

## THE PREVALENCE OF LEPROSY IN THE COOK ISLANDS

J. NUMA

*Assistant Medical Practitioner*<sup>1</sup>  
*Rarotonga, Cook Islands*

### INTRODUCTION

The Cook Islands group includes fifteen small islands widely scattered throughout an area of some 850,000 square miles of the South Pacific Ocean, extending from 9° to almost 23° South latitude and from 156° to 167° West longitude. The total land area is approximately 110 square miles; none of the islands is more than four miles in diameter.

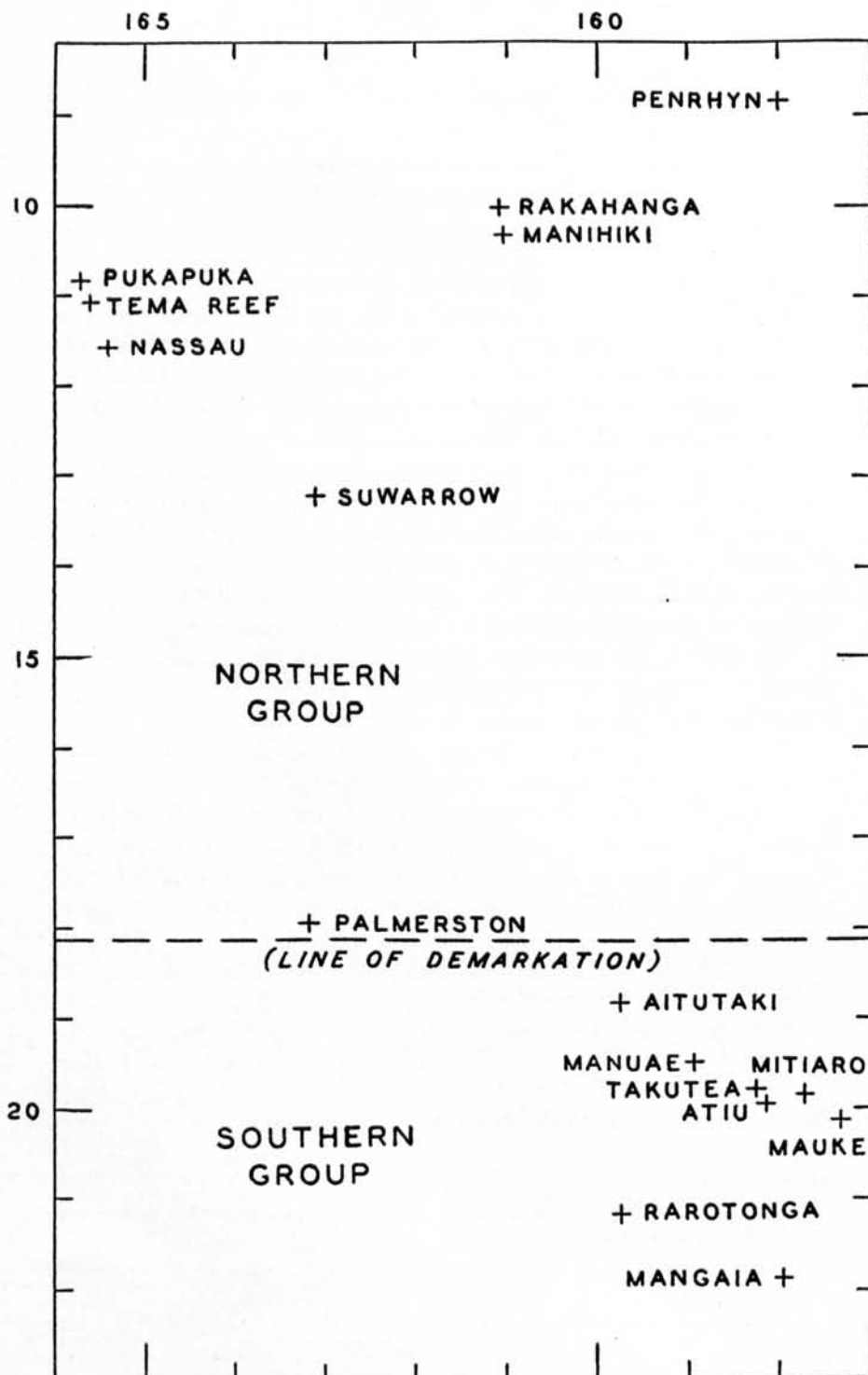
As in most Pacific Island groups, considerable expanses of sea separate the islands, as will be seen from Text-fig. 1. For example, it is about 780 miles by sea from Penrhyn, the most northern island, to Mangaia, the most southern one, and not much less to Rarotonga, the capital. The difficulties of leprosy survey work under such geographical conditions are obvious. For practical purposes the archipelago may be divided into the Northern and Southern groups, as indicated by a line of demarcation on the map.

