

A FIELD STUDY OF LEPROSY IN THE VIRGIN  
ISLANDS OF THE UNITED STATES\*

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INTRODUCTION

As part of an investigation of leprosy being conducted by the American Leprosy Foundation, field studies were made in the Virgin Islands during 1939 and 1940. In the Philippines (1, 2), intensive surveys had proved of value in yielding reliable quantitative data not available from other sources. The Virgin Islands were chosen for a similar study because they differ from the Philippines in climate and are small and accessible, the inhabitants differ from the Filipinos in race, culture, social customs and economic conditions, records of cases were found to be available for many years and cooperation of the physicians and of the people was assured.

In approaching the studies in the Virgin Islands, certain major objectives were set up. These may be stated briefly as follows:

1. What type of leprosy prevails in the Virgin Islands?
2. According to the statistical records, St. Croix has suffered much more heavily from leprosy than has St. Thomas. Is there a significant difference in prevalence at the present day and, if so, can any explanation be offered?
3. In a study of admissions to the leprosarium at St. Croix, Hayes (3) pointed out that "the females predominate, and as far back as we have statistics this predominance of females has always existed." Does examination of the entire population confirm the existence of this unusual situation?
4. What is the age distribution of the cases and what is the usual age of appearance of first signs of the disease?
5. In what proportion of cases can contact with antecedent cases be determined?
6. What is the annual incidence of new cases?
7. What is the risk of attack for persons exposed in the household?

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The present paper will consider only the frequency of leprosy by age, sex, race, type of disease, differences in prevalence in St. Thomas and St. Croix, and the proportion in which contact with antecedent cases can be traced.

#### DESCRIPTION OF THE AREA

A detailed description of the Virgin Islands has been given in a previous report (4). In 1940 the population numbered nearly 25,000, of which only 700 lived on St. John, the remainder being divided almost equally between St. Thomas and St. Croix as shown in the following table:

##### Number of inhabitants of the Virgin Islands, 1940.

St. Thomas .....	11,256
St. Croix .....	12,896
St. John .....	722
Total .....	<u>24,874</u>

Seventy per cent of the inhabitants are Negroes, more than 20 per cent are of mixed Negro and white blood, and less than 10 per cent white. Economically, the Virgin Islanders are so poor that for many years they have been far from self-supporting. The majority of the people live in crowded, insanitary quarters, and housing conditions generally are far from satisfactory. Nevertheless, economic and sanitary conditions have improved materially since 1917 and especially during the past decade.

#### METHODS OF STUDY

An intensive survey requires first a complete census and second the physical examination of as large a proportion of the population as possible. These steps were followed in the present investigation. Also special epidemiological studies were made of cases of leprosy known previously or discovered during the survey. In St. Thomas, work was commenced in September, 1938, and completed in October, 1939. The island was divided into six districts to each of which a field worker was assigned. Districts I to V were within the town of Charlotte Amalie which has more than 90 per cent of the population of the island. Information for each individual who was or had been a member of each household since its establishment was recorded on special schedules. A clinic was opened in Charlotte Amalie and selected persons were requested to attend each day for examination and medical advice. For outlying sections clinics were held in schools or other available buildings. Some persons were examined in their homes in town or country and others in the municipal hospital. The procedure was essentially the same in each case. A brief medical history was obtained, including any knowledge of leprosy in the family or associates. Each person was examined unclothed except for a draping sheet. The physical examination was as thorough as time permitted, and included weighing, measurement of height, blood pressure

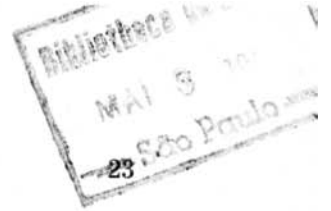
determinations on persons 15 years of age or older, inspection of eyes, ears, nose, and mouth and auscultation of heart and lungs. Particular attention was given to the skin and to those nerve trunks frequently enlarged in leprosy. Blood was taken from most persons except very small children and shipped to Puerto Rico where Wassermann and Kahn tests were made at the School of Tropical Medicine. During the course of the year, approximately 70 per cent of the enumerated population were examined.

In St. Croix the studies began in January, 1940, and ended in November, 1940. The same general procedure was followed except that no attempt was made to include the entire island in the survey. An area was chosen between the towns of Christiansted and Fredericksted which included most of the rural territory and the large estates and estate-villages. This was divided into five districts, to each of which an enumerator was assigned. Because of the size of the area, about 11 x 5 miles, examination centers were located at six points, namely, at Big Princess, Concordia, Anna's Hope, Bethlehem, Grove Place and Whim. In addition many persons were examined at home or in the municipal hospitals. Histories were taken and physical examinations were made in a manner similar to the procedures in St. Thomas, except that routine blood pressure determinations were not made and the patients were weighed but not measured. Blood samples were taken from persons over five years of age and sent to the local hospital laboratories for Kahn-testing. Approximately 95 per cent of the enumerated population were examined, as well as most of the known contacts and familial associates of cases living outside the study area.

