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A cross-cultural comparison of filarial disease in the Fiji Islands

Prasad, Usha Kiran, Ph.D.
University of Hawaii, 1989

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A CROSS CULTURAL COMPARISON OF FILARIAL DISEASE
IN THE FIJI ISLANDS

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF
THE UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT
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DOCTOR OF PHILOSOPHY
IN ANTHROPOLOGY

August 1989

By

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always turn to for support and advice; and Dr. Nancy Lewis, who helped me by being both a friend and a teacher.

Lastly, I owe a great deal to my parents, for their unyielding faith and support of my hopes and dreams. Through their inspiration, I was able to return to Fiji to carry out this work. This one is really for them.
ABSTRACT

As a study in medical ecology, this dissertation looks at the differential ethnic distribution of filarial disease in Fiji. Filariasis was prevalent in Fiji prior to European contact, currently the indigenous groups - Fijians and Rotumans - show higher rates of microfilaraemia than the larger ethnic group of Indians. This differential ethnic distribution appears to be affected by cultural adaptation to the environment, the degree of exposure and contact with mosquito vectors, and the ethnomedical practices in response to the disease. Using an ecological framework, cultural behavior, vector-host contact and environmental features which contribute to the occurrence and persistence of filarial disease are assessed.

Filariasis poses unique problems as an infectious disease because of the complex interaction of the three disease agents (host, vector and pathogen), and because the symptoms vary significantly between individuals as well as between the separate disease stages. Firstly, the filariae themselves are dependent on both humans and mosquitoes for survival, thereby the hosts - both ultimate and intermediate - are critical to its survival. The filariae do not kill either host, rather they develop a parasitic relationship with both humans and mosquitoes. Secondly, the life cycle of the filariae and its ecology (periodicity) is unique to each species of this nematode; subperiodic (appears during early morning and evening) Bancroftian filariasis is prevalent in Fiji.
Thirdly, the mosquito vectors themselves vary a great deal in species as well as ecology, and several members of the *Aedes* group serve as filariasis vectors in Fiji. Lastly, the human groups in question - Fijians, Rotumans and Indians - differ significantly from one another in their culture and ecology, which in turn determines the choice and practice of health care in response to control and prevention of this disease. All of these factors lend to the differential prevalence and recurrence rates of filariasis in Fiji.
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CHAPTER I
HUMAN FILARIASIS

Introduction

Filariasis is a "poor man's disease". This is how Duke (1963) summarized the problems he encountered with control programs in India. The same can be said for Fiji. Since filariasis does not kill, since it does not transfer directly from human to human, and most importantly, since it is confined primarily to the under-developed and developing areas of the world, filariasis control receives little financial support.

Filariasis does not receive the same degree of attention as diseases such as cancer and diabetes, nor does it rank with other vector borne diseases such as dengue and malaria. If the only important difference was that filariasis does not kill (even though it maims), whereas many of the other "attention getting" diseases do, then the lack of financial support for its control would be more acceptable. However, the truth behind the neglect of filariasis may lie more in "who" suffers from the disease, rather than "what" the disease does.

There are two broad problem areas into which my concerns about filariasis are grouped. The first of these looks at the biophysical and cultural context in which filariasis is transmitted and maintained. The second is concerned with the question of why there is a relatively high recurrence rate of filariasis in certain groups/areas, even after control measures have been implemented. Whereas the first problem identifies and looks at relationships among host, vector and pathogen,
the second problem looks at human efforts of control and cure against the disease.

"Filariasis is a group of human and animal infectious diseases caused by nematode parasites of the Order Filarioidea, commonly called filariae" (Sasa 1976:15). Various bloodsucking invertebrate hosts serve as vectors in the transmission cycle. There are several hundred species of filarial worms but only eight are known to be parasitic to humans (Ottesen 1984). Out of these eight, *W. bancrofti*, *B. malayi*, and *Onchocerca volvulus* are the three filarial parasites which account for most of the pathology in humans (ibid).

Human filariasis is found throughout Asia, Africa, the Pacific and Central and South America. In humans, the filarial parasite inhabits three areas of the body: cutaneous tissue, lymphatics and the body cavity. Lymphatic filariasis and onchocerciasis (skin and eye infections caused by the subcutaneous filariid *O. volvulus*), are the two most common pathologies. There are various zoonotic forms of the disease found in monkeys and other warm-blooded animals. Sasa indicates that "in the course of evolution, the filariae must have separated before they became parasitic in man, since there are a number of closely related filarial species of the same genera parasitic in animals other than man" (1976"19). This hypothesis is similar to that drawn by Frank Livingstone who considers malaria to be an agriculturally dependent disease (1980). It could very well be that with the advent of agriculture, filariasis, like malaria, moved from being strictly zoonotic to becoming a human disease.
One of the most interesting and perhaps most elusive features of the filarial parasite is that of periodicity. Filarial worms show a rhythmic variation in the microfilarial density during the 24-hour cycle. Strains that show such variations are termed periodic or subperiodic and those that do not are called non-periodic (Mak and Dennis 1985). Periodic strains of microfilaria will appear in peripheral blood during certain hours (usually coincides with the local vectors) of the day and night. Periodicity is affected by both species variation and geographical distribution (Appendix A shows the correlation between *W. bancrofti* and *Aedes polynesiensis*).

In Fiji, the diurnally subperiodic (active throughout the day) form of *W. bancrofti* is the main filarial agent. No reservoirs, apart from man, have been reported for Bancroftian filariasis (Kessel 1961). This subperiodic form migrates to the peripheral blood during the daylight hours, with the heaviest (most dense) concentration being in the early morning and early evening hours. A blood test during midday for instance, may fail to show any signs of microfilariae in the blood, since during these hours they would be resting closer to the heart and lungs. During active hours, however, the microfilariae swim towards the periphery and can be easily detected in blood samples. The implications of periodicity on the disease cycle and in the collection of blood samples, will be discussed in Chapter VIII.

An additional feature of the adaptability of the pathogen to its intermediate host - the mosquito vector - is that of "synchronized" activity periods; the pathogen and vector are active during the same time periods. In Fiji, the microfilariae are most active when the
mosquito vectors, especially *Ae. pseudoscutellaris, Ae. polynesiensis,* and *Ae. fijiensis,* are most active. Since the activity hours between pathogen and vector coincide, there is a good chance of the microfilariae being picked up by the vector during its search for a blood meal. This symbiotic relationship may be the primary reason why *C. fatigans* is considered to be a lesser vector in the transmission of the diurnally subperiodic form, since this mosquito is primarily a night biter.

Two of the geographical features which sets filariasis apart from some other vector-borne diseases are: 1) filariasis is found mostly in the tropics (it is considered one of the true tropical diseases); and 2) it most commonly occurs in non-malarial regions. The tropical distribution pattern may be determined more by the vectors, especially members of the *Culicine* family, which are found throughout the tropics, than the parasite. Also in many cases the vectors themselves may be possible carriers of either malaria or filariasis, as with *C. fatigans* in Fiji; however in the absence of the malarial parasite, *C. fatigans* is host to filariae. As Scheder suggests, the wider distribution of filariasis is probably due precisely to the fact that it is less lethal than malaria (personal communication). In other words, filariasis can better propagate itself by ensuring that its hosts will still be around, thereby guaranteeing its survival.

The current geographical distribution of filariasis indicates that it is most prevalent in areas south of the equator (see Map 3). Dasgupta (1978), a pioneer of filariasis research, estimates that nearly 300 million people suffer from filariasis, which is about 100 million
more than those affected by malaria. Sasa (1976) shows similar figures in his global study of the distribution of filariasis.

The Disease Cycle: Pathogen - Vector - Host Relationship

Although the disease cycle appears to be relatively simple, successful transmission depends entirely on timing. Filariasis is dependent upon the "synchronized" connections between host, vector and pathogen. Figure 1.1 (below) shows the transmission cycle of filariasis:
Filariasis Transmission Cycle

Methods of Infection

Mosquito
a. microfilariae enter stomach and cast sheath
b. bore hole through stomach wall to midgut and travel to thorax
c. microfilariae travel to mosquito’s head and enter the proboscis sheath, where they remain for 10-14 days
d. during blood feeding, microfilariae attracted by warmth, break through the proboscis of the mosquito and enter the human host via the skin puncture.

Human
a. inhabits nodes and ducts of the lymphatic system
b. mating takes place and microfilariae are formed
c. microfilariae migrate through the lymph ducts into the host’s blood system
d. microfilariae appear in the peripheral blood during early morning and early evening hours (during inactivity, they remain in the interior blood vessels).

Figure 1.1
Once the microfilariae have been swallowed by the mosquito they lose their sheath and migrate to the thoracic muscle; soon afterwards they break through and enter the proboscis sheath of the mosquito. They remain in this stage for 13 to 15 days (this stage lengthens during the cooler months, Symes 1956). During the mosquito's blood meal or when it bites a human, the microfilariae, attracted by warmth, break through the proboscis and enter their human host.

Timing is critical for successful transmission from vector to host. Recent studies have modified the role of parasites in enhancing vector-host transmission; blood-borne parasites have been found to induce changes in both the arthropod vector and vertebrate host which increases transmission. Rossignol (1988) has found that parasites such as the malaria sporozoite invade specific regions of mosquito salivary glands which enhance blood location by probing mosquitoes. As a consequence, infected mosquitoes probe longer and contact more hosts to which they can transmit the pathogen\(^1\). At the same time, blood-borne parasites induce hemostatic changes so that mosquitoes locate blood faster in infected hosts than in uninfected hosts (Rossignol 1988). If filariae have the same influence on their vector and host as the malarial sporozoites then the role of the parasite in filarial prevalence may be underestimated. In light of this recent discovery, further work is needed on the role of the pathogen in filarial transmission.

\(^1\) In regards to filariasis, Jachowski (1953) noted the one outstanding feature about *Ae. pseudoscutellaris* was its voracious appetite. Thus he credits this mosquito as being perhaps the most successful vector in areas such as Tahiti, where it is highly prevalent.
Within the human host, the microfilariae inhabit nodes and ducts of the lymphatic system. Here they mature and reproduce, and spend the remainder of their lifetime, which may last 18 or more years (Manson-Bahr 1978). After the filariae have fully matured and reproduced, they continue to occupy the various lymphatic tissues of the body, possibly causing obstruction, while the microfilariae once again return to the host's blood system. Microfilariae migrate to the peripheral blood only during their active periods, awaiting the mosquito. Thus the cycle continues.

The symptoms of filariasis also vary with different disease stages. Filarial fever, which occurs after initial infection with microfilarial parasites, is usually a flu-like fever accompanied by inflammation and swelling of the lymphatics and subcutaneous tissue. Kershaw (1970) relates infection to the time which it takes for the parasite to develop in either the vector or host. "Filarial infections are based on two biological time scales, one a short-term scale similar to the life-span of the vector, and the other a long-term scale similar to the life span of the host" (1970:880). Therefore infection in children is usually an early stage and of light intensity.

The areas of the body most often affected are the arms, legs, breasts, vulva and scrotum. The inflammation and flu-like symptoms subside within one to two weeks, but the swelling can and often does remain for a much longer period. This fever is the result of microfilariae migrating into the lymphatic tissues. While some people experience little or no debilitation, others feel lethargic and weak to the point of being confined to bed. If the lymphatic swelling goes
unnoticed or does not occur, then filarial fever may be mistaken for other fever-inducing illnesses such as dengue, Ross River fever and the common flu.

As the disease advances, hydrocele may develop. Hydrocele is commonly identified as the swelling of the genitalia - the labia in women and the scrotum in men (Wilcocks and Manson-Bahr 1978). However, hydrocele also occurs in the mammary glands of women. Prevalence rates (as well as incidence) for hydrocele are difficult to establish since this aspect of the disease is easily hidden under clothing and may never be told to other family members or friends. Even for medical personnel such as those who were members of the filariasis survey team, it was difficult to establish who was or was not affected with hydrocele. In many cases it was after our departure from the village that male team members revealed all of the "actual" hydrocele cases. In general, hydrocele is a condition which affects men more than women.

