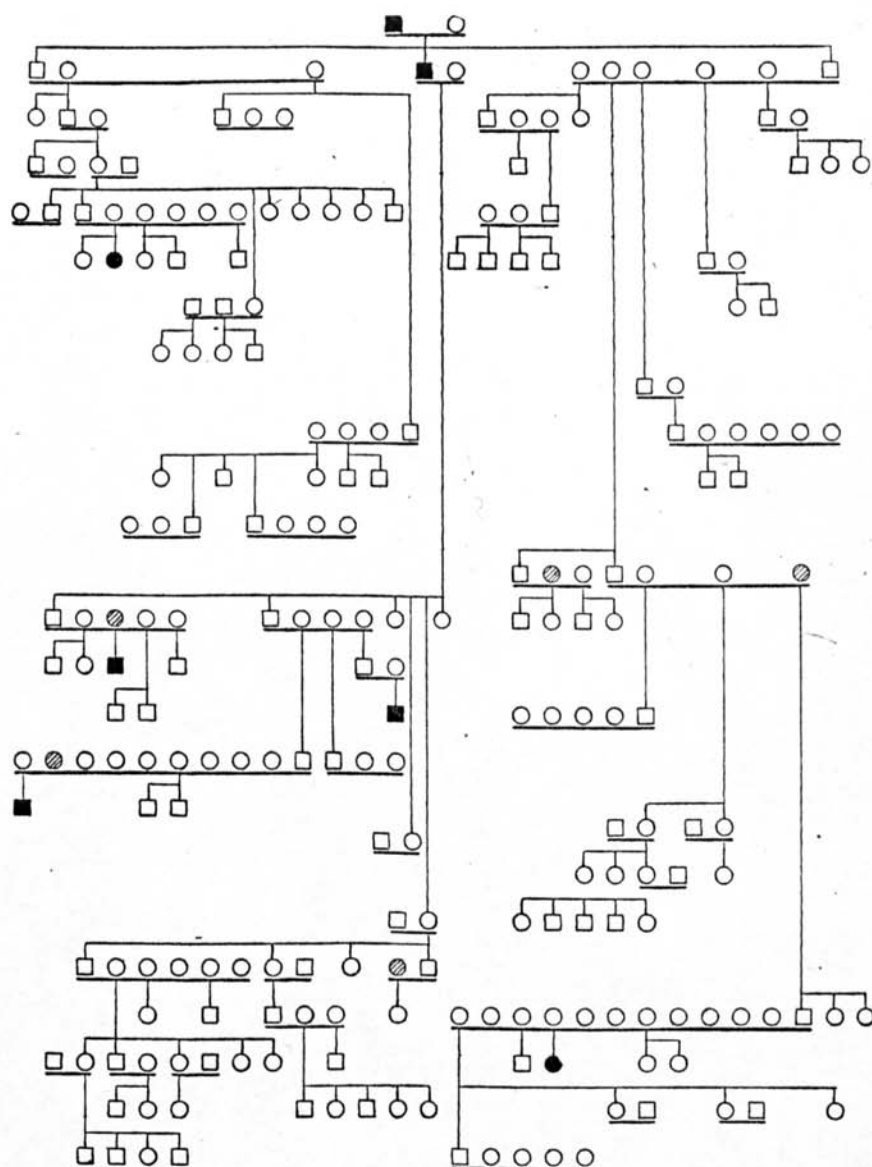


TEXT-FIG. 4. Age distribution, percentages. A, total population; B, leprosy population, by percentages of that group (sixth column, Table 5); C, leprosy population, by percentages of the numbers of persons in each age group in the total population (fifth column, Table 5).

represented live in the notable's village. Though the whole family is descended from a leper, only one child out of three became leprosy in the first generation. The descendants of the eldest son have had but one leper, occurring in the fifth generation. Those of the third son have had three leprosy women, but two of them came from outside the family, by marriage. Thus this case is similar to the former one. The second son, leprosy like his father, seems to have given rise to a line containing more lepers. However, only three of the six are direct descendants, the other three being women coming from outside. From this it cannot be concluded that the relatively high frequency of leprosy



TEXT-FIG. 5. Distribution of leprosy cases by type and age. A, ordinary neural (Na and Ns) cases; B, tuberculoid (Nt and NT) cases; C, lepromatous (L and Ld) cases.



TEXT-FIG. 6. Geneological chart showing leprosy among the 234 members of the clan of the Gboya notability, including both descendents and persons of extraneous origin introduced by marriage. Males are represented by squares, females by circles. Solid black figures represent lepers of direct descent, crossed figures represent lepers of extraneous origin. Light transverse lines indicate descent, heavy lines indicate marriage.

in this group is due solely to heredity. As a matter of fact the introduction of leprous elements of extraneous origin, who lived intimately with the members of this family, may be considered as a factor favoring contamination through prolonged contact.