#### RESULTS OF STUDY

*The survey of St. Thomas.* In St. Thomas the census, completed in January, 1939, listed 10,592 persons. This is 664 less than the 11,256 estimated by the official census of 1940, but such a discrepancy is easily explained. In the first place the population was increasing by nearly 150 each year between 1930 and 1940 and the increase was doubtless much greater in 1939 due to special factors. In the second place, no attempt was made to enumerate men and families belonging to the military forces or other continental Americans living temporarily in St. Thomas.

The age and sex distribution of the population is given in Table 1. Females outnumbered males in a ratio of about 55 to 45; nearly 34 per cent of the total were less than 15 years of age; 39 per cent were between 15 and 40 years of age, and 27 per cent were 40 years of age or older. The racial distribution by sexes is shown in Table 2. "Negroes" included persons of apparently pure, or nearly pure Negro blood; the "mixed" group were nearly all crosses of Negro and white strains, while the "white" group were apparently pure Caucasian without Negro or other racial strains. The place of birth of the examined group is given in Table 3. About two-thirds were born in St. Thomas, a relatively large number in



St. Croix and St. John, many in St. Bartholomew or other West Indian Islands and a few in the United States. A considerable part of the white group, about one-fifth, were natives of the French island of St. Bartholomew, or their descendants, and a relatively small fraction were natives of the Virgin Islands, continental American or Europeans.

During the survey, 7,344 persons were examined. These included 78 per cent of the Negroes, 74 per cent of the whites, but only 38 per cent of the mixed group, whose cooperation was more difficult to obtain. The percentage of unexamined persons was slightly greater in the older age groups and in infancy than for other ages.

*Leprosy in St. Thomas.* At the end of the survey only 16 cases of leprosy were known to be in the enumerated population of 10,592, or 1.5 per 1,000. The prevalence rate would be considerably higher, or about 2.2 per 1,000, if the examined group only were included in the denominator. The former figure is doubtless more nearly correct for the following reason: eight cases were already known to the medical authorities before the survey, six were discovered among known household contacts, nearly all of whom were examined, and one case was a person who had been reported as having a condition suggesting leprosy. Only one additional case was found. Therefore, one would expect to find not more than one or two additional cases among the unexamined group.

The number of cases is too small to provide reliable figures for prevalence by race, sex, and age. Nine cases were in females and seven in males. Nine were in Negroes, four in persons of mixed blood, and three in whites. Four were in children under 15 years of age, three in persons of 15 to 29 years, and nine in those of 30 years and over. Five cases in males and the same number in females were classed as neural; four in males and two in females as lepromatous.

Many of the cases were undoubtedly infected outside St. Thomas. Five were in persons born in St. Croix and four of these cases probably originated there. Ten were in persons born in St. Thomas but three possibly acquired the disease elsewhere. There remain nine persons who were probably infected in St. Thomas.

*The survey in St. Croix.* The inhabitants of the surveyed area numbered 5,062, or about 40 per cent of the population of the entire island which was estimated to number 12,896 in 1940. Of the enumerated population 4,830 or 95.5 per cent attended the clinics. In addition, 373 persons living outside the area were examined, for the most part persons known to have had contact with leprosy either within their families or elsewhere. The unexamined persons of the enumerated group were nearly all uncooperative residents of suburban districts of Christiansted and Fredericksted. This fraction

included a larger proportion of adults than the examined group, but otherwise it was fairly comparable.

The age and sex distribution of the enumerated population is given in Table 1, which indicates certain differences from the St. Thomas group. Males comprised 54 per cent of the St. Croix population while in St. Thomas they accounted for only 45 per cent. This is explained in part by the inclusion of some 200 members of a C. C. C. camp which was located in the St. Croix area and in part by the fact that the sugar estates and cattle farms in the area employ a slightly higher proportion of males than females. The St. Croix population was also an older group with a greater proportion more than 40 years of age than in St. Thomas.

In St. Croix, Negroes and persons of mixed blood formed a slightly greater part and white persons a much smaller part of the population than in St. Thomas (Table 2). The mixed group was relatively more numerous in St. Croix because a large number of Puerto Ricans have emigrated to that island during the past ten years, and they, with their offspring, comprised almost three-fourths of this class in the study area. The mixed Puerto Rican is a combination of white, Negro and probably Indian strains. The proportion of whites was very small, only about 3 per cent, as compared to 13.5 per cent in St. Thomas, which is the metropolis of the Virgin Islands and attracts more continental Americans and Europeans, but the difference is attributable mainly to the large number of white French in St. Thomas.