The Southern group consists of eight islands, of which six—Rarotonga, Aitutaki, Atiu, Mitiaro, Mauke and Mangaia—are permanently settled. Of the two remaining islands, Takutea is visited by parties from Atiu who make copra there, and Manuae (or Hervey) is privately leased and is worked as a coconut plantation. The Northern group consists of seven islands, of which five—Penrhyn (or Tongareva), Manihiki (or Humphrey's), Rakahanga, Pukapuka (or Danger) and Palmerston—are continuously inhabited; the other two are Suvarrow and Nassau.<sup>2</sup> Nassau Island was recently purchased by the people of Pukapuka and is now in temporary occupation. It was necessary to evacuate the personnel of a weather station from Suvarrow in 1950, and the station has not been reinstated.

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<sup>1</sup> Graduate of the Central Medical School, Fiji Islands. This report was prepared with the cooperation of Dr. C. J. Austin, Makogai, Fiji.

<sup>2</sup> The names given in parentheses are unofficial ones which appear in some atlases.



TEXT-FIG. 1. Geographic location of the islands of the Cook Islands group, and the division into Northern and Southern groups.

The southern islands, with the exception of Manuae which is a coral atoll, are of volcanic origin, having a hilly or mountainous interior surrounded by fertile lowlands. All the islands are surrounded by coral reefs. Most of them have in addition an elevated coral reef, known locally as the *makatea*, which encircles the islands almost immediately behind the coastline. The soil is very fertile and is suitable for the cultivation of the usual tropical and subtropical products.

The islands of the northern group are typical coral atolls. The soil of most of them is poor, being largely coral sand. Coconut palms thrive, but there is some shortage of other food crops.

The group lies within the hurricane belt. In the southern islands the climate is mild and equable, except in the summer months. At Rarotonga the mean annual temperature is 74.5 degrees. The average rainfall is 84 inches.

The present population of the group is 15,079, of which all but 322 are Polynesians, ethnologically akin to the Tahitians and the New Zealand Maoris. The individual island populations vary from 20 on Manuae to 6,048 on Rarotonga.

In four of the northern islands, viz., Penrhyn, Rakahanga, Manihiki, and Palmerston, the people are very closely related, and this relationship may be important with regard to the incidence of leprosy in these islands. These islands are the important ones with respect to this disease in this region.

With the exception of those on the capital island of Rarotonga, the people are dependent on tanks, wells and springs for their water supply. Their food is mainly local produce, but importation of other articles (e.g., tinned meats, flour, sugar and biscuits) is fairly high.

In the northern islands, copra cutting, pearl-shell diving and fishing are the main occupations. The women weave mats, hats, fans and other island souvenirs, both for the small tourist trade and for local use. In the south, the people are mainly planters, and in addition to growing food for local consumption they produce citrus fruits, tomatoes and pineapples for export to New Zealand.

The islands are administered by the New Zealand Ministry of Island Territories through a Resident Commissioner, who resides at Rarotonga.

#### PREVAILING DISEASES AND LEPROSY

In a survey of social conditions in the Cook Islands, Hercus and Faine (2) found the prevailing diseases to be tuberculosis;

filariasis; intestinal helminthiasis; skin infections, including yaws; miscellaneous infections, including gonorrhoea; abscess formation considered to be staphylococcal, secondary to skin infection rather than filarial; and diphtheria. No cases of leprosy were seen because the survey was conducted only on the island of Rarotonga, where the disease is rare. Indeed, all cases from this island have been in families originating in other islands.