Elephantiasis is the most extreme form of filariasis. In most cases, the symptoms of gross swelling are permanent, while in others, drainage of swollen areas may give temporary relief; however, the recurrence rate is fairly high. Elephantiasis does not necessarily disable the individual, but behavior and activity patterns have to be moderated. A person with elephantiasis is susceptible to bouts of filarial fever, especially if the swollen area is cut or wounded; injury to the swollen limb appears to increase filarial activity in the lymph (Dr. Solano, personal communication). Disability or lack of activity depends upon the area of the body or the limb affected. The most limiting factor about having elephantiasis is the excess weight which
the individual has to carry; this alone restricts freedom of movement. Individuals whose leg(s) have elephantoid swelling are often restricted to walking short distances.

It is commonly believed that elephantiasis results from dead filarial worms which have blocked the glands, "thus the dead worms might impede the return flow of lymph and cause an overgrowth of skin and subcutaneous tissue" (Lambert 1942). Recent works such as that by Sasa (1976) and Wilcocks and Manson-Bahr (1978), support Lambert's earlier observations. In most cases elephantiasis is a latent form of the disease and therefore believed to manifest itself after a period of 15+ years. However, the youngest elephantiasis patient in Fiji was a 14 year old Indian boy from the island of Taveuni; this boy had elephantiasis for several years prior to being brought to the hospital. Other accounts of young children suffering from elephantiasis come from the villages and settlements in the rural areas such as India, Cochin, West Indies and Maldives (Kershaw 1970).

The etiology of the disease involves a complex interplay of pathogen, vector and host. The breeding pool or reservoir of either of these disease agents ultimately determines the effective transmission and prevalence of filariasis. Each of these will be discussed next in more detail.

---

2 Recent studies have implicated volcanic soil deposits, rich in basalt and iron, as contributing to the elephantatic pathology in both bancroftian and brugian filariasis in Ethiopia (Ottesen 1984). These soil deposits are believed to enter through the feet of microfilariae infected individuals and deposit in the draining nodes which results in lymphatic obstruction and pathology.
The Pathogen reservoir

The filarial parasite is not a free-living organism in that it spends its entire life span in the mosquito and human host; it therefore depends on the vector and host to maintain a successful reservoir. Little is understood about the behavioral and molecular mechanisms which filarial parasites induce in their intermediate and definitive hosts. This is partially the reason why a successful chemoprophylactic measure has not been yet developed. But like other vector-borne diseases, the disease cycle of filariasis is perpetuated through continuous exchange among the disease agents.

The adult *W. bancrofti* can survive from 10 to 18 years (Sasa 1976). Only the first developmental stage (approximately 2 weeks) is spent in the intermediate host - the mosquito vector; thus the mosquito serves as the obligatory host. This leaves the human as the definitive host and the primary living and reproductive grounds for the nematode. Within the human host, the parasite undergoes three developmental stages: larvae showing two molts, adult worm, and production of microfilaria. The pathological symptoms of the larvae developing into adult worms affect the lymphatic system, whereas microfilariae affect the lungs, liver and spleen (Wilcocks and Manson-Bahr 1978).

Filarial infections can be deceptive, as is the case with "Occult" filariasis (when antigen reactions destroy microfilaria and therefore peripheral blood samples are useless in determining whether the individual has been infected) where an individual may not be aware that he/she has been infected (Wilcocks and Manson-Bahr 1978). In such instances, the reproduction of microfilariae continue because the adult
worms survive, and the human, unknowingly, continues its role as a reservoir.

Even though the advanced stage of elephantiasis is thought to be caused by adult worms, this does not rule out the possibility that an individual with elephantiasis may also be a carrier of living adult worms and microfilariae. In the case of hydrocele, living adult worms cause blockage in the lymphatic ducts. Hydrocele fluid sacs can be drained (by surgical operation) successfully, without recurring symptoms (Kenneth Gilchrist, personal communication). But primarily because of failure to follow the complete recovery course, hydrocele infections can recur, in which case the filariae are still successfully reproducing in the human host.

Whereas the survival of the parasite depends entirely on the human and mosquito, the vector is not so restricted in its choice of feeding and breeding grounds. In fact the most suitable habitat for mosquitoes may be the "disturbed" environments (due to both climate and human behavior) of the tropics where mosquito vectors continuously find newly created bodies of water (Spielman and Rossignol 1984).

The Vector reservoir

Filariasis is a tropical disease. "In general, the true tropical diseases are those transmitted by vectors that are subject to

\[\text{\footnotesize 3}\text{ The head nurse at Savusavu Hospital recalled the large number of hydrocele cases which were successfully operated on at this hospital. However, she reported an inverse pattern between the incidence of elephantiasis and hydrocele between the northern town of Labasa and the southern town of Savusavu; there were more elephantiasis and fewer hydrocele cases in Labasa; and more hydrocele than elephantiasis cases in Savusavu.} \]
environmental constraints in temperate regions" (Spielman and Rossignol 1984). There are two additional features which make the tropics a very suitable habitat for mosquito vectors: 1) tropical islands generally lack large animals (other than domestic livestock which are introduced by humans), therefore humans are often the primary hosts; and 2) in human-altered environments, while adapting to these alterations, mosquitoes also become dependent on humans as their primary host (Edman 1988).

The mosquito’s life is highly variable and with suitable food it can live up to several months. Mosquitoes, both adult and larva, are known to hibernate during winter and dry seasons; however, with the absence of such extreme climactic situations, the mosquito thrives in the tropics. Under tropical conditions, the mosquito’s developmental stages, both larval and pupal combined, may take from 7 to 14 days (Mattingly 1969). The female, though unable to reproduce without a blood meal, can survive on fruit and flower nectar. Day and Edman (1988) also found that C. nigripalpus can retain its eggs up to 5 months when suitable oviposition sites for depositing the eggs were not available. Vector mosquitoes are generally anthropophilic but other animal hosts can substitute for human blood meal. There are strong indications that members of the Genus Aedes prefer human blood over cattle, pigs, horses, fowl and birds (Jachowski 1954). Laboratory tests have shown that Ae. fijiensis and Ae. polynesiensis have a preference for human blood over other animal blood (Symes 1960). In addition to Aedes anthropophilic preferences, this genus is also known to be most
adaptable to the transient environmental conditions of the tropics (Spielman and Rossignol 1984).

Another factor in need of mention is the increasing adaptability of mosquito vectors to urban and semi-urban environments. Among the peridomestic mosquitos is *Ae. polynesiensis* which will use domestic/household containers and lives in coexistence with *Ae. aegypti* (Pillai and Urdang 1979). The peridomesticity of vector mosquitos brings into question the urban adaptability of "natural" diseases. Perhaps vector-transmitted infectious diseases will add to the changing morbidity pattern found in urban settlements. As Bates (1963) had noted, humans are agents of dispersal of their own parasites. The urban vectors, *C. fatigans* and *C. quinfaciatus*, are already increasing in number in areas where stagnant polluted water (drainage ditches) is found near homes or within the mosquito’s flight range. The squatter settlements around Suva, an area where hygiene is very poor and clean running water is nearly absent, have the largest concentration of these mosquitos.

Of the five filarial vectors in Fiji, the endemic species *Ae. fijiensis*, has shown the highest microfilarial counts (Iyengar et al. 1965). The remaining *Aedes* vectors, however, are not to be underestimated in their abilities to transmit filariasis since most of the areas with high microfilarial infectivity are those from which *Ae. fijiensis* is absent. Table 1.1 lists the five vectors found in Fiji according to their habitat.
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<td><strong>Ae. polynesiensis</strong></td>
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<td><strong>Ae. pseudoscutellaris</strong></td>
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<td><strong>Ae. fijiensis</strong></td>
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<td><strong>Ae. rotumae</strong></td>
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<td><strong>C. fatigans</strong></td>
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These *Aedes* vectors have a wide geographical distribution. They are found in all areas of human habitation. Often several vector species overlap because there is little competition for food and breeding grounds. Thus coexistence is common due to the large number of available breeding habitats. Diversity coupled with the highly adaptive nature of the Genus *Aedes*, helps the vector population maintain large numbers. Human behavior also contributes significantly to maintaining and creating new breeding sites.

Based on the vector samples collected, it appears that densely populated villages have the largest concentration of vector species, e.g. all of the villages on Beqa and Vunibau village. A second area with high vector concentration is newly cleared fields; lands which are cleared for agricultural use, housing and development. While forests (both primary and secondary) serve as natural breeding habitats, deforestation creates man-made or altered breeding sites. Deforestation, however, probably leads to an increase in the vector because humans introduce themselves as new hosts as they also drive away other smaller hosts such as rats and mongoose.

Areas which yield the least number of vector mosquitos are:
1) urban homes with indoor plumbing and well maintained yards;
2) settlements on the windward sides of the islands; 3) atolls where there is little or no human habitation (but which may have wild goats and birds), e.g. Cagalai; and 4) areas exceeding 400ft. in elevation. Other factors which contribute to the presence or absence of vector mosquitos are temperature, rainfall, humidity, sunlight, etc. Although the capacity for examining these factors was not within the scope of this
study, mosquitos were found in larger numbers after periods of heavy rainfall and on days which shielded direct sunlight with some cloud cover.

But the role of humans in unknowingly encouraging and maintaining the vector population is very important. The opening of new lands for various agricultural schemes is likely to increase in the future as Fiji searches for exportable crops. The population density of urban areas will increase as urban life and economic hardship draw more people towards such centers. Also there appears to be no simple solution to the problems of the landless; the number of squatter settlements will probably increase, adding to existing health problems.

The Human reservoir

The true reservoir of human filariasis are humans themselves. Without the human host, the parasite would not exist and anthropophilic mosquitos would be significantly reduced in number. As long as there are filarial carriers, there will be a constant reservoir of parasites and a possible "bloodbank" for the mosquito. Thus this study is directed towards the human reservoir, without which the disease cycle would not continue.

While the vector reservoir is difficult to control in an environment so suitable for its success, the human reservoir may be equally difficult to control. In order for humans to break the disease cycle, changes in human behavior are necessary. Some of these changes involve issues which are central to the cultural identity of the individual, such as social and economic patterns adapted to the island way of life. Other changes involve the acceptance of introduced
behavior, such as following the introduced biomedical protocol for filariasis treatment.

Filariasis can only manifest itself as a disease if the pathogen-vector-host cycle is successfully completed. Successful transmission is further dependent upon suitable environmental conditions. These environmental conditions have, more often than not, been created by human alterations to the landscape (Roundy 1978, Dunn 1984 and Audy 1958). In Fiji, filariasis is most prevalent in rural areas where subsistence agriculture is the predominant economic activity. Rural settlement in general occupies areas which are suitable vector breeding sites.

One aspect of human behavior which may play a critical role in the dispersal of parasites, is migration patterns. Island cultural (Fijians and Rotumans) traditions are such that travel between social and kin groups is quite frequent. Therefore residence patterns fluctuate a great deal among villages and islands. This creates major problems for controlling both testing and treating microfilariae. Through continuous migration, humans transport and reintroduce the parasites into areas which may have had no previous exposure as well as areas where infectivity loads have been reduced (either as a result of treatment or by the use of environmental measures). Along with environmental alterations which increase contact with vector mosquitoes, migration patterns increase parasite proliferation.
For the past 150 years that biomedical\(^4\) intervention has been in place, the efforts to control and cure the disease has continuously fluctuated. Success is sometimes immediate in areas which are heavily saturated with drug and environmental measures. But without constant reinforcement, success is often shortlived. This by no means is unique to Fiji since in Tahiti, which is known to have had a successful antifilariasis campaign, similar difficulties were encountered (Cardines c.1965). However, unlike Tahiti, Fiji has a much larger and ethnic diverse population; the islands themselves are too numerous for coverage under a single survey period.

**Control and Treatment of filariasis in Fiji:**

*a modern day solution to an age old problem*

Some of the earliest documentation concerning filariasis and elephantiasis in the Pacific islands come from British medical officers assigned to the Fiji. In 1901, M. Finucane made the following observations:

Every growing Fijian child suffers periodically from "wagaga", which is simply an attack of lymphangitis, generally occurring in an extremity, an arm or a leg, but most frequently in the male it affects the testicle or cord, suggesting a commencing "epididymitis". With this wagaga there is fever, headache, and general malaise. It is not common to be able to define or see the inflamed lymphatic cord in the native, though amongst Europeans and half-castes it is nearly always noticeable. The commonest result in these cases is the formation of an abscess which terminates the attack, and the patient returns to his ordinary health to await another outburst of filariasis, most Fijians being liable to four or five such attacks annually. It would be rare to find a Fijian who did not bear on his body the many previous scars

\(^4\) The terms biomedical and biomedicine are used to identify the non-traditional, European based medical system. This should not be interpreted as an absence of biological values in traditional medicines, since all types of medical practices have biological values to varying degrees.
of former filarial abscesses. Elephantoid enlargement of the leg, the arm, and the breast is very common amongst Fijian women, and the disease is occasionally met with attacking the vulva (1901:24).