The place of birth of the St. Croix population is shown by race in Table 3. About 70 per cent were natives of St. Croix; 12 per cent were born in Puerto Rico, and 10 per cent in the British West Indies. Fewer than 2 per cent of the St. Croix group were born in the other Virgin Islands, but of the St. Thomas population nearly 10 per cent were born in St. Croix or St. John. This indicates an appreciable migration from St. Croix to St. Thomas and accounts in a large measure for the age differences of the populations because it is chiefly the younger people who have migrated to St. Thomas.

*Leprosy in St. Croix.* There were 71 cases of leprosy among the enumerated population in November, 1940, or 14 per 1,000. Twenty-five of the cases were newly discovered. The prevalence by sex and broad age groups (Table 4) was higher in the older ages and was slightly greater among females than among males. Two cases, both in males, were discovered in children under 5 years of age. Twenty cases were classed as lepromatous and 51 as neural, prevalence for both types being slightly greater among females.

In the population of St. Croix outside the study area, there were 40 additional known cases of leprosy, only three of which were discovered during the survey, two in persons known to have had contact with the disease. Therefore, at the end of 1940, there were 111 known cases in a population of about 12,900 or a prevalence rate of 8.6 per 1,000 for the island as a whole. However, if



the prevalence rate of 14 per 1,000 for the surveyed area be accepted for the entire island, there should be 181 cases in St. Croix, with 110 cases from outside the study area; that is, 70 more than were known to exist. On the other hand, there is evidence that leprosy prevalence may be lower in the unsurveyed part of the island. Before the survey of 1940, known prevalence was 9.1 per 1,000 in the area surveyed as compared to only 6.3 per 1,000 in the remaining portion. Furthermore, the survey increased the number of cases known in the study area by 24, or 55 per cent. Applying the same per cent of increase to the number already known in unsurveyed territory would add only 22 cases instead of 71, which would make a total of 133 for the island, or a prevalence rate of 10.3 instead of 14 per thousand. The true figure is probably between these extremes.

An important factor which must be taken into account in considering the prevalence of leprosy in St. Croix is the large number of Puerto Ricans living on the island. Not only is leprosy comparatively uncommon in Puerto Rico but all Puerto Rican immigrants to St. Croix are examined carefully before admission. In addition, since the Puerto Ricans do not intermarry with Crucians to any great extent, they form a group set apart somewhat from the remaining population among whom the prevalence of leprosy is considerably higher than 14 per 1,000.

The total population of St. Croix, numbering approximately 12,900, has been classified by age and sex on the assumption that its age and sex distribution was approximately the same as that of St. Thomas and the study area of St. Croix combined. Based upon these estimates, the prevalence of the disease is given by age and sex in Table 5. The rate was found to be slightly higher for females than for males and to increase with age up to 60 years after which it decreased slightly, possibly because of selective mortality.

#### SPECIAL FEATURES OF LEPROSY IN THE VIRGIN ISLANDS

*Age:* The age of leprosy patients may vary with locality, dependent upon such factors as age distribution of the population, age at onset and duration of the disease, general incidence, and epidemic trend. Table 6 gives the age distribution and the prevalence rates for broad age groups for St. Croix, for an area in the Philippine Islands (1), and for two surveyed areas in Africa (5, 6). The St. Croix group shows a much greater proportion of cases more than 50 years of age than any of the other areas. In St. Croix and in the Belgian Congo, prevalence is greatest after 50 years of age, but in Cebu and Nigeria it is greatest between 15 and 50 years of age. It is considered that the incidence of leprosy is declining in St. Croix (4), and the fact that a large proportion of cases are in persons more than 50 years old tends to substantiate this opinion.

*Age at onset:* Histories considered to be reliable concerning the appearance of the first signs of disease were obtained from 89 persons. The results are given in Table 7 and indicate that the age

at onset of disease was less than 15 years in about half the cases, less than 20 years in about two-thirds. Doull *et al* (1) showed that in Cebu the age at onset was under 15 years in about 63 per cent, and under 20 years in 85 per cent, or somewhat younger than in the Virgin Islands. The higher prevalence in Cebu (about 17 per 1,000) as compared with St. Croix (about 10 per 1,000) may account for the fact that infections occur later in life in the Virgin Islands. Allowing for an average incubation period of 5 years, it is estimated, however, that nearly 75 per cent of Virgin Islands cases were infected before 20 years of age.

**Sex:** In many parts of the world leprosy appears to be much more prevalent among males, and statistics from most leprosaria reveal that male patients outnumber females by 2 to 1, or more. Hopkins and Denney (7) reported that among 718 cases of leprosy admitted to the leprosarium at Carville, Louisiana, 72.3 per cent were males. Wayson and Rhea (8) stated that 64 per cent of 3,567 admissions in Hawaii were in males, but that the numbers for the sexes were equal from 15 to 19 years of age. Rogers and Muir (9) indicated that in India females outnumbered males up to 30 years of age after which the reverse was true. Muir (10) reported prevalence in India to be 59.3 per 100,000 males and only 23 per 100,000 females. In Cebu, Doull *et al* (1) found that prevalence in childhood was essentially the same in males and females but that after 14 years of age the disease was much more prevalent in males, and that prevalence for all ages was 23.5 per 1,000 males and only 11.0 per 1,000 females.

