SOUTH PACIFIC COMMISSION

RESPIRATORY DISEASE IN THE COOK ISLANDS

by

T. Kuberski and W.J. English

1341/79

Noumea, New Caledonia
August, 1979

TABLE OF CONTENTS

I. BACKGROUND

The Cook Islands consist of 15 islands widely scattered over an area of 851,000 square miles in the South Pacific Ocean between 8° and 23° South latitude, 156° and 167° West longitude. The total land area is estimated to be 91.2 square miles. The largest and capital island of the group is Rarotonga. The climate is tropical with mean monthly temperatures ranging between 18-29°C. Trade winds blow almost continuously. The annual rainfall of about two metres is distributed throughout the year, reaching peaks in the summer months (January-April) and a trough during the winter months (June-September). The indigenous people, who are Polynesian (Maori), comprise over 90 per cent of the inhabitants. The economy is mainly agrarian. Rarotonga is connected to Fiji, Tahiti, Hawaii and New Zealand by regular airplane flights. Internal flights operate daily connecting to the islands of Aitutaki, Atiu, Mauke, Mitiaro and Mangaia. There are regular boat connections to the remaining outer islands.

Respiratory diseases are a common cause of morbidity and mortality in the South Pacific Islands. In particular, they were thought to be a significant health problem in the Cook Islands[1]. The Cook Islands Government requested the South Pacific Commission (SPC), which has a special programme devoted to the prevention and control of respiratory diseases in the region, to provide evaluation and advice on respiratory disease problems. The SPC made available its Epidemiologist, Dr. Tim Kuberski, and a consultant infectious disease specialist, Dr. Woodruff J. English from the Center for Disease Control, Atlanta, Georgia, USA. The assignment was undertaken in late July and early August 1979. A short visit of four days (30 July - 3 August) was made to Mitiaro to evaluate a family of children with a neuologic disease; this will be the subject of a separate report to the Health Department.

II. EPIDEMIOLOGY OF RESPIRATORY DISEASES IN THE COOK ISLANDS

The total population of the Cook Islands at the 1976 census was 18,128. The most populous island of the group is Rarotonga, population 9,802 (Figure 1), where the health administration and major medical facilities for the group are located. The findings in this report are principally based on information from the only hospital on Rarotonga, Rarotonga Hospital, and outlying clinics on Rarotonga.

A. Incidence. Admissions to Rarotonga Hospital for a three and a half year period, January 1976 to June 1979, were reviewed. All admissions for acute respiratory diseases were tabulated by month. A list of diagnoses included under the general category of respiratory disease is given in Table 1. Patients admitted for tuberculosis are not included. The results of this analysis are illustrated in Figure 2. The pattern of respiratory disease admission is irregular until an epidemic threshold, shown by the shaded bar in Figure 2, is established. This demarcation illustrates that Rarotonga experiences two periods each year when hospital admissions for respiratory disease increase beyond the epidemic threshold. The outbreak in the early part of the year coincides with what clinicians refer to as the "flu season" during the winter months. A comparison of the admissions for respiratory disease against monthly temperatures and rainfall revealed no correlative pattern. Clinicians, however, adhere to their observation that the drop in temperature seen at the beginning of the winter months is associated with an increase in influenza-like illness. Clear epidemic outbreaks of influenza-like illness were experienced in April-May 1976 and April-May 1979.

Hospital admissions for respiratory disease during 1976 by Rarotonga census district versus the population density of the corresponding census district are shown in Figure 3. The 1976 census divided Rarotonga into the following census districts: Pue-Matavera, Tupapa-Maraerenga, Takuvaine-Parekura, Tutakimoa-Teotue, Avatiu-Ruatonga, Nikao, Arorangi, Titikaveka and Ngatangiia-Muri (Figure 1). Figure 3 illustrates a positive correlation between the number of persons per dwelling and the rate of hospital admissions for respiratory disease, except in the Nikao district. Why Nikao should be different from the other eight census districts is not clear. Essentially all dwellings are of European style construction.

B. Morbidity. The major reason for admission to Rarotonga Hospital is respiratory disease. In 1976, of 1,267 admissions to Rarotonga Hospital, 288 (22.7%) were for respiratory diseases. Admissions to the Hospital in 1976 by age and sex for various respiratory diseases are given in Table 2. The male to female ratio was 1.2:1. Sixty per cent of admissions were children aged 14 years or less; 18 per cent were children less than one year of age.