The earliest treatment and prevention measures against filariasis in Fiji, dating back to the late 1800's, were taken by the British. European doctors such as Lyth, were among the first to provide medical treatment for filariasis and elephantiasis. Treatment and prevention efforts were increased in the 1900's. Specialists such as Gilchrist were brought to Fiji specifically to treat hydrocele and elephantiasis patients; public health officers such as Nelson and Amos were brought in to help eradicate mosquito breeding sites; and the mass administration of Diethylcarbamazine (DEC, also known as hetrazan) began in 1948, as part of the antifilarial campaign. Much of this effort was supported by WHO. Today, WHO remains the sole supporter of the antifilarial campaign.

Initial attempts at controlling filarial disease relied on trial and error. Little consideration was given to the cultural barriers between the introduced (European-based) medical model of disease and the islander's model of disease. The biomedical control agents were confronted with problems of intervention and acceptance, ranging from the side effects of DEC to initiating cultural changes of traditional

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5 Diethylcarbamazine, a filaricide which kills microfilariae, was discovered in 1947 by Hewitt et. al. Whether DEC can destroy adult filarial worms is still not known, however it is the principal weapon in the campaign against filariasis. As Sasa states, "there still exist a number of difficulties for its extensive use in developing areas, and also, little is known about why the drug is effective against filarial parasites" (1976:747).
subsistence patterns such removing pandanus plants from the household compound. The control measures were probably put forth in sincere effort to reduce the disease, but the naivete of these biomedical measures can still be seen in the continued struggle to control filariasis in the islands.

The first antifilarial campaign in Fiji began in 1944. This initial campaign was concerned largely with control measures which were aimed only at the vector population (Nelson and Cruikshank 1955). However, with the discovery of DEC efforts were redirected towards chemotherapeutic control. To date, DEC remains the only therapeutic treatment available for filariasis. Whereas the earlier control methods involved environmental modifications - larvicide spraying and elimination of vector breeding sites - the latter became a means of controlling pathogen infectivity in the human host. Neither of these methods account for the role that human behavior plays in the ecology of filariasis.

Similar control efforts have been attempted elsewhere in the Pacific. The islands of Tonga, Samoa, and Tahiti have all had antifilarial campaigns but successful treatment (without recurrence) has only been reported for Tahiti (Cardines c.1965). Samoa has seen a resurgence of filariasis (this is attributed to the lack of participation in the DEC protocol), and filariasis rates in Tonga are currently being reported as the highest in the Pacific (Dunn, personal communication). The problems encountered in Samoa and Tonga are typical of the problems in other filariasis control projects, they clearly point out that a successful control program must be tailor-made to suit the
environment and culture. The cultural barrier is a major problem, but the biophysical environment is also a problem since the tropics provide an ideal breeding haven for mosquito vectors. Perhaps even more important is the economics of filariasis, since it is a disease almost entirely confined to the poor, rural, tropics.

Prophylactic measures were initiated prior to the 1900's. Surgical operations for hydrocele and elephantiasis and the administration of quinine to sufferers of acute filarial attacks, was quite common (Finucane 1901). These medical officers also make note of the problems encountered by the lack of native cooperation in seeking help for the disease. G. Lynch notes that: "these attacks of fever are so common amongst the natives that they are not as a rule in the habit of seeking hospital assistance for this complaint" (1905:21). On a similar note, Finucane reported the difficulty of diagnosing the disease, especially hydrocele, since Fijians would not seek treatment until the growth had exceeded 10 lbs. in weight.

The antifilarialsis campaign currently underway will last until 1990. Like the previous campaign and follow-up surveys, there are limits on the number of study areas. In this particular instance, only the islands in the Eastern Division are included for blood testing and DEC administration. Islands such as Kadavu were chosen primarily because of their location and easy access from Viti Levu. However, islands such as Beqa and Taveuni are not covered by the current campaign, even though they appear to have among the highest filariasis rates in the Fiji group.
and treatment difficult. The synchronized relationship between pathogen and vector make this a "hardy" disease. And humans act as an important agent in the disease cycle since they serve as reservoirs of filariasis. The consequences of human behavior, the tropical environment, and the economics of filariasis, all have implications for the persistence of this disease.

Organization of the Dissertation

In this introductory chapter, the reader has been familiarized with filarial disease. Human filariasis is a vector-borne infection which is dependent upon mosquito vectors as intermediate hosts. The biological cycle of the pathogen and vector, the disease reservoirs (including humans), as well as the symbiotic relationship among all three disease agents have been addressed. The "periodic" appearance of pathogens which corresponds with both mosquito and humans adds to the complex nature of the disease, and the tropics serve as ideal habitats for *Aedes* vectors of filariasis.

Chapter II introduces the field of medical anthropology, both in historical development and its current use as a conceptual model for integrating biological and cultural adaptation. Medical anthropology is perhaps the only subdiscipline within anthropology that attempts to look at humans as both biological and cultural beings. It does this by assessing the ecological and cultural factors which contribute (create) to disease patterns, including the traditional health care or ethnomedical practices which define and treat disease. A review of relevant literature demonstrates how biology and culture influence
relevant literature demonstrates how biology and culture influence disease patterns, and how such studies can serve as models for the current study.

Chapter III describes the methods and procedures used for the study. One major problem in identifying the actual pattern of the disease is that there is a lack of representative prevalence figures for the islands. This problem is addressed in the introduction to research methods since a goal of this study was to gather data which could help indicate the distribution of the disease. Age, sex and ethnic distribution of filariasis are discussed, followed by a description of the five study areas. Lastly, fieldwork involved gathering both qualitative and quantitative data. These included identifying vector mosquitos, vector zones and exposure-contact areas, human behavior within these zones, and cultural reactions towards filariasis as a disease.

Chapter IV is an introduction to the Fiji Islands. This chapter provides a physical description of Fiji followed by a health profile of the islands which updates current health problems, as well as describes the diverse health care systems available to various cultural groups. Particular emphasis is placed on the biomedical system which creates the filariasis control measures. The remainder of the thesis is organized as follows.

Chapters V, VI and VII, are the ethnographic chapters which describe the three study areas. Chapter V is on Fijians, chapter VI is on Rotumans, and Chapter VII is on Indians. Each chapter gives an historical background of the culture study area. Descriptions of the
social and economic patterns of the areas are followed by discussions of the health care systems which are used to treat filarial disease; the emphasis here is on traditional ethnomedical systems and disease theories specific to each individual culture. The last section presents the quantitative data which were gathered by monitoring both humans and mosquitoes in the various vector zones.

Chapter VIII is an analysis of exposure and contact between humans and vectors, as they occur within the Fijian, Rotuman and Indian communities. Following a discussion of islands as biological sanctuaries, the remaining analyses are presented: vector density (activity of mosquitoes) and general human behavior in vector zones; the susceptibility of women and men, and exposure and contact by ethnic group based on the data gathered in each study area; human behavior which acts to decrease/protect against mosquitoes, in terms of how protective measures are often a matter of social and economic importance; and how vector density corresponded with microfilariae rates on Kadavu island. This study shows that in Fiji, environmental features (which are often culturally modified) and activity patterns of Kadavu residents lead to different susceptibility and contact with vector mosquitoes, which is turn is reflected in the different microfilariae patterns.

The last chapter, IX, looks at cultural perceptions of and reactions to filariasis. The differential distribution pattern of the disease is affected by not only perceptions and reactions to filariasis but also by the reactions to control methods which are a part of the introduced biomedical system. This chapter is divided into four
sections. Section one looks at the knowledge and attitudes towards filariasis as a disease and how this differs from western-scientific notions of the disease. Section two looks at treatment and prevention measures which are used and available to the community, and how health seeking behavior differs due to geographical accessibility and availability, as well as by the socio-economic meanings attached to health and disease. Section three addresses whether or not control of filariasis is possible in the tropical, multicultural setting of Fiji. And the last section addresses the perception of control models by each ethnic group; this differs not so much specifically by group but is influenced by lack of association between the disease stages, previous encounters with the biomedical system and with the cultural significance of behaviors which are asked to be changed.

Finally, in conclusion, the differential disease pattern and the factors which can and need to be accounted for in order to determine the patterns of recurrence are summarized. Filariasis is both difficult to assess and control because in Fiji, the specific cultural patterns which lead to exposure and contact with vector mosquitoes and cultural perceptions and reactions to the disease differ from those which exists in the biomedical model of control and cure.
This is a study in medical anthropology which looks at how patterns of human behavior which are simultaneously adaptive and maladaptive, can perpetuate disease hazards.

....[Great] changes evidently occurred not because human populations were altered genetically, but because they were altered culturally. The human species is biologically an extraordinary success, precisely because its culture can change ever so much faster than its gene pool. This is the reason cultural evolution has become adaptively the most potent extension of biological evolution. For at least 10,000 and perhaps for 1,000,000 years man has been adapting his environments to his genes more often than his genes to his environments (Dobzhansky 1962:319).

The Nature-Nurture Debate in Anthropology

Anthropology is devoted to the search for knowledge about human biology and behavior. An important feature of the discipline is its holistic approach. That is, at least ideally, it is concerned with presenting, in temporal perspective, a broad integrated picture of human life, including biology, language, and culture. Thus, for example, anthropology can be contrasted with disciplines such as psychology and political science which restrict themselves to very specific aspects of the human condition. Within this broad ever-encompassing arena are a variety of specialties or subdisciplines, ranging from the study of fossil humans to the study of symbolic representations in urban culture. There need not always be consistency in theoretical frameworks but the
There need not always be consistency in theoretical frameworks but the underlying goal behind all of these approaches is to better understand humankind. In the end, the question "what is anthropology" becomes far less appropriate than "what isn’t anthropology". These questions are explored implicitly in this thesis on humans as biological beings who are a part of nature, and humans as cultural beings who are also a product of nurture.

Although anthropology’s roots can be traced back to the ancient Greeks and Romans, it was not until the latter half of the nineteenth century that anthropology was recognized as a scientific discipline. The study of humans came to the forefront in the wake of the Darwinian revolution. The implications that Darwin’s studies of biological processes of evolution had for human evolution were overwhelming; this encouraged the community of social thinkers to present their arguments for the processes of cultural evolution. Cultural evolutionists such as Edward Tylor and Henry Morgan equated human evolution with cultural evolution and were concerned with demonstrating how human culture had evolved from primitive levels to the level of civilization. The Tylorian school proposed that societies (culture) evolved progressively toward "civilization"; human social organization as well as religion (animism to monotheism) served as examples of evolutionary development. Thus human biology and culture were addressed separately, with proponents on both sides, each claiming their approach to have greater value than the other. This may possibly be the roots of the great nature-nurture debate, or at least the academic acknowledgement of this debate.
The nature-nurture debate has spawned a variety of naturists and nurturists. The nurturists still cling to the idea that biological processes are the dominant force behind human evolution. Sociobiologists such as E.O. Wilson (1975) and D. Barash (1977), are strong proponents of this view. On the other hand, nurturists, such as Spradley and Geertz, look for cognitive and symbolic expressions of culture; their theoretical and conceptual models do not address humans as a part of nature but rather focus entirely on learned behavior.

There is yet a third approach in looking at human evolution better known for the "middle ground" which it takes. This consists of those individuals who are attempting to bridge the gap between biology and culture. By the very nature of its questions, medical anthropology attempts to bridge this gap. As Alland notes:

medical anthropology may serve as a major link between physical and cultural anthropology, particularly in the areas of biological and cultural evolution (1966:40).