It is to be said that 82 of the individuals noted in the chart emigrated to neighboring chefferies, and only one of them is a leper. If we seek the percentage of leprosy cases among the subjects who have remained in the same village, we find 11 cases among 152 persons, i.e., 7.23 percent—very near the rate for the notability, which is 8.35 percent. The percentage calculated on the basis of the whole number of the family is 12/234, i.e., 4.74. This number approximates very closely to that calculated for the whole region, 5.29.

I. CONTAGIOUSNESS OF THE DIFFERENT TYPES

As has been said, the cases of leprosy are not distributed regularly in our district, but are grouped in small foci. With respect to 258 of them I have tried to trace the origin of the infection. In this connection it is necessary to rely in part upon observations made in the medical census of 1935, also recorded by a medical man, Dr. Westerlinck. Descriptions of all of the foci examined cannot be given here, and consequently I confine myself to reference to a few typical cases, and to the general conclusions that I believe can be drawn from the survey.

Cases with abundant bacilli.—In 43 percent of the foci the appearance of cases with abundant bacilli (lepromatous) has been followed rather soon afterwards by an extension of the disease in those centers. This occurrence was the more marked when the case was not quickly suspected. This happened especially in the village of Bananga, notability Kotinay, chefferie Timoniko. Between September, 1935, and August, 1939, eight new cases appeared, while there were but two in 1935. One of these two, which I classified as Ld (diffuse lepromatous), was at the time considered to be a macular (N) case. Another example is to be found in the village of Balinga, notability Korote, chefferie Timoniko. In 1935 a child was suspected of having leprosy; at present he is an Ld case and eight new ones have appeared in his neighborhood.

It seems particularly important to draw attention to the fact that the diffuse lepromatous cases are especially difficult to diagnose if, as there is all too often a tendency to do, the diagnosis of the disease is based on the presence of a dyschromic

lesion, the terms spots and macules being exclusively understood, in the case of a colored population, in the sense of achromia. A microscopic examination seems to me indispensable, especially when there is a question of suspected spots with only slight dyschromia and slight infiltration.

Cases with few bacilli.—Contagiousness does not seem to pertain solely to lepromatous cases. It appears that N or Nt cases can also be held responsible for the infection of other cases which have arisen since 1935 in the locations listed in Table 6. These are N or Nt cases; this is said to avoid the possible objection that any L case might have been ignored at the time of the first examination. As is to be expected, the N or Nt type cases are less contagious than those of the L type, but the appearance of 25 new ones in four years among the individuals in contact with 35 N or Nt lepers shows that the problem of segregation of neural leprosy must certainly be given attention.

TABLE 6. *Villages in which neural-type cases (N or Nt) have apparently been sources of infection.*

Villages and notabilities	Number of old cases	Number of new cases
Bambaa, Linga.....	6	3
Baguanama, Gbému.....	4	3
Bangbuma, Bamwenda.....	2	3
Babingama, Fala.....	4	4
Babenako, Fala.....	3	1
Babengue, Fala.....	3	1
Bakaye, Madupa.....	2	3
Batabongea, Madupa.....	2	2
Bamangangue, Kilongo.....	1	3
Bamasoki, Chiba.....	8	2
TOTALS.....	35	25

J. EFFECTS OF SEGREGATION

Segregation as practised in this district is based exclusively on methods of persuasion. The lepers in the isolation villages, except those of Pawa and Bengue, were left without any treatment until the beginning of 1939, and for this reason the villages were only partly successful. In consequence, we find centers in which segregation has been well carried out, and others in which the contrary is true.

The value of segregation, as shown by a comparison of the data for certain villages collected in 1935 and 1939, is to be

seen from Table 7. Not all of the villages listed had lepromatous cases; I have included four (in italics) that have already been spoken of in connection with the question of contagiousness of neural leprosy.

TABLE 7. *Effects of segregation, 1935-39.*

Village	Segregated		Not segregated		Total new cases (segregated or not)
	Old cases	New cases	Old cases	New cases	
<i>(a) Segregation relatively well carried out</i>					
Bamboli.....	3	—	—	1	1
Mayade.....	5	1	—	—	1
Mapamba.....	9	3	1	—	3
Bembay.....	7	—	—	2	2
<i>Bamasoki</i>	6	1	2	1	2
Bamundaka.....	11	2	—	—	2
Bakudaye.....	4	—	—	—	—
Bakiabange.....	6	—	1	—	—
Banakumbise.....	5	—	1	—	—
Bapipio.....	9	1	2	3	4
TOTALS.....	65	8	7	7	15
<i>(b) Segregation relatively defective</i>					
Bananotiane.....	2	1	4	6	7
Banzeniego.....	5	—	3	4	4
<i>Baguanama</i>	2	1	2	2	3
<i>Babingama</i>	1	2	3	2	4
Bamwane.....	4	3	3	3	6
<i>Bamangangue</i>	—	—	1	3	3
Basingi.....	5	4	6	5	9
Balinga.....	3	2	5	6	8
Babosanga.....	1	—	2	4	4
Bamosangue.....	3	3	5	4	7
TOTALS.....	26	16	34	39	55

L. CONTACTS AND PREVIOUS DISEASES

The lack of good will, and especially the small interest aroused by questions concerning contacts, the duration of contacts, and the diseases that the patients had experienced before the onset of leprosy, have forced me to give up this subject; the purpose was, after all, to carry out an objective inquiry. It may be remarked that, before the organization of a medical service by the Congo Red Cross, syphilis and yaws devastated the country. Since then both diseases have undergone marked regression.