Rarotonga Hospital also has an emergency room/outpatient facility which provides outpatient medical consultation services. In 1976, there were 5,879 outpatient visits; of these 1,982 (33.7%) were for respiratory disease.

C. Mortality. There were 104 deaths during 1976; these are listed by causative disease category in Table 3. The second leading cause of death was respiratory disease, which accounted for 12 per cent of all deaths. In accord with Polynesian custom, confirmatory autopsies are rarely performed.

D. Economic impact. In 1976, 288 patients were hospitalized for respiratory diseases for a total period of 2,345 days. The average duration of stay was 8.14 days. Medical care is free to Cook Islanders, but the charge per day for hospitalization of non-residents is $20.00. This daily rate does not reflect the true cost of hospitalization. If the hospital running costs, salaries, loss of work etc. are considered the actual cost per day is considerably higher. On the basis of $20.00 per day the minimum direct cost would be $46,900. During 1976 there were also 1,982 outpatient visits to the hospital. The charge per consultation is $5.00, which would give a total direct cost for these visits of $9,910. The total direct cost in 1976, inpatient and outpatient, for Rarotonga Hospital alone therefore amounts to $56,810, or six per cent of the total Health Department expenditure for 1976 ($56,810/$994,977).

E. Outer islands. A well known observation in the outer Cook Islands is the "cough and fever of the boat". Boat visits to the remote islands of the group are frequently followed by an epidemic of respiratory illness. This is becoming a greater problem because of the increasing traffic between islands. Highly accurate figures for respiratory disease in these communities are not available, but respiratory disease and diarrhoea are reportedly the most common causes of morbidity and mortality. Lack of health manpower is a chronic problem on most outer islands.

III. CLINICAL ASSESSMENT OF RESPIRATORY DISEASES IN THE COOK ISLANDS

A. Wheezy-bronchitis syndrome and asthma. In general, patients with bronchospasm are usually differentiated on the basis of age rather than on a clinical basis. Young children with bronchospasm are usually diagnosed as having wheezy-bronchitis, whereas adults are called asthmatics. The admissions for wheezy-bronchitis and asthma by age group are given in Figure 4. Bronchospasm in adults is generally observed in individuals of the older age groups (over 40 years); young adults are at lowest risk of being admitted to hospital for asthma. The causative agents for these two diseases in Rarotonga have not been established.

B. Pneumonias. Hospital admissions for pneumonia do not appear to have any seasonal trend; in general, however, they do tend to follow the fluctuations of respiratory disease admissions. Table 4, which shows the age-adjusted admission rates to Rarotonga Hospital for pneumonia, illustrates that the very young and older populations of Rarotonga are most susceptible to developing serious pneumonia requiring hospitalization. During the early part of 1979 there was an increased number of pneumonia admissions in the 15-39 year age group. This would be consistent with an outbreak of the H_1N_1 (Russian) strain of Influenza A known to be active elsewhere in the Pacific at that time[2].

C. Clinical assessment of wheezy-bronchitis and pneumonia
Cook Islands clinicians are well aware of the wheezy-bronchitis syndrome in young children, although their diagnostic criteria and terminology differ. There are no uniform guidelines for the diagnosis of wheezy-bronchitis; patients with the same clinical findings can also be said to have bronchiolitis, bronchial asthma or, occasionally, bronchitis. The causes are presumed to be multiple - viruses, allergens and/or parasites. Ascaris is common in young children and is believed to contribute to the wheezy-bronchitis syndrome. Anecdotally, the wheezy-bronchitis and asthma syndromes are thought to decrease following mass filariasis chemoprophylaxis with Hetrazan. The general anti-helminthic action of Hetrazan is believed to reduce the helminth parasite load (Ascaris and Wucheraria) and, correspondingly, the incidence of wheezy-bronchitis.

The approach to therapy of children with this disease usually includes hydration and broncho-dilators, combined with antibiotics when the patient is febrile. Mortality from this disease is rare.

Patients with pneumonia are generally treated with antibiotics empirically. Sputum cultures or Gram stains for bacterial pathogens are not commonly carried out before the institution of therapy. A high index of suspicion for pulmonary tuberculosis exists for patients presenting with pulmonary complaints and much of the bacteriology of respiratory infections is directed at excluding or establishing the diagnosis of tuberculosis.