Medical anthropology has been defined in numerous ways, most of which emphasize the content of the field (Colson & Selby 1974). One of the better definitions is that by Fabrega, who has written that medical anthropology,

...(a) elucidates factors and processes that play a role in or influence the way in which individuals and groups are affected by and respond to illness and disease, and (b) examines these problems with an emphasis on patterns of behavior (1980:167).

This definition, like that of Foster and Anderson (1978), is broad enough to encompass biological, ecological and sociocultural concerns.
The field of medical anthropology is expanding and the boundaries between "culturally" oriented and "biologically" oriented studies are slowly fading. This may in part be due to the increasing number of anthropologists who are biologically trained, and medical/biological professionals who are anthropologically trained. But the variety of theoretical and conceptual models, as in anthropology generally, remain. Some of the more distinct orientations in use are: 1) the ecological approach; 2) ethnomedicine; 3) medical systems; 4) culture-contact diseases, and 5) urban applied medical anthropology.

Among the most notable contributions made by medical anthropologists in studies of biology-culture interaction are: S. Lindenbaum's (1979) work on Kuru sorcery in New Guinea; F. Livingstone (1958, 1980) and S. Weisenfeld's (1967) work on malaria and agriculture; and E. Hudson's (1965) work on treponematosis and social evolution. Each of these studies has looked at a natural disease by tracing the interaction of biological and cultural mechanisms leading to its occurrence. Other than their obvious focus on communicable diseases, all of these studies look at the specific ecological relationships between humans and pathogens in the disease producing environment. In other words, disease is not treated as an isolated phenomenon but rather as a maladaptive process.

As in the field of anthropology in general, there is also a division in the field of medical anthropology, with one group emphasizing culture's role in disease patterns and the other emphasizing environmental factors of which culture is but one component. Fabrega
identifies two broad approaches commonly used by medical anthropologists: 1) the ethnomedical approach which deals with culture and society's influence on perceptions of health and disease; and 2) the ecological-epidemiological approach which looks at the biological aspects of disease etiology.

Hunt (1978) also notes the contrast between ethnologists and ecologists in medical anthropology. According to Hunt the contrast is between the ethnological search for qualitative data through interviews, etc., while the ecologist searches for quantitative data and biological processes; the latter is summed up as an eclectic approach towards the study of human behavior (ibid). Hunt's view is rather simplistic, yet it is exemplary of the two major directions taken by medical anthropologists. However these two approaches - the ethnomedical and the ecological - need not be mutually exclusive. As Foster and Anderson (1978) note, the sociocultural and biological emphasis can be treated as end points of a continuum. In a recent paper entitled "Epidemiological Research on Infectious Disease: Quantitative Rigor or Rigormortis? Insights from Ethnomedicine", Nations (1986) provides a model for incorporating sociocultural (ethnomedical) data in epidemiological studies. She identifies three ways in which ethnomedicine has contributed already to the epidemiology of infectious diseases through: (a) the lay recognition of disease; (b) the lay etiology of disease; and (c) the lay treatment of disease. These can be summarized as the

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6 Another growing area of interest in medical anthropology, known as Critical Medical Anthropology, looks at the economic and political aspects of western-based (imposed) medical systems (Baer et al. 1986).
culture's perception, reaction (based on disease theories), and response to disease. Through her own work in Brazil, Nations demonstrates how people's health practices and beliefs affect mortality and morbidity statistics gathered by epidemiologists.

Medical anthropologists are taking a greater interest in natural (infectious) diseases, e.g. kuru, malaria, small-pox, yellow fever, etc., and there is increased awareness of how human health is conditioned by: (a) the environment; (b) human behavior; and most importantly (c) through the interaction of both. Perhaps Durrenberger's (1979) observation of paradigms for looking at supernatural and natural diseases among the Lisu also applies to the existence of such paradigms in the field of medical anthropology. Anthropologists, traditionally, have looked at supernatural diseases but the study of natural diseases, such as those mentioned above, is a more recent development. Despite efforts of medical ecologists to promote a multifactorial model of disease causation, infectious diseases continue to be analyzed, for the most part, by following a "biologistic" approach (Fabrega 1975). Nation's study is a rare example of an application of the ethnomedical and biomedical techniques in medical ecology.

Medical ecology concerns itself with the question of adaptability, i.e. health as a measure of environmental adaptation. The ecological approach, by nature and design, attempts to explore how humans adapt culturally and biologically to health and disease in their environments. Alland, who strongly urges the use of an ecological perspective in medical anthropology, summarizes the adaptive process in relation to disease as follows:
The epidemiological patterns which vary from population to population provide interesting material for the analysis of the adaptive process. In general, the incidence of disease is related to genetic and nongenetic factors. Any change in a behavioral system is likely to have medical consequences, some of which will produce changes in the genetic system. On the other hand, disease-induced changes in the genetic structure can affect the behavioral system. Such effects may be the result of population restructuring or the emergence of new immunological patterns which alter the possibilities for niche exploitation. In addition, induced or natural alterations in the environmental field provide new selective pressures relating to health and disease which must be met through a combination of somatic and nonsomatic adaptations (1970:50).

Alland's statement draws upon the dynamics of the interaction between humans and disease organisms. The interaction, though cyclic, is also indeterminate because the parameters surrounding the disease, the human, and the interaction of both, are not predictable. This also implies that not all aspects of the adaptive process have positive results. In other words, some behavioral changes are or can be maladaptive.

History of Medical Anthropology

Although medical ecology is rapidly gaining interest, medical anthropology is a highly diversified subject. Current directions in medical anthropology reflect and are still guided by the influential sources behind its development as a field of specialization. Most of these sources can be summarized into one of four general groups. First are historically significant ethnographic and biological studies within anthropology bearing on medical issues. These historical studies were not titled as medical anthropology and the gathering of medically related data were often byproducts of other studies, e.g. village ethnographies.
Though their focus was on the broader boundaries of culture, the early evolutionists, possibly unknowingly, laid down the groundwork for anthropology's concern with matters of health and disease. The effects of disease in the evolutionary process did not go unnoticed by Darwin either. But it was Darwin's successors who put his ideas to test in looking at the genetic resistance and susceptibility to disease in human populations. Physical anthropologists were amongst the earliest of medical anthropologists. Rudolf Virchow's (a medical sociologist and medical anthropologist) analysis of Neanderthal fossil remains in the late 1800's is one of the first documented applications of paleopathology. A. Hrdlicka's (1926-1931) work among the Kodiak islanders is yet another example of examining pathology in fossil remains.

There were also numerous nineteenth century anthropologists such as J. G. Fraser whose Golden Bough epic includes a volume devoted to magic, science and religion (which addresses matters relating to health and disease). Some years later Malinowski's work among the Trobriand Islanders also included consideration of health and disease in a ritualistic and religious context, an area which is of continued interest to medical anthropologists. In looking back, many of the late 19th to early 20th century ethnographies such as Boas' work among the Kwakiutl, include accounts of health and disease. So the impetus for a specialization which focused on health and disease specifically was set in motion with the origins of the field, but the formal recognition of it came later with use of more systematic methods and concepts.
The second area of influence has been the participation of anthropologists in multidisciplinary studies and surveys of health and disease. The lack of and need for anthropological analysis in such large scale studies became evident as questions dealing specifically with human behavior went unanswered. Often these were comprehensive epidemiological surveys such as the Easter Island Expedition conducted by a Canadian team of physicians and social scientists in 1967 (Boutilier 1984). While anthropological know-how was being added to these studies, medical anthropology was benefiting from the methodological skills of epidemiologists, physicians, botanists, etc.

Two disciplines which have had particular influence in strengthening the development of medical anthropology are epidemiology and medical geography, both of which were established prior to the 20th century. In his paper on the historical collaborative efforts between anthropology and epidemiology, Trostle (1986), notes that along with Virchow and Snow (who identified the source of cholera), Durkheim also contributed to the study of the social causes of diseases. In Le Suicide (1897), Durkheim looked at a variety of factors (race, heredity, climate, etc.) to explain the causes of suicide. The field of epidemiology continues to provide methods which are critical to good applications of medical research. Epidemiological data is often used by medical anthropologists for furthering their own studies.

Medical geography also has an influence; spatial and climatic effects on humans and disease are an integral part of medical ecology. Some of the ideas germane to anthropological thought have in essence, been fostered by medical geographers. For example the work of E.
Ackernecht, who was a combination medical geographer, historian of medicine, and medical anthropologist, has had significant impact on the development of medical anthropology. He emphasized the importance of the sociocultural response to health and disease. Because of the sociocultural implications of human behavior in disease patterns, medical geographers such as J. May, M. Meade and R. Roundy have also called attention to the need for anthropological analysis in the study of health and disease.

A third source of influence has been the growth of applied anthropology. The thrust toward the application of anthropological ideas arises from several different, yet overlapping concerns: a) WHO sponsored programs relating to health and disease in developing countries, particularly in the areas of nutrition and maternal and child health; b) the "bio-medically" trained medical anthropologists employed in non-academic settings; and c) the increased availability of funds for anthropological research from medically interested sources. The latter has perhaps the largest or the most productive influence on the subdiscipline. The job market may be an incentive for medical anthropologists to enhance their social training with practical medical skills. There are many medical anthropologists currently employed in the urban-hospital setting.

The practical use of anthropological skills in areas concerning health and disease, however, is not new. The earliest medical ecologists may have been the Greeks and Romans who instituted behavioral and structural modifications to maintain a healthy and hygienic environment (Hunt 1978). The eradication of small-pox, cholera and
typhoid have all involved the efforts of medical ecologists. Up until
the latter part of the nineteenth century, medical geography and public
health were thriving fields. However as Hunt (1978) notes, with more
efficient laboratory and clinical medicine, medical geography and
ecological public health declined, except in the areas of tropical
public health and environmental and occupational health.

It is no surprise that a field such as medical anthropology became
formally recognized after public health measures, especially in the
tropics and among colonized peoples, began to fail (after all,
anthropology has traditionally been concerned with exotic and colonized
peoples). Diseases such as yaws and VD in Yap, malaria in Africa,
schistosomiasis in Egypt and filariasis in India, have all brought
attention to the need for incorporating an understanding of cultural
behavior into environmental health programs. In 1980, as a
collaborative effort to combat diseases of poverty, i.e. malaria,
filariasis, schistosomiasis, leprosy, etc., UNDP, World Bank and WHO
created the "Special Program for Research and Training in Tropical
Diseases (Rosenfield 1981). Rosenfield, who is the director of Vector
Transmitted Diseases, is also an anthropologist.

The last area of influence is anthropology's concern with culture
change and the effects of such change on colonized peoples. This is a
matter which deserves separate attention because the impact of
"colonial" or "contact" diseases are only slowly being realized and
because of the disastrous effects which many of these diseases have had
In the tropics, which already had its share of endemic infectious
diseases, colonial diseases wreaked havoc and now the diseases of
development are showing similar consequences. Crosby's Colombian
Exchange: The Biological and Cultural Consequences of 1492 (1972),
vividly examines the effects of disease on the native peoples of the
Americas. For example, massive depopulation of Indians in the New World
was a result of diseases such as syphilis, influenza, measles, and
pneumonia which were introduced by the Old World Europeans. W. W. R.
Rivers' Essays on Depopulation in Melanesia (1922) demonstrates how
culture contact resulted in large-scale epidemics. The actions of the
colonial conquerors were not always intentionally malevolent, but their
ignorance led to major blunders from which indigenous peoples still
suffer.

As infectious diseases decline, diseases of development, e.g.
cancer, diabetes and high blood pressure increase. Ian Prior's (1981)
work on high blood pressure and hypertension amongst the Cook Islanders
is exemplary of modern or developing diseases in the Pacific. Also
Baker, Hanna and Baker's (1986) work on obesity and hypertension shows
the effects of such modern diseases on the Samoan population. Taylor,
Lewis and Levy's (1988) study of morbidity and mortality patterns in the
Pacific also confirms the increase in non-communicable degenerative
diseases. The cultural environment becomes increasingly more important
as changes in diet and social habits begin to show unhealthy effects.
The health provider is now as concerned with drug and alcohol abuse as
with environmental measures. This is an area where anthropological
inquiry can shed some light on health care delivery programs and preventive efforts (c.f. Rubenstein and White, 1983).