An excess of males is, however, not the invariable rule. In Nigeria, Davey (5) surveyed a village of 1,800 inhabitants and found a gross prevalence rate of 56 per 1,000. Prevalence was slightly higher in females and the more severe types were about equally frequent in the two sexes. In the examination of more than 38,000 persons in the Belgian Congo, Degotte (6) found only slightly higher prevalence in males, 56 per 1,000 as compared to 50 per 1,000 in females.

Although prevalence in the Virgin Islands is on a far lower level than in these African areas, the sex ratio in the Virgin Islands conforms with these rather than with the usual picture. Likewise, the more severe types of the disease were found to be about as frequent in females as in males.

Perhaps the simplest explanation of the inconsistency of the sex ratio is that there is no difference in susceptibility between the sexes, but that in many parts of the world there is greater exposure of males after childhood. In other localities where social and moral habits differ, there is more nearly equal exposure in the two sexes and consequently a nearly equal sex incidence. In most countries, including India and the Philippines, females from the age of puberty are set apart, protected more, and do not have as wide a variety of extra-familial contact as males. But in the more prim-

itive culture of the West African and his descendants in the Virgin Islands, there is little tendency to set females apart in this way, and "marriages" last only so long as both parties are agreeable. Common-law unions are the rule among the lower economic and social classes in the Virgin Islands. Females probably have as numerous mates as the males. In this connection, it is of interest that females in St. Croix showed a slightly higher prevalence of syphilis than males. In other words, opportunity for exposure seems to determine subsequent disease prevalence and suggests transmission through direct contagion.

*Race:* The number of cases and the known gross prevalence of leprosy in each racial group for St. Thomas and St. Croix is given in Table 8 which shows that the prevalence for Negroes was nearly 7 per 1,000 or about 3 times that for either the mixed or the white group. The number of white cases is too small to be of significance and three of the four were in the special group of white French. If Puerto Ricans were excluded from the population, prevalence for the mixed group would be proportionately higher, or about 2.5 per 1,000. The greatest prevalence was expected among Negroes, most of whom are of the lowest social and economic class.

*Place of birth:* A study of the birthplace of Virgin Islanders suffering from leprosy (Table 9) reveals that about 84 per cent were born in the Islands as compared with 75 per cent of the entire population. Those born elsewhere were all of the older age groups in which leprosy reaches its highest prevalence and practically all had lived in the Virgin Islands more than 10 years before the onset of the disease. It is probable, therefore, that most of them were infected locally. In his survey of the patients in the leprosarium in 1926, Hayes (3) found that of a total of 78, 24 were foreign-born, 11 were born in the Virgin Islands but had one foreign parent, seven were native born but had two foreign parents, five were native born but could give no information concerning their parents.

Considering only St. Thomas, it has been stated that about two-thirds were born on the Island, while the rest were natives of St. Croix, where four out of the five probably were infected. Of those in St. Croix 75 per cent were natives, none was born in the other Virgin Islands and most of the remaining 25 per cent immigrated from the British Islands of Barbados, Nevis, St. Kitts and Antigua. It follows that most of the leprosy in the Virgin Islands is indigenous and that prevalence in St. Thomas is maintained partly by cases from St. Croix.

*Clinical classification:* About 30 per cent of the 127 cases were classed as lepromatous, and three-fourths of all cases were regarded as active (Table 10). Inactive cases represent, in part, simple neural cases which have become arrested in old people and, in part, secondary neural cases. A few showed "healed" macules, usually children or young adults. The proportions of the various types was essentially the same for males as for females. Sixty-three patients,



including all those of the lepromatous type, were in the St. Croix leprosarium in November, 1940. Of the remaining 64, 24 were on parole from the leprosarium and 40 had never been isolated. The fact that no lepromatous cases were discovered in the general population during the surveys indicates efficient detection and segregation of lepromatous leprosy in the Virgin Islands. It is possible also that early signs of the lepromatous type are difficult to recognize and may even disappear, as is the opinion of Rodriguez and Guinto (11). Macular and neural lesions, on the other hand, are usually well defined and of slow evolution.