Austin (1) has drawn attention to the remarkable familial occurrence of leprosy in the Cook Islands, and his genealogical survey of a family demonstrates the fact that members of such families do not all come from the same island. In that instance there were cousins from Penrhyn, Manihiki, Rakahanga, Palmerston and Aitutaki.

Early in 1926 Dr. S. M. Lambert, of the Rockefeller Foundation, did a general health survey of the southern part of the group (3). This survey, which dealt with general health, intestinal helminthiasis, yaws and leprosy, resulted in a brief survey of the whole group for leprosy by Sir Maui Pomare and Dr. E. P. Ellison later that year. As a result of discussions between Drs. Lambert and Pomare and with the respective governments interested, it was agreed that all leprosy patients in the Cook Islands should be sent to Makogai, Fiji, for isolation and treatment.

Pomare (5) states that leprosy was not known in the group until about 1860, at which time a Penrhyn Islander returned to his home from Hawaii, where he had lived for some years as a laborer and had contracted the disease. As will be seen, Penrhyn has much the highest prevalence of leprosy in the whole group. The disease is so well known in its many manifestations to the people of this island that the author gained the greater part of his early training in the diagnosis of its early stages from them.

From Penrhyn the disease spread later to the neighboring islands of Manihiki, Rakahanga and Palmerston. It was only at the beginning of the present century that it reached Aitutaki. It is said that at that time in Rarotonga a Chinese suffering from the disease was buried alive at the instigation of his own countrymen. The spread was so peculiarly restricted within family groups that the Cook Islanders naturally assumed that the disease was inherited.<sup>3</sup>

<sup>3</sup> This information about the spread of leprosy was obtained by the author in conversation with the older people in the islands where surveys

In later surveys this apparently reasonable belief in the inheritance of leprosy led to great difficulties in work amongst the people, as they would not accept the idea that the disease is infectious. To explain how only certain members of a family became afflicted the people—until the author's first survey—believed that some sin, either religious or against the custom of *tabu*, committed by the patient accounted for it. To complicate matters, the Penrhyn Island people are fatalistic in their general outlook. Thus, if a diver is mauled by a shark the people believe that nothing could have prevented it, and that the man was doomed from his birth to that particular death. This fatalistic attitude made early attempts to educate the people about leprosy decidedly difficult, especially as another of their beliefs—now happily discarded—was that a person who had leprosy would certainly die of the disease. By now, however, the conjunction of regular surveys and of treatment at the Makogai Central Leprosarium has led to a very different outlook, and the author has been embarrassed on occasions by people pretending to have leprosy, hoping for the excitement and adventure of a trip to Fiji.

Between 1860 and 1926, the victims of leprosy were given no treatment and were left on their islands, there to suffer mutilation and disfiguration. At Penrhyn the most advanced cases voluntarily isolated themselves on an islet, about three miles from the main village-settlement. Ironically, they proudly named the islet "Molokai," after the island on which the famous Hawaiian leprosarium of Kalaupapa is located. Elsewhere, however, leprous persons mixed freely with the healthy population, living and sleeping together in the same dwellings.

There is no record available of the total number of cases occurring between the introduction of the disease and 1926. The brief general survey of the group at that time resulted in 33 cases being sent to Makogai under the new arrangement. From 1926 to 1951 a total of 238 patients had been admitted there, giving an over-all average annual admission rate of 7.5 per 10,000 population. The data are given in Table 1, by five-year periods because admissions do not occur regularly every year. The 15 cases shown for 1951 were admitted to Makogai before the author's survey of that year. Cases found since then

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were conducted from 1936 to 1940. It is fortunate that by custom the Polynesian is expert in knowledge of his folklore, and a surprisingly accurate picture of the matter could thus be formed.

are not included in the table because they are still awaiting transportation (see Footnote 4).