Medical anthropologists have been very critical of the consequences of contact. In the introduction of their paper, "Toward a Critical Medical Anthropology", Baer et. al., state that "the dominant ideological and social patterns in medical care are intimately related to hegemonic ideologies and patterns outside of medicine" (1986:95). Through critical medical anthropology, anthropologists such as Frankenberg (1980), Lock and Scheper-Hughes (1986) and Singer (1986), believe that a new medical system can come to realization. Although critical medical anthropology looks primarily at the economic and political structure of medical systems (as opposed to symbolic, healing, and social aspects), their point is well-taken, especially in light of the continued export of industrial technology to colonial nations. The Pacific Islands have become a dumping grounds for insecticides and pesticides such as DDT, Malathion, and ineffective/dangerous birth control technologies, all of which are restricted or obsolete in their country of origin. (Although the dollar amount of such transactions is difficult to estimate, U.S. and Australia are the two major suppliers of such items). No doubt studies on medical cultural hegemony will continue to gain the interests of medical anthropologists working in colonial and developing countries. (The hegemony applies in western nations, too.)

Towards a Conceptual Model

A definition is but a tool; there is no absolute definition of anything. It must be understood that a tool in dialectics is as important as a propeller is for navigating through air and water.
The good definition, and the good propeller, is that which allows for good navigation through the ocean of thought (May 1958:29).

In the *Dictionary of Anthropology* (1986), Seymour-Smith defines theory as "a set of lawlike generalizations which is employed to explain and predict empirical phenomena. However, few such theories (if any) exist in the social sciences, where the term is usually employed interchangeably with MODEL...and... a model is a device employed in order to aid the interpretation of reality and the building of THEORY" (p53 & p99). Wellin (1976) echoes this definition in his statement that "we do not have much theory in anthropology generally or in medical anthropology specifically" (p47), what we have are theoretical orientations. The ecological perspective is the orientation most often used by medical anthropologists studying natural diseases.

There is no need here to oppose any of the grand theoretical orientations of the discipline, since the ecological perspective in medical anthropology, also defined as medical ecology, espouses an holistic view. In the spirit of cultural materialism, human life is to some degree a "response to the practical problems of earthly existence" (Harris 1979:ix); in the spirit of functionalism, there are mutually related and interdependent parts which make up the whole; and in the spirit of cognitive models, each culture is unique in how health and disease are experienced. To varying degrees the ecological perspective considers all of these perspectives.

Some of the influential forces behind the need and utility of an ecological model have been discussed in the historical development of medical anthropology. However, the need and popularity of ecological
models is also propelled by: 1) the need for broad, comprehensive studies of health and disease (primarily an influence of the synthetic theory of evolution which emphasizes the importance of cultural adaptation of entire populations in the evolutionary process); and 2) a greater emphasis on explaining the biology-culture environment interaction, i.e. "single trait" studies such as McCracken's (1971) work on lactase deficiency. So important are ecological models in the anthropological inquiry of human health, that the American Anthropological Association meetings have recently held Symposia on, "Infectious Disease: Biological and Cultural Interaction (1980)"; and "Anthropology and Disease Control (1982)".

Because medical ecology looks at health as a measure of environmental adaptation, it provides a framework for the study of natural diseases such as filariasis. By using this ecological perspective, factors which influence the development of disease, i.e. cultural changes which create new disease niches, change in vector populations, the relationships between disease agents, biological features of the disease agents, etc., are identified. The emphasis is on humans as both cultural and biological beings, i.e. the need to survive (nature) and how one chooses to fulfill that need (nurture). Equally important is that humans are not seen as passive agents but rather as a part of the disease process. Culture can be an active agent in the disease process. Thus by using an ecological perspective, the following factors are considered: 1) all disease agents are identified in relationship to one another; 2) humans are not treated as merely the receptors of disease but may also take an active role in creating
disease hazards; 3) human behavior is identified both culturally and biologically in how it relates to a specific disease pattern; and 4) disease is a one-way process but often consists of a set of relationships between the various disease agents. These are among the most important considerations for choosing the ecological model for the present research. Although a longitudinal study would provide more comprehensive data on the endemicity of filariasis, a short-term study such as this one can provide useful observations on the role of human behavior in the disease pattern.

Relevant Research

It is now recognized that any human disease or disorder is the result of many factors within what may be described as a "causal web", a web of determinants. These webs, their extent varying with population characteristics such as size and density, include exogenous factors, biotic and nonbiotic; endogenous (genetic) factors; demographic factors; and behavior as governed by psychological, social, and cultural factors. Within any such causal web, many of the determinants of disease and disorder are behavioral (Dunn & Janes 1986:3).

Dunn and Janes emphasize that the collaborative efforts of epidemiologists and medical anthropologists can best explain the a) health consequences of behavior, and b) the social and cultural correlates of that behavior. However, they fail to emphasize the consequences which health and disease, in turn has on human behavior. Thus a cross-cultural comparison of infectious diseases such as filariasis can only be completely discussed in terms of the interplay between behavior, environment, and disease. This thesis is a study in medical ecology and looks at the feedback relationship between human behavior and disease patterns. The questions being asked are:
1) Why is there a difference in the prevalence of filariasis amongst Fijians, Indians and Rotumans?

and

2) Why does the disease persist in light of knowledge about its cause, cure and prevention?

The first question is approached from the direction of how human behavior interacts with the disease agents to create the specific disease pattern. The second question is approached from the direction of cultural behavior which defines filariasis as a health problem. The principal argument in this study is that these questions are mutually related. Therefore my thesis is that a pattern of human behavior, which is simultaneously both adaptive and maladaptive, perpetuates these disease patterns. In other words behavior which is necessary (beneficial) for basic survival, e.g. horticultural practices dependent on the use of coconuts in an island community, can also lead to contact (detrimental) with disease agents, e.g. mosquito vectors.

May (1961) addresses cultural traits which are beneficial as well as those which can be detrimental or not "survival-worthy". According to May, culture can be a promoter or preventer of disease by: 1) linking or separating challenges of the environment and host; 2) by changing the environment; and 3) by changing the host population. May's hallmark study in North Vietnam illustrates how cultural patterns (or traits as he calls them) influence disease patterns. This was a comparative study of how human behavior and habitat occupation led to differential disease patterns in three environmental zones - the mountainous, the hilly, and the lowland or delta region of North Vietnam. In the following summary May outlines the differential pattern of disease:
It can be summed up thus: from the waters the people get their food, also their cholera, their dysenteries, their typhoid fevers, their malaria; from the earth they get their hookworm; from the crowded villages they get their tuberculosis and their yaws; from the type of housing they have been forced to adopt they get their plague and typhus; and from the food which earth, temperature, and rain produce, their protein deficiencies, their beri beri


An important point which May demonstrates is how cultural practices are maintained when a group resettles, and how some of these formerly adaptive practices become maladaptive in the new environment. For example malaria is not found in the delta but it is endemic in the hilly region where the vector finds suitable breeding grounds (clean water). The hill people have adapted to this disease hazard by building their houses on stilts, under which they keep pigs and they also have indoor kitchens. However, delta residents moving to the hilly malarial regions continue to build their houses onto the ground, keep pigs in separate enclosures and have outdoor kitchens. As a result, the delta migrant comes into greater contact with mosquito vectors and suffers more from malaria. Although May’s primary interest is in looking at the geographical distribution of disease, he encourages modern anthropologists to include medicine among their areas of focus. His contribution in delineating the relationship between living organisms, the biological environment in which they interact, and the role of human cultural behavior in the success of disease systems, have become central to the goals of medical ecology.

Roundy (1978) offers a similar framework in which the cultural impact on disease patterns is assessed by identifying the "disease hazards" in the community. Roundy's model looks at the people at risk
and treats disease as a hazard system (the various ways in which human behavior can influence disease transmission) rather than an isolated or individual problem. The hazard system which serves as Roundy’s model spatially identifies the variety of disease causing agents in man’s environment and man’s own behavior in relation to use of the environment. He identifies four specific ways in which human behavior affects disease transmission: 1) exposure; 2) shedding (passing from one host to another); 3) manmade habitat; and 4) diffusion (transport, migrate, etc.).

These four modes of transmission are the ways (process) in which human behavior affects, and even perpetuates communicable disease. Depending upon the disease agents involved - number of vectors and pathogens - the transmission may be simple (person to person), or complex. Sometimes transmission is direct from pathogen to host, such as with flu viruses; however, at the other extreme are diseases such as malaria and filariasis, which may have multiple hosts and vectors.

Degree of exposure is another factor which greatly effects disease patterns. W. Armstrong (1973) conducted a study of traffic accidents on the island of Hawaii, and found that exposure poses as a health risk at several levels. His study demonstrates how time spent in driving and being driven in motor vehicles, exposes one to the risk of vehicular accidents by the duration, mode, location, and intensity of the activity. Based on his observations of activity patterns, Armstrong concluded that certain changes in the environment are more effective in reducing the frequency and severity of accidents than attempts to modify driver behavior. Exposure not only initiates the disease process but
prolonged exposure may implicate further developments of that disease. An example is the eventual development of elephantiasis from the early stages of filarial fever.

Whereas Roundy and Armstrong are both concerned with the general spatial aspects of disease ecology, Dunn is more specific about the effects of human behavior on environmental changes - specifically landscape change and modification. Dunn treats disease as both an agent of natural selection and an influencing force on the size and stability of human populations (1978). A central tenet of his work is that as humans alter the environment, they reduce the number of disease agents in that environment. But contact with the remaining disease agent(s) is intensified, as a result of the successful proliferation of the remaining agent(s) (1973). An example of such environmental change would be the "urban migration" of filariasis vectors as bushlands are cleared for development. However, while Dunn's observations may be true in terms of increased contact with certain disease agents, the number of disease agents is not necessarily reduced. The adaptive abilities of the disease agent, e.g. bush rats adapting to urban settlements or the change of a disease agent from a zoonosis to an anthroponosis, etc., would ultimately determine if human induced changes to the landscape have positive or negative results in the disease process.

Yet another perspective on how human behavior affects disease patterns has been discussed by Audy (1970). Audy looks at "man-made maladies" which result from both tampering with the environment as well as biomedical blunders. Audy takes us out of the natural environment and into man-made environments such as hospitals, which in themselves
serve as breeding grounds for a variety of ailments. A very important feature of Audy's work is the emphasis on the sociological and psychological disorders which arise from biomedical advances which ignore the human (cultural) element in the treatment of disease. A common misconception of modern medicine is that human healing can occur by treating merely the biological manifestations of illness and disease (thereby ignoring the social and psychological needs). This echoes of similar misconceptions held by those who still separate biology and culture, or nature from nurture. The healing process, in fact, is as much social and psychological, as it is biological.

Humans seem to balance on a double-edged sword; what we often do results in unhealthy consequences, if not for ourselves then for someone else. But through culture, we learn how to maintain or regain a sense of balance by using the healing process which we have learned. So while culture can perpetuate disease patterns, it also provides us with the tools (beliefs and practices) for coping with disease.

Ethnomedicine and disease theory

It is culture, not nature, that defines disease, although it is usually culture and nature which foster disease (C. Hughes in Logan and Hunt, 1978:153)

Hughes' description is limited to the cultural definition of human diseases; it does not include diseases which occur among other animals which do not have culture. Although the definition of disease, in fact, determines the healing/prevention process. Thus another dimension of humankind's role in the ecology of disease is the cultural beliefs and
practices which identify and treat disease. Ethnomedical studies fall into several broad categories. The first of these may be lumped into studies of medical systems which define folk, traditional, and western/biomedical/scientific systems. Among those specializing in the study of medical systems are Kleinman (1980), Landy (1977), Leslie (1974) and Romanucci-Ross (1977). A second group consists of those concerned with disease theories or how people perceive and attach meaning/labels to disease; this also includes defining medical nomenclature. Among the specialists in this group are Turner (1964), Frake (1961), and Foster (1976). A third group has conducted studies concerned with the roles of the healer and/or patient. Press ("urban curandero", 1971) and Parsons (the "sick role", 1951), fall into this group. There are, of course, ethnomedical studies such as Rubel's (1964) work on Susto, which incorporate the ideas of all 3 groups.