*History of contact:* The proportion of cases of leprosy in which it is possible to establish contact with a previous case has been variously stated to range all the way down from as high as 90 per cent to below 30 per cent. Much depends, of course, upon the age of the patient at the time such information is obtained and upon the length of time which has lapsed since contact occurred. In the Cebu series of 104 cases (1), house contact was established in about 40 per cent. In the Virgin Islands cases (Table 11) history of household exposure was established in 52 per cent for patients under 20 years of age and extra-household contact in 15 per cent, a total of 67 per cent. "Household exposure" indicates association of the patient with a preceding case in the same house and "extra-household exposure" means frequent and close association with the supposed source case but not within the same household. In some instances previous cases existed among close relatives such as cousins, uncles and aunts, and although no contact could be established, it probably occurred. If this group be added, the total in which contact had probably occurred amounts to 80 per cent. In patients over 20 years of age, definite contact was established in only 39 per cent, and possible contact in 11 per cent more, giving a total of 50 per cent. It was to be expected that fewer in the older group would give a history of contact because in most instances a much longer time had elapsed since contact took place and the fact may have been forgotten. Of the total, 45 per cent gave a history of contact with an antecedent case and in another 12 per cent such contact was possible, making a total of 57 per cent. In St. Thomas, where prevalence is relatively low, contact was established in 6 out of 8 cases discovered in the survey. One of the two cases in whom contact was not established was in a girl of 14 years who had on one arm a neural macule which had been present for about four years. The other was in a man 40 years old with areas of anesthesia, atrophies and contractures said to have commenced at about ten years of age. Contact in each of the other six persons had been with cases which are considered to have been lepromatous.

*Leprosy related to socio-economic level:* Leprosy is commonly stated to be associated with poverty and an insanitary environment and this was found to be true in the Virgin Islands. In St. Croix not more than one-fifth of the population, or about 2,600, may be described as belonging to the upper social and economic class,

fairly well educated, well clothed and housed with adequate bathing and toilet facilities, and with an income sufficient to maintain this level. Four persons with leprosy were found among this upper fifth, representing about 1.5 per 1,000. One was a high school boy of mixed blood who was exposed in infancy to a leprosy nurse, one a white girl who developed leprosy when 21 years old and the other two were a brother and sister of mixed blood. The brother developed leprosy in 1914 at the age of 10 years and the sister about 1930 at the age of 14 years. The lower four-fifths of the total population, or about 10,300 persons, accounted for the remaining 107 cases of leprosy, giving a prevalence rate of 10.4 per 1,000, about seven times greater than that for the upper fifth. In St. Thomas none of the cases of leprosy could be assigned strictly to the upper fifth, although three of them might be classed as "borderline."

There is a well authenticated account of leprosy occurring in two related white families of St. Thomas during the period from about 1885 to 1900. They were among the wealthiest people in the Islands with extensive holdings in St. Thomas, St. Croix and certain South American countries. Some of them made frequent trips to Europe for pleasure, business or education. About 1885 one of the male members (A) developed leprosy, the source of the infection presumably being one of his wife's siblings. A few years later a younger sister (T) showed signs of the disease while at school in Paris; and at about the same time, or earlier, it appeared in a niece and a nephew, children of siblings of the first two. During the time when all four had leprosy, they probably accounted for a large proportion of cases in St. Thomas although the social and economic group from which they came represented a very small fraction of the entire population. It follows that although leprosy usually reaches its greatest prevalence in the lower economic classes, it is by no means absent from the more fortunate members of society.

#### A COMPARISON OF ST. THOMAS AND ST. CROIX

It has been shown that indigenous leprosy in the Virgin Islands is largely confined to St. Croix, where the disease is ten times as prevalent as it is in St. Thomas. Previous reports (3, 4) indicate that such has been the case during the past hundred years and that while there appears to have been a decline in prevalence, especially since 1900, the decrease has been proportionately greater in St. Croix, probably because the level in St. Thomas has been maintained by imported cases. Consideration of the similarities and differences of the two islands may suggest some explanation of the unequal leprosy prevalence.

The climate is essentially the same in the two localities. The majority of the population in each place are Negroes, but proportionately there are more white persons in St. Thomas, mainly due to the large group of white French. Those of "mixed" blood are

more numerous in St. Croix, chiefly because of the Puerto Rican immigration. In St. Thomas the great majority of the people live in the one large town of Charlotte Amalie, while in St. Croix less than half the inhabitants live in the two towns of Christiansted and Fredericksted, the greater number residing in estate-villages in the rural districts. However, leprosy has appeared as frequently in the towns of St. Croix as in the country, so place of residence does not seem to be of much importance as regards leprosy prevalence. In the towns there is usually a more adequate supply of water for bathing. One would assume that there would be more overcrowding in the towns than in the villages but this does not appear to be the case. In the rural districts of St. Croix the population lives in villages of a few to several hundred persons and while the houses may be spaced a little farther apart than in the towns the individual rooms are probably just as crowded and housing facilities are doubtless just as good in one place as in another.

Economic conditions in St. Thomas have been better than in St. Croix for many years, for several reasons. First, St. Thomas is the main port in the islands and is benefited by a large amount of shipping; second, St. Thomas is the commercial center for the islands, where most of the trading is done, and third, most of the tourist traffic during the past 25 years has been with St. Thomas. As a result there has been more money circulating in St. Thomas and more people are employed for wages which in turn are higher than in St. Croix.