IV. LABORATORY ASSESSMENT OF RESPIRATORY DISEASES IN THE COOK ISLANDS

A. Sputum culture and Gram stain for bacterial pathogens. The approach in the laboratory to the microbiological diagnosis of respiratory diseases is standard. A Gram stain is performed on submitted specimens, followed by plating on standard bacteriological media. Antibiotic sensitivity testing is done on any apparent pathogens isolated. The infrastructure for an appropriate bacteriological work-up exists, but this capability is probably under-utilized by clinicians.

B. Viral serologic diagnosis and virus isolation. Specimens for viral serologic diagnosis are sent to reference laboratories in New Zealand, where serologic diagnosis for virtually any viral disease is available. Mechanisms for providing specimens for serologic diagnosis and obtaining results have been established, but there is no routine surveillance of respiratory infections. There were three instances when confirmatory serologic evaluations of respiratory disease outbreaks were done. In March 1975 seroconversions were demonstrated to Influenza A; in May 1976 seroconversions were again demonstrated to Influenza A (Port Chalmers). In November 1977 serologic evidence suggested a para-influenza virus outbreak. Virus isolation capability is also available in New Zealand, but requires special efforts and arrangements. Virus isolation for common respiratory viruses has not been attempted.

V. DISCUSSION

Respiratory diseases in the Cook Islands represent the commonest cause of morbidity and one of the commonest causes of mortality. The high admission rate to Rarotonga Hospital for respiratory disease found in this study is similar to that reported in Rarotonga in 1970[3]. This suggests respiratory diseases have been, and probably will continue to be, a major health problem in Rarotonga. In general, the pathogens responsible for respiratory disease are probably the same as in most other countries. In the Cook Islands, however, respiratory disease problems are compounded by crowded living conditions (created by both cultural factors and circumstance), increased susceptibility and borderline nutrition in some children.

There appear to be two periods during the year when hospital admissions for respiratory disease increase. The most apparent outbreaks clinically appear in the early months of the year, coinciding with the change in weather at the beginning of the cooler season. Although there are flight connections between the Cook Islands, the United States (Northern hemisphere) and New Zealand (Southern hemisphere), the limited serologic information available suggests that the apparent "flu season" in the Cook Islands corresponds to that of New Zealand. The second peak during the latter part of the year is probably due to non-Influenza A viruses. In the latter months of 1977, serologic evidence was suggestive of para-influenza virus activity. A serologic survey done in 1971 indicated the population of preschool children on Rarotonga would be susceptible to respiratory syncytial virus and mycoplasma outbreaks[3].

The relationship of the high incidence of respiratory disease to the number of persons per dwelling was shown for eight of nine districts on Rarotonga. The average household on Rarotonga has 5-6 persons, due to a shortage of housing and the tendency toward extended families. This setting is conducive to intrafamilial spread of respiratory disease.

Economically, respiratory diseases impose a considerable financial and manpower utilization burden on the Cook Islands Health Department. Respiratory diseases are the most common cause of hospital admission and outpatient clinic visits. The true cost of these diseases cannot be assessed accurately, but they should be considered a priority problem for the Health Department.

Dealing with respiratory diseases in the outer islands presents unique problems. In general, the isolated islands experience little respiratory disease on a day to day basis. However, periodic severe epidemics occur, presumably because of the general lack of immunity to newly introduced virus strains. In anticipated severe epidemics of influenza, these populations might benefit from vaccination campaigns to avoid severe disease. Also, moving to Rarotonga from the outer islands appears to result in an increase in the amount of respiratory disease observed in the migrant population[4]. This appears to be associated with more chronic sequelae from recurrent respiratory tract infections in Rarotonga versus the outer islands.

Wheezy-bronchitis and asthma are common clinical problems on Rarotonga. The inciting agents are not known, but the causes are probably multiple. Intestinal parasites have been postulated as a major cause of these syndromes in preschool children[3]. There is some anecdotal evidence suggesting that control of helminthic parasites reduces the incidence of wheezing bronchitis in children. The true asthma seen in Rarotonga occurs mainly in older individuals. Much of the chronic forms of respiratory disease in older individuals has a bronchospastic component.

Cook Islands clinicians generally deal with pneumonias on an empirical basis. Little reliance is placed on laboratory diagnosis. To a certain extent, this may be appropriate considering the limited laboratory resources available. However, the bacteriological and virological capabilities appear to be under-utilized. Whether this is the result of unfamiliarity of physicians or poor laboratory feedback, or both, could not be assessed.