Health and disease are defined both at the cultural level and at the individual level. The latter becomes very important in the introduction of new medical systems, because it is often the individual-personal experience with a new system that initiates redefining the old. This occurs as a result of actual encounters with the new system, whether by choice (when the individual seeks out new treatment), or by imposition (when the new system is forced upon the sick individual). However, there are instances when entire communities may be put through mass testing or drug inoculations, in which case it is the "collective"

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7 The term ethnomedicine is used to describe the medical practices of non-western, traditional cultures. By using this description, biomedicine which is European/Western based, is differentiated from traditional ethnomedicines.
experience which may lead to redefining disease. In either instance, the old disease theory is subject to change when new systems are encountered.

The disease theory of a culture determines how a disease is defined. The definition becomes singularly significant because the perception and understanding of what causes ill health partially determines health seeking behavior, and mediates the healing process. Medical anthropologists have designed a variety of models which examine the process of health seeking behavior. Most of these models are descriptive (c.f. Young 1978, Kleinman 1980) and do not consider experience as part of normal process of health seeking behavior. An all-encompassing model should include not just disease definitions and onset of illness but also the experience which results from the disease-behavior process. The following diagram (figure 2.1) offers a broader means of conceptualizing the disease-behavior process:
The disease-behavior process

disease theory
(what is healthy and what is not healthy)

↓

disease occurrence
(context is very important)

↓

perception/interpretations of symptoms

↓

reaction and response

↓

result/outcome
(positive and negative)

Figure 2.1

This 5-tiered model simplifies the feedback process between belief and outcome. The steps may not consistently occur in the order in which they are presented but they constitute a general pattern of information accumulation and action. For instance, someone who gets sick while already in a hospital would perhaps be influenced more by the diagnosis and treatment methods of the hospital staff than his/her own individual-cultural perceptions.

The importance of this model is that regardless of the outcome (positive or negative), it shows how experience (process) with an illness episode influences disease theory. This model diverges from traditional functional models (Fabrega and Hunter 1979, Young 1982, Foster and Anderson 1978), in that an equilibrium is not always the end result. It also suggests that disease may be considered as disequilibrium in the adaptive process. Changes which are brought about when a cure-healing process fails often lead to complete rejection or
reorganization of the original disease theory. As is seen with infectious diseases, the self-perpetuating motives of pathogen, vector and host are survival. However each could not survive without upsetting (invading) one or all of the others; in other words, disequilibrium is perhaps a more appropriate way to describe the repetitive nature of infectious diseases.

Although the adaptive process is simplified by this model, it does serve as a tool for comparing disease theories and health seeking behavior across cultures. It also provides a comparative framework for investigating whether the similarities and differences manifested towards one disease could also apply to other diseases. In other words, do similar disease theories lead to similar disease consequences; and do similar disease consequences result from similar behavioral patterns. As we shall see, however, cultural adaptation to health and disease is often singularly unique because variation, even within one culture, is more often the rule than the exception.

To some degree, the principle of cultural relativism applies here, at least to the extent that it is "in essence an approach to the question of the nature and role of values in culture" (Herskovits 1966). It does not apply to the degree, however, that all behavior in response to health and disease can be considered rational. As Shweder (1985) has so eloquently demonstrated, there lies between the realm of the rational and irrational behavior, the realm of the nonrational:

....there are cases where canons of rationality, validity truth, efficiency are simply beside the point - irrelevant! This is what the romantic rebellion against the enlightenment is all about. That there's something more to thinking than reason and evidence - culture, the arbitrary, the symbolic, the expressive, the
that many of our ideas and practices are beyond logic and experience (1985:38).

Shweder credits L. Levy-Bruhl for recognizing that there is another realm beyond science and logic which can explain specific attitudes, beliefs and behaviors. Levy Bruhl (1910) called this the mystical realm. Shweder, having modified Levy-Bruhl's concept, calls this the realm of the arbitrary. In his discussion on "divergent rationalities", Shweder states that "the object world is subject dependent; subjectivity is objectlike...rationality is not independent of our version of it" (1986:191).

The nonrationality that Shweder describes is an important realm for beliefs and practices associated with health and disease, especially where ill-health of a repetitive nature becomes evident. This arbitrary-nonrational realm becomes significant when explanations are sought for why introduced biomedical measures fail in a society which has its own set of ethnomedical practices. Such explanations need to be approached from both the emic or how culture defines, treats, and prevents filariasis, and the etic perspectives or the biomedical definition, cure and prevention of filariasis. Similar environment and similar disease do not necessarily lead to similar "emic" categories, yet much to the contrary, similar environment and similar disease often leads to similar biomedical methods of cure and prevention.

The disease theory models, the behaviors that result from as well as perpetuate them, and the actual occurrence of disease can be looked at in terms of where they depart from the rational responses. This can serve as a conceptual framework for looking at the cross-cultural
ethnomedical practices relating to filariasis. Perhaps, even more so, it will lead into explanations/observations for why there is persistence of this disease in spite of the knowledge about cause, cure and prevention.

Thus the question to be addressed is whether or not the behavior in response to filarial diseases is adaptive or maladaptive. Is nonrational behavior maladaptive? Or is it adaptive in specific circumstances? Clues to the answer may be found in the culture's own disease theory, in human-environment interactions, and in changes brought about as a result of intervening medical beliefs and practices. Furthermore the answers are best understood in the ecological context in which disease takes place, for it is within this context that disease occurs, and it is within this context that cultures differ in terms of their contact with and reaction to disease agents. The fact that modern medical science is continuously kept on its feet by "new" developing diseases such as cancer and AIDS, indicates that maladaptation may not be an issue only in the realm of nonrational behavior but also in the rational-scientific realm.

Summary

Anthropology, the study of humankind, has been divided between those who favor biological processes vs. those who favor cultural processes as the prime movers of human evolution. Medical anthropology, however, is a field which allows for an integrated study of humans as both biological and cultural beings. In particular, studies in medical ecology emphasize the natural processes (the relationship of disease agents in a given environment) of disease patterns. And through the
discovery of ethnomedical data, human behavior can be evaluated in terms of how culture specifically influences disease patterns, after disease occurs.

The problem at hand is twofold: 1) the differential prevalence of a disease in three cultures sharing similar environments; and 2) the recurrence of this disease in areas thought to have been successfully treated. The complexity of the disease itself, and of culture, as well as the natural environment, offer an infinite range of possible explanations for such patterns. There is no attempt to create a static model here (albeit that would probably lead to simpler questions and simpler answers), on the contrary, this is a glimpse of cultural adaptation in process and, as with organic evolution, this process is indeterminate. Thus the remainder of this presentation will show the indeterminate nature of possibilities in cultural adaptation to a single disease hazard.
CHAPTER III
RESEARCH METHODS

Introduction

Human behavior plays an important role in the ecology of infectious diseases. As discussed in the previous chapter, numerous studies have shown that the occurrence, distribution, and environmental conditions leading to disease are often affected by human behavior (c.f. May 1961). Furthermore, the course of disease is often affected by cultural (ethnomedical) behavior in response to the illness episode (Fabrega 1980). The implications of human behavior in the ecology of filariasis have been recognized through previous research (Mataika et al. 1971) but efforts have not been made to study these implications. The need for such a study has been strongly emphasized by Dunn, who states that:

most of the available data on man's behavior and filariasis have been collected as byproducts of other investigations, e.g. entomological studies done on man-made breeding sites...the entomologist does not consider in any detail those human activities and underlying sociocultural and psychological considerations that may have their physical expression in man-made mosquito breeding sites. His attention is obviously fixed on the behavior of mosquitos rather than of man (1973:6).

At the first national symposium of filariasis, Rao (1978) pointed out that filarial diseases have detrimental socioeconomic consequences on the individual and family. Papao (1976) has noted that in Samoa, lost labor as a result of filarial infections seriously affects the socioeconomic status of the family. In a previous study, Kessel et al. (1970a) had found that Samoan males refuse DEC treatment because the
side effects of the drug disables them from working the plantations. Based on these factors and his own experience, Desowitz also advocates the need for a study of human behavior:

It is easy to prescribe the mass administration of drugs to a community inflicted with filariasis but those of us who have been evangelical in these pursuits know how futile these intellectualized approaches to public health programmes can be. The behavioral scientist could, and should, have a major role in designing health campaigns that would be acceptable in the cultural setting where they are to be carried out (1973:47).

My interest in filariasis developed out of a meeting with Dr. Robert Desowitz, one of the pioneers of the antifilarial campaign in Fiji. Having had some familiarity with the multicultural context of Fiji, my interest in filariasis developed further as I became aware of both the academic and practical needs to study this disease. Fiji, like many of the developing South Pacific islands, has its share of developing diseases such as diabetes, tuberculosis, and coronary heart disease. All of these problems have their individual cultural implications. But the history of filariasis, the disease vectors and the periodicity of microfilariae, allowed me to look at disease in a context where humans have little control over contact with disease agents in their environment. Perhaps more importantly, there is a need to look at why such inconsistency exists between cause and cure or cause and control of filarial diseases. And in this sense, I knew culture was perhaps the prime mover in determining the direction/pattern of the disease.

Two points which need to be noted concerning my role as an anthropologist in Fiji, are my own ethnicity and my status/affiliation with the Ministry of Health. I am a Fiji born Indian and although I had
returned to Fiji for brief visits in between, I was returning for this study after living in the United States for 20 years. I was familiar with 2 of the study areas, Vunibau village and Waidova settlement, but not with any of the other areas. Having had contact with some of these areas did help me to gain access into the community and communication was made easier by my fluency in Hindi and some knowledge of Fijian. My being Indian and returning from the U.S. to Fiji met with more ambivalence by Indians, especially Indian health officials, than by either Fijians or Rotumans. Overall, acceptance and rapport was gained easier because of familiarity and ease with the islands and the people.

Knowledge and access to traditional healers was often hampered by my affiliation with the Ministry of Health. Since my research project was under the direction of the Ministry, people in the study areas often associated me with other medical staff. And since the Ministry frowns upon many of the traditional practices (particularly those which were outlawed by British rule), my own position was under constant scrutiny. This problem of "mistaken identity", was more evident in some villages than others. However time became the key element in gaining trust and rapport. Inevitably, the more time I spent with any one group the more data I was able to collect.

The remainder of this chapter describes the various methods employed to gather data. First, the prevalence estimates on which this study is based, need to be considered since the primary objective was to map the distribution of the disease in order to identify possible study sites. The search for a geographical distribution of the disease became in essence, the initial part of my fieldwork. This section is followed
by a description of the study areas and the method of controlled comparison. The last section describes the specific qualitative and quantitative methods of data collection used in each of the study areas.

Considerations regarding prevalence and selection of Study sites

In the absence of national prevalence rates\(^8\), the initial objective of this study was to map the distribution of filariasis in Fiji. This was a rather difficult task since the fields of data varied with each survey i.e. only some results were broken down by age and sex, and some results/charts could not be located. Therefore based on what data were available, a distribution map was prepared designating the year of the survey and the approximate ethnic distribution (see figure 3.1).

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\(^8\) Prevalence rates are used to show the number of people in a population who have the disease at a given point in time. Such prevalence data are not available for all of Fiji. Rather prevalence, as used in this thesis, denotes an estimate of the distribution of filarial disease. This estimate is based on the results of a smaller number of area-specific studies which have been projected onto the greater population.
Figure 3.1 The Distribution of Filariasis in Fiji
This task was completed during my first week in Fiji in the hopes that on the basis of locating "known" filarial areas, study sites could be chosen. However, after discussing possible study sites with District Medical Officers (who maintain records on known disease in their districts), I discovered that there were areas in need of study which had either been excluded from previous surveys, i.e. Waidova, or a follow-up of the original data had not yet been done, i.e. Beqa island. In addition, the most recent survey results showed a recurrence of filariasis in areas where mass drug administration had previously been completed, i.e. Rotuma and Lau.