Probably because of its superior economic position health conditions in St. Thomas have been better than in St. Croix since 1900. Crude mortality rates for St. Thomas have declined from a level of 30 per 1,000 in the first decade of this century to about 18 per 1,000 during the past five years. For St. Croix there has also been a decrease over the same period, but at a higher level, from approximately 40 to 22 per 1,000. Infant mortality rates for St. Thomas have decreased during the past 30 years from 250 to 110 per thousand and for St. Croix from 400 to 125 per 1,000. During the period 1924 to 1938, the annual specific mortality rate per 100,000 population from tuberculosis was 100 for St. Thomas and 126 for St. Croix; from dysentery it was 6 for St. Thomas and 27 for St. Croix; from pellagra, it was 65 for St. Thomas and 146 for St. Croix. During the surveys in 1939 and 1940 serological tests were positive for syphilis in 14.5 per cent of the examined population in St. Thomas and in 18.2 per cent in St. Croix. The percentage with positive tests was much higher in Negroes than in other racial groups and slightly higher among females than among males. Filariasis is known to be very prevalent in St. Croix, where microfilariae can be demonstrated in the blood of approximately 25 per cent (12) of hospital admissions, but in St. Thomas this condition is rare. Skin infections such as tinea flava and scabies which usually flourish in an insanitary, crowded environment are not uncommon in the Virgin Islands but the prevalence of both taken together is about

twice as high in St. Croix as in St. Thomas as shown in the following tabulation:

*Percentage of examined population with tinea or scabies.*

	<i>Tinea</i>	<i>Scabies</i>	<i>Total</i>
St. Thomas	2.7	1.6	4.3
St. Croix	7.2	1.9	9.1

Considering all factors therefore it is evident that the health of the population is on a considerably higher level in St. Thomas than in St. Croix.

During October and November, 1941, a special study was made of the dietary habits and expenditures for food in a group of 100 families in St. Croix, and 45 families in St. Thomas, unselected except that they were all from the lower half of the social and economic structure. A list was made of the articles of food consumed by each family during the 24 hours preceding the investigation. The approximate amounts, kind, and cost of food and articles used in its preparation, purchased each week by each family was determined and also the number and ages of persons in each household during the 24 hours previous to the visit. In the late summer and fall months the scarcity of local agricultural products is greater than usual and the diet during this period is of necessity more restricted than during late winter and spring when fruits and vegetables are more plentiful. The average expenditure was approximately the same in St. Croix (16 cents per person per day) as in St. Thomas (15 cents per person per day). Prices for various commodities are a little higher in St. Croix. In St. Thomas food shops are more accessible and there is a greater supply and variety of fresh foods so that the residents have better food for less money than they do in St. Croix. Furthermore, the average expenditure per person does not give the whole picture because the range of amounts spent was greater in St. Croix where there were a few families who spent much more than the average, and most of them spent less than in St. Thomas.

A study of the articles of food listed on the menus of the two groups for the 24-hour observation period brings out certain very definite points (Table 12). Fresh fruits and vegetables were almost absent from the diet; animal protein was provided largely in the form of fish, and the caloric intake consisted mainly of wheat bread, cornmeal, rice, peas, beans and potatoes with some fish and beef. It is evident that the diet of the St. Thomas group was superior in that more fresh fish, beef, cheese, butter and milk were provided. Such a diet must be lacking in vitamins and ample evidence of this was found during the clinic examinations. Numerous signs of deficiencies of vitamins A and B were present, such as follicular keratosis over elbows, knees, and elsewhere, general scaliness and dryness of the skin, cracking of the muco-cutaneous borders at the corners of the mouth, corneal ulcers and scars and skin lesions of pellagra. Generally speaking, such signs were commoner in St.

Croix. It may be concluded that the diet of the great majority of Virgin Islanders, while it may provide adequately for caloric requirements, is inadequate in vitamins and probably also in proteins and fats, and that the greatest inadequacies occur in St. Croix.

#### SUMMARY AND CONCLUSIONS

1. A field study of leprosy in the Virgin Islands has demonstrated that the disease is about ten times as prevalent in St. Croix (10-14 per 1,000) as in St. Thomas (1-1.5 per 1,000), and previous reports (3, 4) indicate that for at least 100 years the relative frequency has been much the same. St. Thomas has been favored, economically; its people have a more adequate diet; it has had a higher level of health and sanitation, and it has had considerably lower general mortality and morbidity rates than St. Croix.

2. In two-thirds of the cases of leprosy the first signs of disease appeared before 20 years of age, a smaller proportion than in Cebu, Philippine Islands (1). It is suggested that the greater prevalence in Cebu may favor earlier infection.

3. Prevalence in the Virgin Islands increases with age and it is greater in persons over 50 years old than in most other localities where intensive surveys have been made. The large proportion of cases in older age groups is interpreted as suggestive evidence of declining incidence.