Respiratory diseases are clearly a significant health problem in the Cook Islands. Considering the polarized population structure of the Cook Islands, with many children and older adults, the general Cook Islands population has a large number of individuals generally at high risk of respiratory disease. Because of the complexity of the problem, there are no simple solutions; in general even the best health systems cannot effectively prevent these diseases. Realistically, the Cook Islands Health Department must progressively evolve a system to deal with respiratory disease effectively within its resources. This cannot be done simply by emphasizing the single problem of respiratory disease; it requires integrating and co-ordinating gradual improvement measures in the Health Department infrastructure, emphasizing a better information gathering system, gaining the co-operation of clinicians and improving their diagnostic capabilities.

VI. SUMMARY POINTS

1. Rarotonga appears to experience two epidemics per year of respiratory illness causing hospital admission. Epidemics in the early part of the year during the winter months are clinically thought to be influenza. The cause(s) for the second peak during the latter part of the year is unknown.

2. Epidemics of respiratory disease requiring hospitalization do not appear to correspond to mean monthly temperature or rainfall. However, clinically the "flu season" is felt to correspond with the cool temperatures experienced in the early winter months.

3. The amount of respiratory disease seen in the various census districts of Rarotonga can be generally correlated with dwelling density; the higher the density, the higher the incidence of respiratory disease.

4. The major cause of admission to Rarotonga Hospital is respiratory diseases. Respiratory diseases accounted for 22.7 per cent of all admissions during 1976.

5. The second leading cause of death in 1976 was respiratory diseases, accounting for 12 per cent of all deaths.

6. The minimum direct cost (covering direct cost estimates for Rarotonga Hospital only) of respiratory disease in Rarotonga was greater than $55,000 in 1976. This is equivalent to six per cent of the total annual budget of the Health Department.

7. Wheezy-bronchitis and asthma are seen most commonly in young children and older adults.

8. Clinicians do not have uniform criteria for the diagnosis of wheezy-bronchitis and asthma. Criteria need to be defined for record-keeping purposes.

9. The older population of Rarotonga is most likely to develop pneumonia requiring admission to the hospital.

10. The treatment of respiratory diseases is empirical to a large extent.

11. Laboratory capability in diagnosing bacterial pneumonias is not utilized to its fullest extent by clinicians.

12. Reference laboratory capability is underutilized and laboratory confirmation of respiratory disease outbreaks is infrequently made.

VII. RECOMMENDATIONS

1. Accurate information on respiratory diseases is essential. A system of epidemiological information gathering has been developed in the Cook Islands and is evolving. To provide uniformity in respiratory disease diagnosis, the patient findings should fulfill the following criteria before the indicated diagnoses are made:

   (a) Wheezy-bronchitis. A child with bilateral bronchospasm of non-cardiac origin.

   (b) Asthma. An adult with bilateral bronchospasm of non-cardiac origin.

   (c) Upper respiratory illness. Signs and symptoms limited to rhinitis, pharyngitis and cough.

   (d) Influenza-like illness. Upper respiratory signs and symptoms accompanied with systemic symptoms (myalgias, arthralgia and fever).

   (e) Pneumonia. Physical or x-ray evidence of lung involvement, usually accompanied by signs and symptoms of an upper respiratory illness.

2. Clinicians need to familiarize themselves with the new developments in the approach to patients with respiratory illnesses and to learn how to utilize laboratory resources effectively. The laboratory should actively encourage physicians to utilize its expertise.

3. The pattern of Rarotonga Hospital admissions for respiratory disease indicates that when over 22 admissions have been made in a period of a month or less, Rarotonga is probably in the process of experiencing an epidemic of respiratory disease. A surveillance system should be set up to identify when this number of admissions is reached. This should then be followed up by taking nasopharyngeal swabs and paired sera on 10-12 patients seen in the hospital outpatient clinic for apparent respiratory infections. The Virus Research Laboratory in Dunedin, New Zealand, is an excellent facility to assist the Cook Islands in implementing this type of surveillance system.

4. Influenza vaccine is useful in protecting individuals at high risk of influenza and its complications; the aged, patients with congestive heart failure, pregnant mothers, etc. are all at high risk. Use of this vaccine should be considered as a preventative measure when severe pandemics are documented elsewhere in the world. Because of their isolation, protection of populations in the outer islands could also be implemented in situations where an epidemic appears likely.

5. Nursing personnel should be instructed about obtaining good respiratory specimens for laboratory diagnosis as well as the general care of chronic respiratory disease patients. Good nursing care is essential in the uneventful recovery from a severe respiratory ailment.