TABLE 1.—*Admissions from the Cook Islands to the Makogai Central Hospital, Fiji, by five-year periods.*

Period	Admissions	Population (average)	Admissions per 10,000 population per year
1926-1930	81	10,081	16.0
1931-1935	27	10,851	4.9
1936-1940	61	12,246	9.9
1941-1945	27	13,713	3.9
1946-1950	27	14,451	3.7
1951	15	15,079	9.9
Totals	238	12,140	7.5

#### RECENT SURVEYS

In 1935-1936 the author spent two months at Makogai, doing a postgraduate course in leprosy. After returning to the Cook Islands he carried out extensive surveys at Aitutaki in 1937, and at Penrhyn, Manihiki, Rakahanga and Palmerston in 1938-1940, these surveys resulting in the diagnosis of the 61 cases recorded in Table 1 as admitted during the 1936-1940 period. Subsequent surveys have been made at Manihiki and Rakahanga in 1943-1945, at Aitutaki in 1948, and at Aitutaki, Manihiki, Rakahanga and Penrhyn in 1951.

The surveys in Penrhyn made in 1938 to 1940 were of the whole population, and similar complete surveys were also carried out in Manihiki and Rakahanga in 1943 to 1945. Elsewhere, the surveys were only of those families known to have had cases in the past. The surveys were clinical only until 1951, when biopsies were begun for diagnosis and confirmation of clinical findings.

The dates of these surveys largely explain the apparently strange variations in incidence rates. Each survey made in the most heavily affected part of the region—i.e., Penrhyn, Manihiki, Rakahanga, Palmerston and Aitutaki—resulted in a large crop of new cases. The 1951 survey was carried out during the

latter half of the year, after the admission to Makogai of the 15 cases recorded in Table 1.<sup>4</sup>

#### ANALYSIS OF CASE DATA

*Geographic distribution.*—The distribution of the 238 cases admitted to Makogai, shown in Table 2, has varied markedly from island to island among the eight from which they came. The figures for those of the northern group concerned are much the highest. There is not one family in Penrhyn, Manihiki or Rakahanga, or in Palmerston, that can boast of not having had leprosy in the past. As said, the surveys in these islands have been complete, every individual being examined, whereas in the southern group the surveys have been less thorough, attention being given only to certain families. No cases of leprosy have as yet been diagnosed on the islands of Mauke, Mitiaro and Mangaia.<sup>5</sup>

TABLE 2.—*Geographical distribution of 238 new cases admitted to the Makogai Central Hospital, 1926-1951.*

Island	Population (average)	Number of cases	Prevalence rate per 1,000	Annual incidence per 1,000
Penrhyn Rakahanga Manihiki	1,371	166	121	4.7
Palmerston	92	5	54.3	2.1
Aitutaki	1,913	47	24.5	0.9
Pukapuka	542	4	7.4	0.3
Rarotonga	4,992	15	3.0	0.1
Atiu	1,101	1	1.0	0.04

The three northernmost islands are taken together in Table 2 because there is constant movement between them. For example, many of the people of Penrhyn and Rakahanga have

<sup>4</sup> In 1952 the author went to Makogai for a further two months study of the modern treatment of leprosy and of its pathology. A complete survey of Aitutaki was then undertaken and resulted in the finding of 43 cases, including 34 from a previous survey made in 1951. A brief survey of Manihiki, Rakahanga, Palmerston and Pukapuka, and of the Pukapukans occupying Nassau Island at that time, was also made. As a result of these surveys a total of 44 new cases are awaiting transportation to Makogai.

<sup>5</sup> Manuae does not count, it being populated only by laborers who are examined medically before leaving for the island on one-year contracts.

been in Manihiki since 1945 for pearl-shell diving, and this year there will be a general movement to Penrhyn for the same purpose. The population of Palmerston has been reduced by migration to Rarotonga and Manihiki because of the frequency of severe hurricanes at Palmerston. That of Pukapuka has been affected by the movement of many of the people to Nassau and Rarotonga Islands because of a large real increase in the population. Almost all of the cases from Aitutaki and Rarotonga are from families which have intermarried with Palmerston or Penrhyn families.

*Changes of frequency.*—In the northern islands, which have given the largest number of cases and the highest prevalence rates, the frequency rates have been much reduced since the earlier periods, as shown in the first part of Table 3. This change is ascribed to the thoroughness of the surveys made there and the resultant isolation of the cases found. On the other hand, in the southern group the figures (second part of

TABLE 3.—Frequencies of cases diagnosed in the northern and southern islands, by five-year periods.