4. Leprosy is about equally prevalent in females and males in the Virgin Islands, a condition similar to that found in West African natives, but in marked contrast to that found in the Philippines and most other areas. If males are more susceptible to the disease they would be expected to exhibit higher prevalence universally and not in certain localities only. It is suggested therefore that in the Philippines males may be more exposed than females, whereas in the Virgin Islands exposure may be approximately equal. It should be borne in mind, however, that even where infections are equally common in females and in males, a greater proportion may conceivably remain latent in one sex than in the other, because of some environmental variation.

5. Leprosy was found to be more prevalent in Negroes than in other racial groups in the Virgin Islands.

6. A history of contact with antecedent cases, either within or without the household, was obtained in nearly 70 per cent of patients under 20 years of age but in a much smaller proportion of older cases.

7. Leprosy was found to be much more frequent among the lower economic classes where there are found also higher morbidity rates for other diseases, less cleanliness, less favorable housing conditions and a more inadequate diet.

8. Lepromatous leprosy comprises less than 30 per cent and neural leprosy more than 70 per cent of all cases in the Virgin



Islands. These proportions were found to be essentially the same in males as in females.

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TABLE 1. Age and sex distribution of the enumerated population of St. Thomas and St. Croix

Age in years	St. Thomas			St. Croix		
	Male	Female	Per cent of total in each age group	Male	Female	Per cent of total in each age group
0 - 4	623	600	11.7	291	301	11.7
5 - 9	578	600	11.3	267	264	10.5
10 - 14	520	614	10.9	232	223	9.0
15 - 19	541	564	10.6	306	202	10.0
20 - 29	866	905	17.0	420	305	14.3
30 - 39	540	696	11.8	273	251	10.3
40 - 49	376	562	9.0	312	292	11.9
50 - 59	343	519	8.3	269	267	10.6
60 - 69	210	365	5.5	227	166	7.8
70 and over	104	299	3.9	109	85	3.9
Total	*4701	**5724	100.0	2706	2356	100.0

\* excludes 84 males }  
 \*\* excludes 83 females } for whom age was not stated.

TABLE 2. Race and sex distribution of enumerated population of St. Thomas and St. Croix

Race	St. Thomas			St. Croix		
	Male	Female	Per cent of total in each group	Male	Female	Per cent of total in each group
Negro	3217	3983	69.0	1917	1709	71.7
Mixed	781	1044	17.5	706	583	25.4
White	703	697	13.5	83	64	2.9
Total	*4701	**5724	100.0	2706	2356	100.0

\*excludes 84 males }  
 \*\*excludes 83 females } for whom race was not stated.

TABLE 3. Place of birth of different racial groups examined in St. Thomas and St. Croix

Place of birth	St. Thomas				St. Croix			
	Negro	Mixed	White	Total	Negro	Mixed	White	Total
St. Thomas	3917	441	665	5023	75	11	0	86
St. Croix	379	25	6	410	3064	445	66	3575
St. John	235	15	0	250	13	0	0	13
Brit. Virgin Islands	677	29	1	707	4	0	0	4
Puerto Rico	46	109	22	177	50	573	4	627
Haiti and S. Domingo	71	10	5	86	21	2	0	23
Barbados	26	1	1	28	179	7	0	186
Nevis, St. Kitts	83	4	0	87	259	15	0	274
Antigua	31	1	0	32	73	6	0	79
St. B. tholomew	12	9	226	247	1	0	0	1
Other West Indies	79	12	13	104	39	4	2	45
U. S. of America	83	13	48	144	28	10	27	65
Elsewhe e	1	2	46	49	0	2	24	26
Total	5640	671	1033	7344	3806	1075	123	5004

TABLE 4. Prevalence of leprosy in the survey area in St. Croix by age and sex

Age group in years	Number in group			Number of cases of leprosy			Prevalence of leprosy per 1,000		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 14	790	788	1578	7	5	12	8.9	6.3	7.6
15 - 49	1311	1050	2361	18	19	37	13.7	18.1	15.6
50 and over	605	518	1123	11	11	22	18.2	21.2	19.8
Total	2706	2356	5062	36	35	71	13.3	14.9	14.0

TABLE 5. Age and sex distribution of the total population of St. Croix (estimated); number of known leprosy cases, and prevalence of leprosy per 1,000

Age in years	Population of St. Croix			Number of cases of leprosy			Leprosy prevalence per 1,000		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	760	753	1513	2	0	2	2.6	—	1.3
5 - 9	698	720	1418	1	0	1	1.5	—	0.7
10 - 14	631	693	1324	6	7	13	9.5	10.2	9.8
15 - 19	705	638	1343	6	2	8	8.5	3.1	6.0
20 - 29	1075	1010	2085	9	9	18	8.4	8.9	8.6
30 - 39	680	787	1467	9	9	18	13.2	11.4	12.3
40 - 49	575	713	1288	4	14	18	7.0	19.6	14.0
50 - 59	513	647	1160	3	14	17	5.8	21.6	14.7
60 and over	543	759	1302	10	6	16	18.4	7.9	12.3
Total	6180	6720	12900	50	61	111	8.1	9.1	8.6

TABLE 6. Age distribution of cases of leprosy and prevalence of the disease per thousand for broad age groups in St. Croix, Cebu, Nigeria and the Belgian Congo (1, 5, 6).