VIII. REFERENCES

1. KOTEKA, G., (1979). Country report to the conference. Eighth Regional Conference of Heads of Health Services, Apia, Western Samoa. Noumea: South Pacific Commission.

2. SOUTH PACIFIC EPIDEMIOLOGICAL AND HEALTH INFORMATION SERVICE (1978). Consolidated notification of disease for the month of April, 1978. Noumea: South Pacific Commission.

3. ELLIOTT, R.B. (1975). An epidemiological study of pulmonary disease in preschool Rarotonga children. New Zealand Medical Journal., 81: 54-57.

4. MEDICAL RESEARCH COUNCIL OF NEW ZEALAND (1966). The health of two groups of Cook Island Maoris. New Zealand Special Report, 26:32-33.

IX. ACKNOWLEDGEMENTS

Our work was always met with enthusiasm and interest, but unfortunately we are unable to name all of the Cook Island personnel who facilitated our investigations. However, we would like particularly to express our appreciation to the following:

Dr P. Robati	Minister for Health
Dr G. Koteka	Secretary for Health
Dr T. Teariki	Acting Director of Public Health
Mr N. Munokoa	Health Statistics Officer
M. T. Norman	Laboratory
Mr I. Samuel	Laboratory
Mr R. Pokoati	Chief Administration Officer (Mitiaro)
Mr P. Tetava	Medical Assistant (Mitiaro)
Mrs R. David	Volunteer Secretary (Mitiaro)

CONSULTANT

Dr. W.J. English
Center for Disease Control
Atlanta, Georgia. 30333
United States of America.

Table 1. Rarotonga Hospital admission respiratory disease diagnoses used for the monthly tabulation of respiratory diseases

	DIAGNOSIS
1.	Pneumonia
2.	Pleurisy
3.	Upper respiratory tract infection
4.	Cough
5.	Influenza
6.	Pleural effusion
7.	Whooping cough
8.	Wheezy-bronchitis*
9.	Acute bronchitis*
10.	Bronchiolitis*
11.	Bronchial asthma*
12.	Asthma*

*Diagnoses comprising the bronchitis/asthma category.

Table 2. Admissions to Rarotonga Hospital for respiratory diseases by age and sex, for the year 1976

RESPIRATORY DISEASE CATEGORY	SEX		AGE GROUPINGS			
	M	F	<1	1-14	15-44	>44
Upper respiratory infection	37	32	13	43	7	7
Influenza-like syndrome	5	2	2	0	4	0
Pneumonia	88	77	25	61	35	44
Bronchitis/asthma	26	21	12	17	10	8
	156	132	52	121	56	59

Total Admissions $\frac{288}{1267}$ (22.7%)

Table 3. Causes of death in the Cook Islands, 1976

CAUSE OF DEATH	NUMBER
Cardiovascular	35(34)+
Respiratory	12(12)
Bacterial infections	11(10)
Perinatal deaths	11(10)
Senility	11(10)
Trauma	8(8)
Neoplasm	5(5)
Central nervous system	4(4)
Others	7(7)
	104

+ *percentage of total in parenthesis*

Table 4. Admissions to Rarotonga Hospital for pneumonia, for the years 1976-1979.

AGE GROUP	ANNUAL RATE*			
	1976	1977	1978	1979
0 - 4 years	42.1	34.1	29.0	11.6
5 -14 years	9.1	4.9	5.8	5.2
15 -39 years	6.0	6.6	8.6	18.8
>40 years	22.2	32.0	24.5	37.8

**rates age-adjusted/1000 population*

FIGURE 1.