Reviews of the records of the antifilarial campaign and discussions with medical personnel suggested that the distribution of filariasis was only known for certain areas and that the prevalence of this disease could be wider than known. These reviews also pointed out the difficulties of measuring the disease. Among the reasons why it is difficult to assess filarial infectivity rates are: 1) lack of maintaining consistent microfilarial records; 2) lack of reports of actual disease occurrence, both by those infected and medical staff; 3) lack of established procedures for reporting to any one agency or group (the Filariasis Laboratory was opened in January 1986); 4) lack of adequate training of medical personnel who can identify symptoms of filariasis as a specific disease; and 5) most importantly, the individual's own perceptions of filariasis which determine the course of action that is taken for treatment. In the instance where filariasis was treated by traditional/local healers, the medical staff responsible for recording filarial cases were not notified. As will be demonstrated
by this study, individual and cultural perceptions of health and disease are not easily changed. In addition to the microfilariae records obtained from the Wellcome Virus Laboratory, various other methods were used to estimate filarial prevalence in the study areas. Medical records maintained by hospitals, clinics, health centers, and nursing stations were reviewed for each study area. Unless a staff member was designated as the resident filariasis expert, hospital records were unlikely to identify filarial cases. In the case of Savusavu hospital, a separate log for filariasis cases was maintained until 1983; this procedure was initiated by the first antifilarial campaign but has been discontinued since 1983.

Smaller health care facilities, especially the nursing stations, were the most consistent in recording the incidence of filariasis, including initial visits, repeat visits, treatment procedures, and complaints. Nursing stations are small units in rural areas and outer islands which have little or no access by roads; the communities which they serve are fairly small. As a result, the nursing staff are very familiar with and have good rapport with their villages/settlements. The nursing staff of these outposts were also privy to knowledge of current traditional health care practices in the community. Thus the medical staff in these small-rural communities had current knowledge about both the incidence of filariasis and the traditional healing practices known in their constituency.

Interviews with village and settlement residents also helped me to gain a better perspective on the occurrence and prevalence of filariasis in the community. Prominent community members, especially village
chiefs, could often provide an updated health profile of their community. Traditional healers also had knowledge about the incidence of filariasis and could name individuals and families who were affected by filarial type diseases. Throughout the study, efforts were made to visit healers known to treat filariasis, which in turn often led to meeting persons seeking treatment.

People in the advanced stage of elephantiasis were another important source of gaining information about filariasis. Because of their own infection, these individuals were among the least mobile members of the community. The majority of people with elephantiasis were over the age of 40 and were long-standing residents of their community; in a sense they were "temporal history books" who could provide a wealth of data about the social, cultural and political issues in the community.

The interviews, combined with data from current medical records, provided me with an updated picture of filariasis for each area. Where names and dates were available for persons seeking medical treatment for filarial infections, a cross-reference could be made with information obtained in the village. For instance in the village of Dakuni, Beqa, 21 of the 35 people on my list (provided by the village chief known as the Turaga) of current filarial cases had also been listed in previous microfilariae survey charts. The ability to cross-reference individuals who had tested positive for microfilariae with information from their

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Mobility or inter-island migration and movement is a common practice amongst both Fijians and Rotumans. This kind of mobility hampers good epidemiological surveys of any given population, as well as the effective treatment of filariasis with DEC.
own village, gave added information about: 1) why DEC procedures were never started or why they were discontinued; 2) if their condition improved with or without treatment; and 3) what their personal reaction was to the disease.

Given all of those considerations regarding the prevalence of filariasis, 5 study areas were identified. The following is a description of each study area.

The Study Areas

In its original design, this study was to be an exploration of the factors implicated in the differential filarial rates between Fijians and Indians. However soon after my arrival, I was advised of the high filarial rates on Rotuma island. With the encouragement of Dr. Sakio Varea (District Medical Officer for Rotuma), and Dr. Jonu Mataika (Wellcome Virus Laboratory), Rotuma island was included as the third culture study area. The comparison would now look at filariasis in three distinct cultural communities, instead of the original two.

The study areas - Rotuma island, the Fijian communities of Beqa island and Vunibau village, and the Indian communities of Waidova and Wainibokasi settlements - were chosen based on two factors: 1) all of these areas have had a high prevalence of filariasis in the past or currently have reported cases; and 2) all of these locations are habitats for at least one or more of the three major vectors of filariasis (see figure 3.2 for study areas). Further ethnographic description of each study area and disease related concerns are discussed in Chapters 5, 6, and 7.
Figure 3.2 The Study Areas
In Rotuma, the village of Motusa was chosen as the primary study area; this was influenced greatly by my own accessibility to the village. However because of the small population and the availability of and access to health care, data were also collected from other areas on the island, particularly leeward villages which have large numbers of mosquito vectors. Although there are Rotuman communities on Viti Levu which could have been included in this study, they are not known to have either high vector or high filarial infection rates. Additionally, the 1983 survey results which were the basis for this area, covered only the Rotuman population on Rotuma island.

The island community of Beqa was selected because of its size, accessibility, and because filarial vectors and filariasis are known to be prevalent on the island. An added feature is that although Beqa is relatively close to Viti Levu, it still remains socially isolated from the mainland. (There is little or no urban development in Beqa although several other small islands at a greater distance than Beqa have some degree of urbanization). This became a primary factor to consider in terms of filariasis and health care, of which the former is highly prevalent and the latter is very limited.

Vunibau village was selected because it is the localized habitat for *Ae. fijiensis*, and since it lies between Beqa and Waidova, it proved to be strategically important. Vunibau has unique social and kinship ties with Beqa and there is frequent travel between the villagers of these two areas. In addition Vunibau borders on Waidova settlement and the villagers share the facilities of Navua medical hospital with their Indian neighbors. Still yet another added feature of Vunibau is its
resident public health nurse who plays a unique role in her own village as well as in neighboring Fijian and Indian communities.

The two Indian communities were selected on the basis of vector habitat as well as their proximity to Fijian villages. Waidova, which lies on the banks of Navua River, is where *Ae. fijiensis* is very prevalent. Rice cultivation is the major source of income in Waidova; it also has social and economic ties, involving exchange and reliance on market crops, with neighboring Vunibau. In addition, Waidova has undergone significant economic change - from small subsistence farms to monoculture - which has rearranged the physical structure of the settlement. Houses which were previously dispersed throughout the settlement have all relocated to the river bank, alongside one another.

Wainibokasi, on the other hand, is a highly dispersed settlement and is much larger than Waidova. Mixed agriculture is more common in Wainibokasi and the Indians have less interaction with their Fijian neighbors. Also unlike Navua, where agricultural development blankets the landscape (rice, corn and sugar cane are grown throughout the area), Wainibokasi homes are surrounded by bushland; this is partially due to the large family lots which are not kept cleared on the periphery. The environmental change in Waidova has been towards large scale agricultural schemes, whereas changes in Wainibokasi are brought about by individual households and smaller farming schemes. As a result, the

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10 The Nausori area, along with the towns of Lautoka and Sigatoka have had a long history of racial tension between Indians and Fijians, which have often led to violence. During January 1986 4 murders were committed in Nausori as a result of racial tension. This is a high figure for one month. In addition other crimes such as assault, rape, theft, etc. are quite common.
bush mosquitos, *Ae. pseudoscutellaris* and *Ae. polynesiensis*, are highly prevalent in the Wainibokasi area.

**The Method of Controlled Comparison**

The method of controlled comparison was used to explore these broad areas of data. Eggan (1954) identifies the method of controlled comparison as that which could be best used as a convenient instrument for exploring and correlating data, while also avoiding too great a degree of abstraction. He adds that the anthropologist has greater control over the frame of comparison by using the controlled method on a small scale. Since there was a need to identify the parameters by which to compare cultural behavior relating to filariasis and this was a synchronic analysis of problems relating to filariasis, this method proved to be most suitable. Two of the most important parameters (measures of correlation) were identifying vector zones and dividing human activity into definable time periods. By the use of the same comparative measures, I was also able to reduce observer bias. With control over the frame of comparison, variation within each culture, i.e. clothing, subsistence activity, etc., could easily be identified. Thus, this method satisfies the need to find regularities and common denominators behind the apparent diversity and uniqueness of cultural phenomena (Ackerknecht 1971).

Another reason why the method of controlled comparison was most suitable for this study is its emphasis on historical factors. In outlining the method of controlled comparison, Eggan was also concerned with how culture’s remain unique (different) in spite of similar environmental stimuli and pressures and influence by other (dominant)
cultures. The issue is twofold: while it is important to look at cultural diversity itself, it is also important to look at why assimilation and acculturation are not always the end results. In Fiji, cultural variations in filarial disease persists in spite of the intervening efforts of the dominant European-based medical system. These issues, based on the historical aspects of filarial disease and the consequences of contact, are to be addressed. In sum, by using the method of controlled comparison, I was able to broaden my data to include both historical events as well as offer an encapsulated, synchronic analyses of filarial disease as it presently occurs among Fijians, Indians and Rotumans.

Data Collection

Given the differential distribution pattern of filariasis, this study was designed to explore: 1) the disease context of filariasis in which human activity leads to greatest amount of contact with vector mosquitos; and 2) the ethnomedical practices of Fijian, Indian and Rotuman rural communities which respond to this disease hazard. Specific problems investigated were:

a) natural and cultural environmental conditions, such as vector density and vector-host contact which contribute to the special risk of contracting filariasis;

b) material culture (housing, clothing, outhouses) which may be related to differential risk rates;

c) individual activities and occupations which lead to greater or lesser exposure and contact with vector mosquitos; and

d) perception of and response to filariasis based on traditional and biomedical preventive and curative measures.
Both qualitative and quantitative measures were used in gathering data for this study. Qualitative data resulted largely from ethnographic research, and quantitative data consisted primarily of the identification of mosquito vectors, and monitoring activity patterns in exposure/activity zones. The five primary fields of data included: a) ethnographic research which was conducted on a continuous basis; b) medical information which was gathered before and during my visit to the study area; c) mosquito collection which was carried out during the early period of my visit and during periods of extreme weather change; these samples were then brought back to the Vector Control Unit for identification; d) the delineation of vector zones which were established after vector species were identified according to breeding and feeding habitats; and e) monitoring human activity patterns throughout the day within the various vector zones. The specific methods employed for each field of data and the specific types of data gathered are as follows:

Ethnographic data were gathered primarily through participant-observation. This resulted largely from residing with the families in the different study areas and participating in daily activities. Except for Waidova, I was accompanied by medical staff during my initial introduction into the study areas. After introduction into the village/settlement was completed, I was either referred to specific families who were willing to participate in my survey, or was left to select households based on my own criteria. In Dakuni, Beqa, the Turaga identified households for my study; in the remaining four areas, I identified households with the help of the local medical staff, e.g. public health nurse or village health care worker.
Formal interviews were conducted with individuals and groups through the use of: 1) household and health resources/use questionnaires (see Appendix); 2) tape recorders; and 3) translators. The survey questionnaires were administered during morning and evening meals when the majority of family members were present. At least one family member throughout the entire study population, spoke and wrote English. Most Fijians, particularly Vunibau residents, spoke both Fijian and Hindi. Likewise, many Indians in Waidova and Wainibokasi spoke both Hindi and Fijian. Resident health care workers assisted in much of the translation in Fijian villages. In Rotuma, in the event that the participants did not speak English, hospital staff nurses would serve as translators.

The tape recorder was an essential tool for gathering ethnographic data. Along with formal interviews, I also taped informal discussions which needed translation. Some of the older non-English speaking residents would tell me about their experience with filarial disease in story form; these were later translated and incorporated into field notes. Although the use of translators may have created some biases, their service was invaluable to this research. Their assistance in Beqa, Vanua Levu and Kadavu was especially appreciated since many of my informants did not speak English nor Hindi.

Along with survey participants, traditional health care practitioners, midwives, public health nurses, community health workers, and village chiefs also served as informants. Ethnographic data were further enhanced by participating in social events as well as through casual conversations with community members. Special attention was paid
to individuals seeking health care treatment, particularly those with filarial fever and elephantiasis. Unfortunately hydrocele was difficult to identify because of individual unease with the affliction as well as reluctance by others to identify individual cases. Therefore, it was easier to elicit causal explanations for hydrocele than to interview the people who actually had the disease.

The Filariasis Laboratory (a unit of the Wellcome Virus Laboratory) was opened in Walu Bay, Suva, midway into my fieldwork. This laboratory was funded by WHO as a part of the antifilaria campaign. Along with providing blood testing and out-patient treatment services to the general public, the Laboratory also gathers epidemiological data on filariasis. It also maintains records all of the records for past and present filariasis surveys. These records provided the historical data needed on filariasis surveys conducted in Fiji.