PLATE 30

FIGS. 5 and 6. A major tuberculoid case in the reactive state, with multiple lesions, many of them papular, some of the larger ones showing desquamation.

FIGS. 7 and 8. The same patient as in Figs. 5 and 6, showing complete subsidence of the reaction lesions five months later. This patient received no injections of hydnocarpus oil.

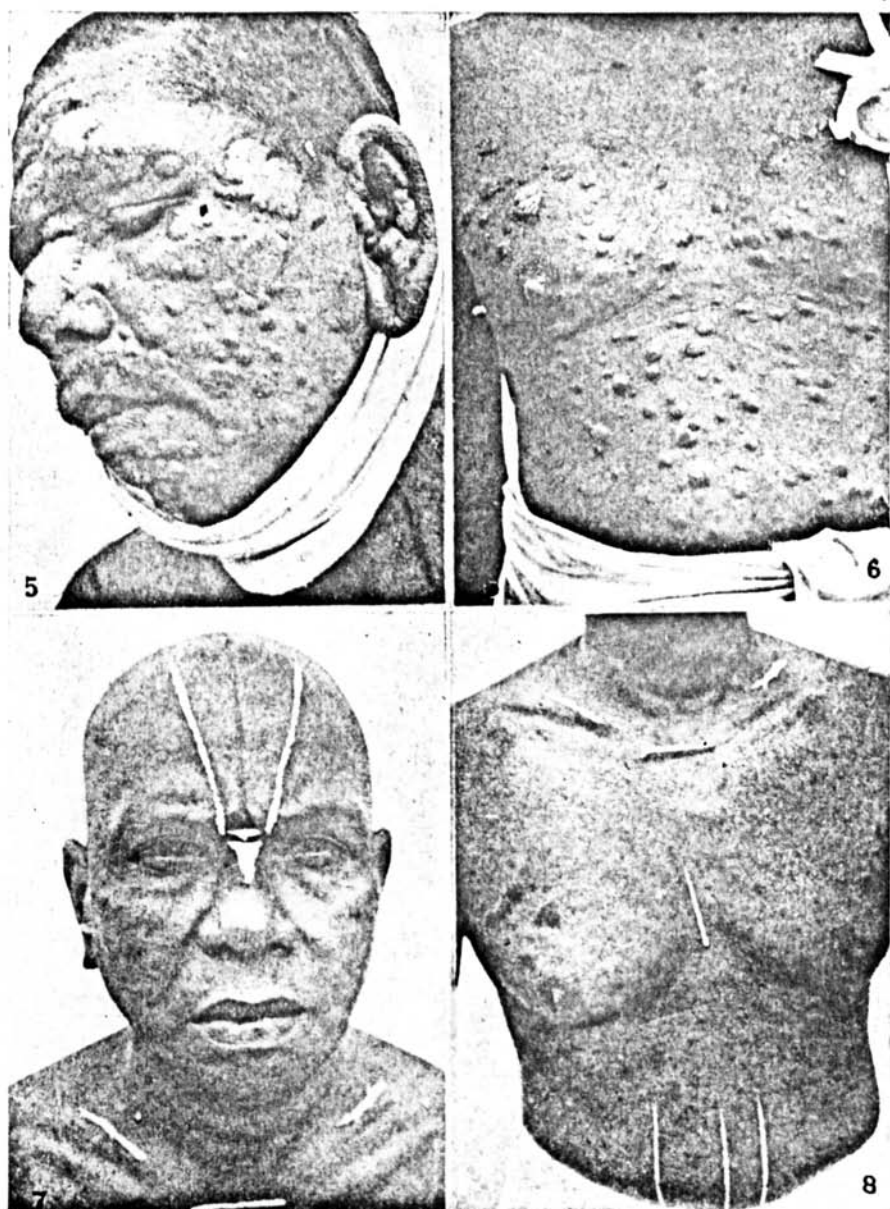


PLATE 30

CONCLUSIONS

(1) From the findings here reported it seems logical to conclude that under very similar conditions of life, the various factors of climate, race, sex and heredity play a very secondary part in the general picture of leprosy in the region studied. In special cases, however, these factors may become of more or less importance, if they increase the contact between sick and healthy people.

(2) It is believed that segregation of lepers presents, as yet, the best collective method of combatting the disease that could be employed in the district under consideration.

REFERENCES

- (1) ANN. SOC. BELGE MÉD. TROP. 19 (1939) 1-12.
- (2) BULL. INST. ROY. COLON. BELGE 9, No. 2, p. 421.