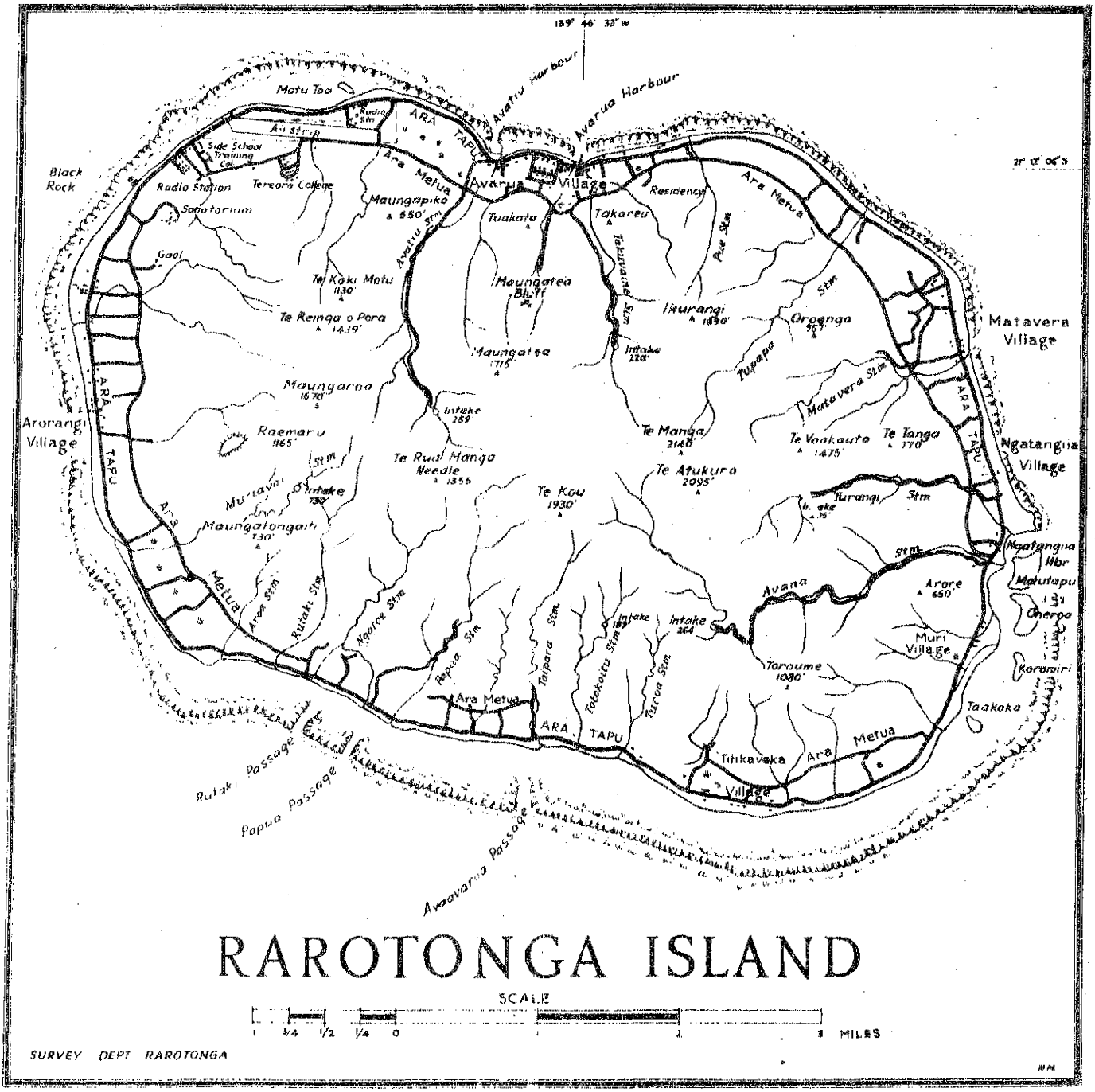
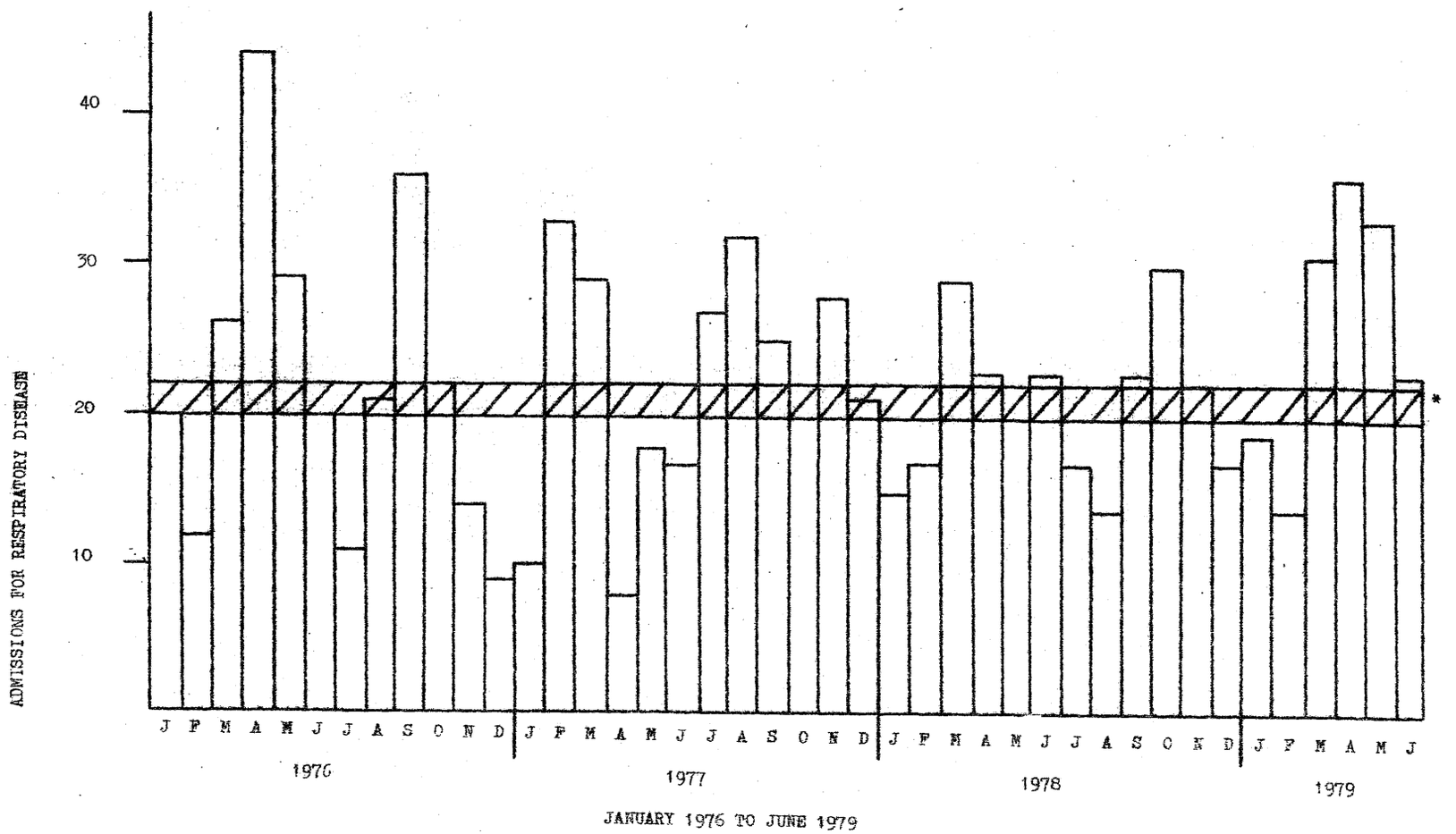