Period	Number of cases	Population (average)	Annual incidence per 1,000
<i>Northern islands, including Palmerston</i>			
1926-1930	68	1,235	11.0
1931-1935	25	1,320	3.9
1936-1940	43	1,420	6.0
1941-1945	21	1,510	2.8
1946-1950	11	1,600	1.0
1951	3	1,691	1.8
<i>Southern islands, Aitutaki and Rarotonga</i>			
1926-1930	9	5,367	0.3
1931-1935	2	5,900	0.07
1936-1940	18	6,500	0.5
1941-1945	6	7,100	0.17
1946-1950	16	7,800	0.4
1951	11	8,444	1.3



Table 3) show a disturbing increase in prevalence. This is probably due to the more recent introduction of the disease there, and the less thorough search for cases.<sup>6</sup>

*The tuberculoid-lepromatous ratio.*—As was done with the data on numbers of cases, those on the relative frequencies of the tuberculoid and lepromatous forms of the disease in the northern and southern groups are considered separately, in Table 4. The differences in these two groups are striking. In the northern islands, where the incidence rates have fallen markedly since 1926, the proportion of tuberculoid cases has increased from 65 per cent in the first half of the period to 98 per cent in the second half, during which time only one lepromatous case was found out of a total of 51 cases. On the other hand, in the southern group, in which the incidence is increasing, the lepromatous rate remains high, having decreased only from 41 per cent to 32 per cent. (See also Footnote 6.)

TABLE 4.—*The tuberculoid-lepromatous ratios in the northern and southern islands, earlier and later periods.*

Period	Number of cases	Tuberculoid cases		Lepromatous cases	
		Number	Per cent	Number	Per cent
<i>Northern islands, including Palmerston</i>					
1926-1938	123	80	65	43	35
1939-1951	51	50	98	1	2
<i>Southern islands, Aitutaki and Rarotonga</i>					
1926-1938	17	10	59	7	41
1939-1951	40	27	68	13	32

*Age and sex.*—Of the 238 cases diagnosed in the entire period from 1926 to 1951, 85 were under 15 years of age, i.e., 33 per cent of the total. There were 130 males and 108 females, a sex ratio of only 1.2 : 1.0.

<sup>6</sup> The recent thorough survey of Aitutaki brought to light 43 of the 44 cases not yet admitted to Makogai. Of these 43, only 9 are adults, 34 being children; 25 are males, and 18 are females; 31 (72%) are tuberculoid, 12 (28%) lepromatous. The diagnoses of these cases have all been confirmed histologically.

## SUMMARY AND CONCLUSIONS

1. Leprosy was introduced in the Cook Islands at about 1860.
2. It was first introduced in the northern islands, where it soon became widespread. No family in this group has escaped infection.
3. Leprosy reached the southern group later, and most families there have never had a case.
4. Complete surveys of the northern islands and isolation of all diagnosed cases have resulted in a marked decrease in prevalence in that region.
5. This reduction has been accompanied by a notable fall in the lepromatous-tuberculoid ratio. Muir's theory of the epidemiology of leprosy (4) does not, therefore, seem to apply in the case of the Cook Islands. The disease is increasing in the southern islands, where the lepromatous-tuberculoid ratio remains high.

## RESÚMEN Y CONCLUSIONES

1. La lepra fué introducida en las islas Cook cerca del 1860.
2. Fué introducida primero en las islas del norte, donde se diseminó rápidamente. Ninguna familia allí escapó la infección.
3. La lepra llegó hasta las islas del grupo sur más tarde, y la mayoría de las familias allí nunca han tenido un caso.
4. Reconocimientos completos de las islas nortes y el aislamiento de todos los casos diagnosticados, ha resultado en una gran disminución en la prevalencia en esa región.
5. Esta reducción ha sido acompañada por un notable cambio en la relacion lepromatosa-tuberculoide. La teoriá Muir sobre la epidemiología de la lepra (4) no aplica en el caso de las islas Cook. La enfermedad está en aumento en las islas al sur donde la relación lepromatosa-tuberculoide se mantiene alta.

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