Age group in years	Per cent of cases in age group				Prevalence of leprosy per 1,000			
	St. Croix 111 cases	Cebu 104 cases	Nigeria 106 cases	Belgian Congo* 2020 cases	St. Croix 71 cases	Cebu 104 cases	Nigeria 106 cases	Belgian Congo 2020 cases
0 - 14	14.4	8.6	11.3	10.4	7.6	3.4	12.7	14.8
15 - 49	55.9	86.6	77.4	73.4	15.6	31.4	98.4	71.0
50 and over	29.7	4.8	11.3	16.2	19.8	8.1	10.9	97.3
Total	100.0	100.0	100.0	100.0	14.0	17.2	56.0	52.9

\*The figures for the Belgian Congo are for age groups 0-19, 20-49, and 50 years and over.

TABLE 7. Age at onset of leprosy in 89 cases in the Virgin Islands

Age at onset in years	Males	Females	Total	Percentage with onset in age group	Percentage with onset accumulated to age at end of age interval
0 - 4	3	1	4	4.5	4.5
5 - 9	10	11	21	23.6	28.1
10 - 14	12	10	22	24.7	52.8
15 - 19	4	4	13	14.6	67.4
20 - 29	5	6	11	12.4	79.8
30 - 39	2	6	8	9.0	88.8
40 - 49	1	5	6	6.7	95.5
50 - 59	1	2	3	3.4	98.9
60 and over	1	0	1	1.1	100.0
Total	44	45	89	100.0	

TABLE 8. Racial classification of cases of leprosy from St. Thomas, St. Croix, and from both islands, and the known prevalence of leprosy per 1,000 in each racial group

Race	Cases of leprosy			Prevalence per 1,000
	St. Thomas	St. Croix	Total	
Negro	10	103	113	6.73
Mixed	3	7	10	1.97
White	3	1	4	2.25
Total	16	111	127	5.40

TABLE 9. Place of birth of leprosy patients, Virgin Islands

Place of Birth	Cases from St. Thomas	Cases from St. Croix	Total
St. Croix	5	91	96
St. Thomas	10	0	10
St. John	0	0	0
Total	15	91	106
Barbados	1	6	7
Nevis	—	6	6
St. Kitts	—	3	3
Antigua	—	3	3
British Guiana	—	1	1
Guadeloupe	—	1	1
Total	1	20	21
Total	16	111	127

TABLE 10. Types of leprosy in the Virgin Islands

Type of case	Males	Females	Total
Lepromatous	16	21	37
Neural			
Active	24	34	58
Arrested or quiescent	19	13	32
Total	59	68	127



TABLE 11. *The number and per cent of Virgin Islands leprosy cases in which there was known contact with an antecedent case, and the type of contact, grouped according to present ages*

Type of contact	Ages 0-20 years		Ages over 20 years		All ages	
	Number of cases	Per cent of cases	Number of cases	Per cent of cases	Number of cases	Per cent of cases
Household	14	51.9	21	21.0	35	27.6
Extra household	4	14.8	18	18.0	22	17.3
None known	5	18.5	50	50.0	55	43.3
None (but cases in family)	4	14.8	11	11.0	15	11.8
Total	27	100.0	100	100.0	127	100.0

TABLE 12. *The frequency of various foods in the menus of families in St. Thomas and St. Croix*

Article of food	Frequency per 100 family days		Article of food	Frequency per 100 family days	
	St. Thomas	St. Croix		St. Thomas	St. Croix
Wheat bread	218	113	Fresh fish	60	53
"Fungy" (cornmeal)	8	57	Salt fish	13	37
Rice	42	57	Canned fish	2	3
Beans	5	53	Fresh beef	24	10
Peas	24	10	Corned beef	2	5
Potatoes	26	12	Beef liver	0	1
Beets	2	0	Fresh pork	9	0
Oatmeal	0	9	Salt pork	0	2
Cream of wheat	2	3	Sausage	7	2
Macaroni	5	1	Shellfish	6	3
Soup	32	19	Bacon	0	1
Coffee	64	62	Eggs	7	7
Tea	89	23	Cheese	20	3
"Bush tea"	15	39	Butter	49	16
Cocoa	33	9	Greens	5	7
Milk	120	35	Bananas	13	4
Fruit juices	5	0	Cucumbers	0	1