159° 46' 32" W
21° 12' 06" S
Matu Toa
Radio Stn
Air Strip
Side School Training Col
Avatiu Harbour
Avarua Harbour
ARA TAPU
Black Rock
Radio Station
Teresora College
Sanatorium
Gaol
Ara Metua
Avarua
Village
Residency
Maungapiko 550'
Avatiu Stm
Tuakata
Takareu
Tutumanu Stm
Pue Stm
Te Keke Motu 1130'
Te Reinga o Pora 1419'
Maungatea Bluff 1715'
Ikurangi 1850'
Orongo 957'
Stm
Matavera Village
Intake 220'
Tupapa
Matavera Stm
Maungaroa 1670'
Intake 289
Arorangi Village
Raemaru 1165'
Te Rua Manga Needle 1355
Te Manga 2148'
Te Vaakauto 1475'
Te Tanga 770'
Ngatangiia Village
Muriavai Stm
Intake 730'
Maungatangaiti 730'
Te Kou 1930'
Te Atukura 2095'
Turangi Stm
Ngatangiia Hbr
Matutapu Is
Metua
Ara Stm
Rutaki Stm
Nootor Stm
Papua Stm
Taipara Stm
Totokoitu Stm
Intake 189
Intake 264
Tarroa Stm
Avana
Arorae 650'
Cherpa Is
Muri Village
Toraume 1080'
Karomiri Is
Taakoka
Titikaveka
Village
Rutaki Passage
Papua Passage
Avaavaria Passage
RAROTONGA ISLAND
SCALE
1 3/4 1/2 1/4 0 1 2 3 MILES
SURVEY DEPT RAROTONGA

Figure 2. ADMISSIONS TO RAROTONGA HOSPITAL FOR ACUTE RESPIRATORY DISEASES BY MONTH, JANUARY 1976 THROUGH JUNE 1979



JANUARY 1976 TO JUNE 1979

* EPIDEMIC THRESHOLD INDICATED AT 22 ADMISSIONS PER MONTH.

Figure 3. RELATIONSHIP BETWEEN RESPIRATORY DISEASE HOSPITAL ADMISSIONS AND THE NUMBER OF PERSONS PER DWELLING (1976)

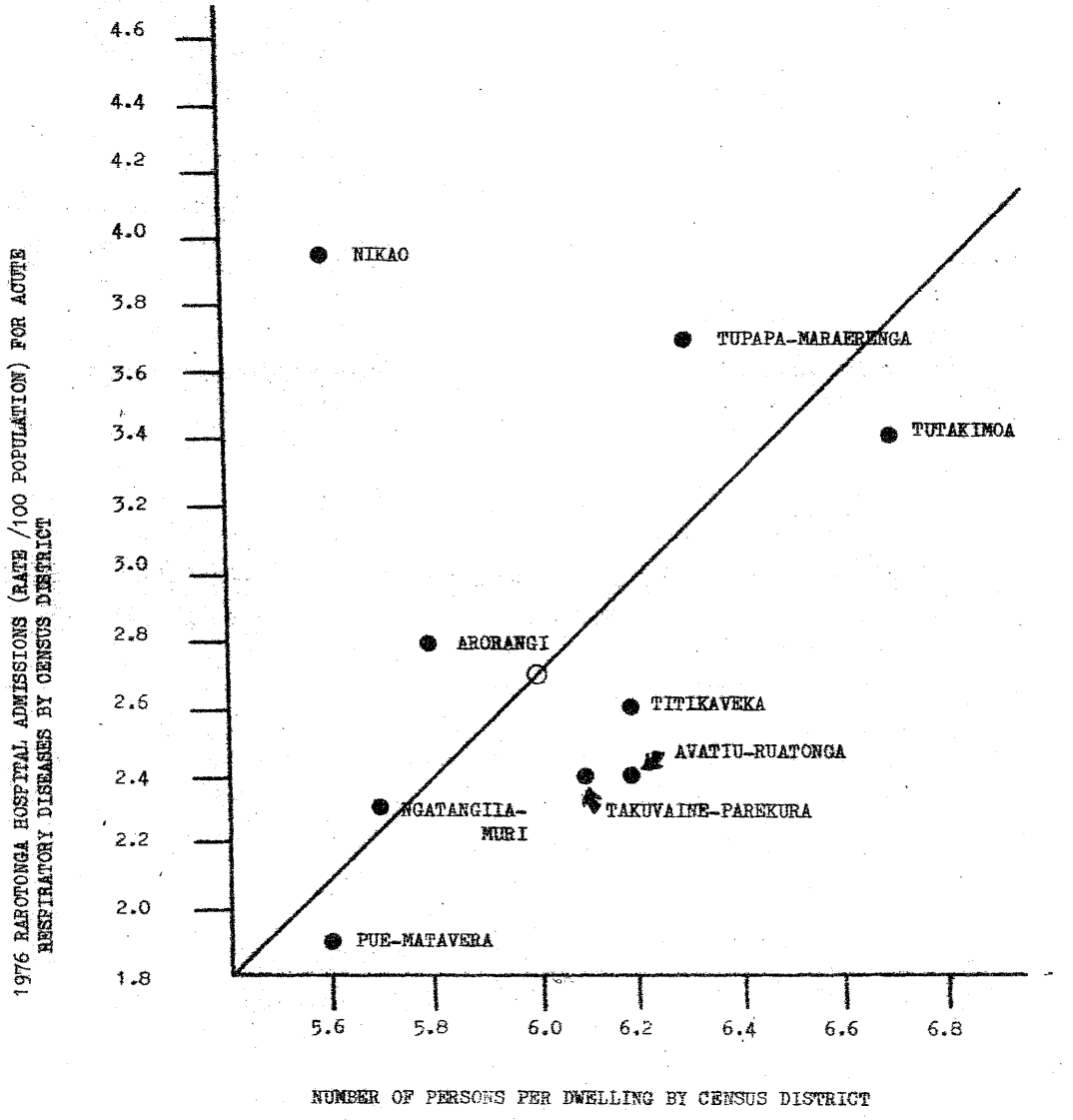


Figure 4. ADMISSIONS TO RAROTONGA HOSPITAL FOR BRONCHITIS/ASTHMA BY AGE GROUPS, JANUARY 1976 THROUGH JUNE 1979