Quantitative data included collecting vector samples from each study area. Previous studies such as Symes' work in 1954, had identified mosquito vectors and their breeding/feeding habitats throughout the islands. However, vectors specific to the study sites needed to be identified. In addition, knowledge of vector prevalence/density was necessary to determine areas and activities which led to greater/lesser exposure and contact between humans and mosquitos. Most mosquito species were easily identified by referring to the Belkin text (1962); samples were also brought back to Suva for further identification.
The sampling method used for collecting mosquitos was human bait. Although the use of dry ice as bait was intended as the original method of mosquito collection, dry ice was not available in the study areas. Other attractants used to collect mosquitos such as carbon dioxide, odor, heat, moisture and visual stimuli were also not viable in this study situation. According to Service (1976), since human bait catches create the least amount of sampling bias, they remain the most useful single method of collecting anthropophilic mosquitos. "Man-biting rates are often used for assessment of malarial, microfilariae and arbovirus risk" (Service 1976:221). Excepting for the fact that multiple human baits were not consistently used (this is often suggested because of the mosquitos chemical attraction to certain hosts), this was the most practical means of collecting vector mosquitos in the islands.

After accompanying the Vector Control Unit team to Yanuca island for a collection of Toxorhynchites (introduced as a biological control measure), I learned the simple tube-suction method which could be used by humans serving as bait. Mosquito collections were done by using myself as the primary bait; several informants also volunteered, simply out of curiosity or because they found mosquito collecting a rather amusing activity. The mosquitos were collected by the use of a suction tube and trap bottle, as they rested on exposed body areas. Density was determined by the number of mosquitos collected in 7 - 5 minute intervals in each vector zone. Collections used to represent density in a study area were taken from average temperature days; collections taken on days/times of significant atmospheric changes were evaluated separately. For instance, heavy rains and periods immediately after
heavy rainfall were not considered to be representative of average days. Light rainfall which is quite common throughout the islands, however, was included as average weather since the number of mosquitos after light rainfall did not vary significantly from periods of no rainfall. These collections took place in areas of human activity such as houses, kitchens, gardens, pathways, outhouses, trees, school yards, pig sties, rest areas, and plantations. Samples were collected over 10 days from each area, including collections from periods of heavy rainfall, flood, hurricane, and very high humidity levels.

Vector zones within the study area were established after the initial collection and identification of vector species. During initial mosquito collections, the study areas were mapped out in terms of where specific activities took place. This allowed me to define the locations within the community for further vector collections and for monitoring human activity. Diagramming vector zones included the physical characteristics of the village/settlement, possible and actual mosquito breeding sites, and other environmental features which influenced mosquito behavior, i.e. height level of house, screening, etc. Even though material culture and cultural behavior varied between and within the study areas, the following features were consistently used to define vector zone boundaries (specific features are identified in the respective ethnographic chapters):

1. **Indoor zone** - includes the primary living quarters of families in the study area. In traditional houses, this area is best defined as the sleeping and eating quarters. In cement, or modern houses,
the cooking and cleaning areas, including toilet facilities (only in Wainibokasi), were often part of the living quarters.

2. Household compound zone - this consisted of the immediate area surrounding the house. Included in this zone were kitchen gardens, outhouses, work and play areas, and vegetation such as coconut and breadfruit trees which are within the compound. Compound sizes varied depending on the amount of land-use pertaining directly to the household area within individual communities.

3. Village/Community zone - this area consisted of schools, churches, community halls, public playgrounds, markets, public transportation centers, and health delivery centers which provided support services to the individual village and settlement. The size of community and social-communal activities varied according to the size and population of the area. Boundaries for each of the culture study areas are provided in the ethnographic chapters.

4. Garden/plantation zone - this area was often furthest away from the household zone and was defined primarily on the basis of economic activity. Planting, gathering and harvesting of coconut, sugar cane, rice, root crops and other vegetables were the predominant activities taking place in this zone. Pig sties were also included in zone 4. Bush areas between villages and gardens, and roads and paths leading to the activity sites were also included in this zone. In addition, activities performed outside of the boundaries of the community of residence such as reef and lagoon fishing, were also included in this zone.
Once vector zone boundaries were established, monitoring began of daily activities in each zone. A sample of 5 to 10 households were selected in each study area; these households represented my survey population. The number of households varied according to the number of resident family members and the economic activities of these individuals (efforts were made to include households whose members participated in activities exposing them to several vector zones). Survey participants were accompanied to their daily activity sites; survey participants were also asked to keep a record of their individual time use. Male participants whose activities I could not monitor (women are not allowed to participate in activities such as commercial fishing and yaqona ceremonies), would give me an account of their daily hours in the evening or the following morning. But daily activities in rural areas were generally routine and therefore, easy to monitor. Daily activities were monitored in 6-4 hour intervals, for 3 consecutive weeks. The 24-hour cycle was divided into 4 hour intervals which best corresponded with vector appearance (activity). These units of time allowed me to monitor behavior within controllable and comparable limits. Exposure charts were prepared for each 6-4 hour interval and daily activities were logged according to the time and duration of specific activities.

Time and duration data were averaged to create "Hours of Exposure in vector zones" tables, which are presented in the following ethnographic chapters. These tables show which groups have greater or lesser exposure to mosquito vectors. In addition to establishing correlates between activity and exposure, activities were also ranked in order of their importance/priority to the individual and the community.
There are some significant differences in the activity patterns between men and women, as well as across cultures and communities. After presenting these data reveal in the ethnographic chapters, cross-cultural comparative analyses in relation to disease occurrence and disease prevalence are discussed in chapters VIII and IX.

One final aspect of this study involved discussing my observations, and finds with Dr. Mataika and the staff at the Filariasis Laboratory. This was usually done after returning to Suva from the study area. These discussions proved to be quite informative, both in terms of identifying issues which needed closer attention in the remaining study areas, as well as factors which surround the disease that are not revealed through surveys, reports, etc. Furthermore, these discussions demonstrated that many of the biomedical staff working with filariasis in Fiji such as Dr. Mataika, are sensitive to the cultural issues surrounding filariasis; much of their sensitivity arises from the experiences with implementing preventive and therapeutic measures.

Summary

This chapter has reviewed the procedures and methods used to conduct this study. Issues surrounding the distribution of filariasis and the lack of accurate prevalence figures were discussed in the beginning of the chapter because these are important in establishing both the ethnic differential in the disease pattern as well as the patterns of recurrence. Based on available figures, ethnic and sex differentials in prevalence figures were provided. Although 2 study sites from each of the culture areas were intended to be used for the study, only one village was selected on Rotuma island because of the
relatively small size and easy access to the general population. The last section outlined the qualitative and quantitative data which were gathered from each area, including mosquito collections, establishing vector zones and monitoring human activities.
Prevalence rates for filariasis are difficult to assess. This problem is not unique to Fiji but is common to the tropics where vector transmitted infectious diseases are prevalent, and culture and medicine offer a variety of explanatory and treatment models. Disease prevalence rates are epidemiological measures, which along with incidence rates, determine the occurrence and distribution of diseases. The prevalence concept is therefore, a tool used by biomedical, public health personnel; it is not a tool of indigenous practitioners of traditional medicines.

Since this study examines why there are ethnic differences in the distribution of filariasis, it is necessary to first discuss how such differences are determined. It is also important to address why it is difficult to obtain island-wide prevalence rates for the true distribution of filariasis. These issues can be addressed in the context of Fiji's health care systems which includes the antifilarial program that determines filarial prevalence patterns. Following an introduction to Fiji, section one of this chapter presents a health profile of the islands with particular emphasis on Fiji's health care systems. Section two looks at the age, sex, ethnic and geographical distribution of filariasis.

The Fiji Islands

The Fiji Islands are located between 16 S to 19/20 S latitude, and 178 W to 177 E longitude (see figure 3.1). It comprises a total area of
17,970 square km, and a population of 715,375 (1986 Population Census). There are about 300 islands, 106 of which are known to be inhabited by humans. Some of the smaller islands, though uninhabited by humans, are used for gardening and/or raising animals. However, in recent years some of the small islands have been sold to outside investors. Among these are Cagalai island which is owned by the Methodist Church of Levuka, and Naitauba island which has recently been purchased by the Josia Diest Church.

The two largest islands, Viti Levu and Vanua Levu, have over 90% of the total population. The greatest concentration of the population is in the urban areas, followed by the coastal belt and river valleys. Population on the smaller islands vary from as little as 3 on Cagalai to over 10,000 on Kadavu. Several of the islands are inhabited by non-Fijians, such as Rotuma, Rabi island (inhabited by Banabans), and Kioa (inhabited almost entirely by Gilbertese who bought the island several decades ago). The Indian population is concentrated on the two larger islands, and on Taveuni, Levuka, and Koro.

Most of the islands are high and of volcanic origin but there are also numerous low-lying atolls. The volcanic islands are mountainous with fertile valleys which are either well cultivated or densely covered with tropical forests. While travel between some islands may be just a matter of minutes by a speedboat, most of the islands are separated by large bodies of water which can take several days to cross even by large boats. The two furthest points are, Rotuma which is 300 miles north of the main Fiji group and is actually closer to Wallis and Futuna, and
Ono-i-lau which is 300 miles south of Viti Levu and is much closer to Tonga than to the main island of Fiji.

The island situation, primarily because of its relative isolation, created a unique endemic pathological environment in precontact Fiji. Although endemic diseases such as filariasis persisted, the islanders had adopted methods of coping with these endemic pathogens, and life in the islands buffered them from exposure to new/introduced pathogens. Pathogenic agents, especially from the continental land masses, were unlikely to survive the open sea voyage into Fijian waters. Also, small isolated islands are incapable of sustaining continuous transmission of acute communicable diseases (Black 1975) since they do not leave enough "untouched" hosts to sustain their transmission. Unfortunately, there are many examples of such epidemics resulting from Fijian-European contact. The "domino" effect of widespread epidemics from introduced and reintroduced European diseases, lasted until the early 1900's. Whether the success of "new" diseases directly affected the increase or decrease in filariasis is unknown. But social and material changes resulting from culture contact led to an increase in the vector population and an increase in disease contact (migration in and out of infected areas), could very well have affected the distribution of filariasis. Whereas introduced changes and disease led to severe depopulation, economic growth and improved medical care over the next century led to significant increases in Fiji's population. Presently Indians outnumber Fijians; this may be due to the large numbers who

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11 The introduction of cholera in 1791 by the crewmen of the Matavy, is believed to have caused the first epidemic in Fiji.
migrated into Fiji, as well as contact resultant decline of the original Fijian population. Such dramatic changes in the population structure of Fiji from the 19th to the 20th century is seen in the census reports. Table 4.1 shows the census figures from 1881\(^{12}\) to 1986; and Table 4.2 shows the current population distribution in Fiji by ethnic origin:

Table 4.1

<table>
<thead>
<tr>
<th>Census Year</th>
<th>Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1881</td>
<td>127,486*</td>
</tr>
<tr>
<td>1891</td>
<td>121,180</td>
</tr>
<tr>
<td>1901</td>
<td>120,124</td>
</tr>
<tr>
<td>1911</td>
<td>139,541</td>
</tr>
<tr>
<td>1921</td>
<td>157,266</td>
</tr>
<tr>
<td>1936</td>
<td>198,379</td>
</tr>
<tr>
<td>1946</td>
<td>259,636</td>
</tr>
<tr>
<td>1956</td>
<td>345,737</td>
</tr>
<tr>
<td>1966</td>
<td>476,727</td>
</tr>
<tr>
<td>1976</td>
<td>588,068</td>
</tr>
<tr>
<td>1986</td>
<td>715,375</td>
</tr>
</tbody>
</table>

*This figure includes the first three groups of indentured laborers who were from the Solomons, New Ireland and the New Hebrides.

\(^{12}\) According to McArthur (1967), the first official census of the Fiji population was taken in 1881.
Table 4.2
**Estimated Population by ethnic origin**

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Population</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian</td>
<td>348,704</td>
<td>49%</td>
</tr>
<tr>
<td>Fijian</td>
<td>329,305</td>
<td>46%</td>
</tr>
<tr>
<td>Part-European</td>
<td>10,297</td>
<td>1.4%</td>
</tr>
<tr>
<td>Rotuman</td>
<td>8,652</td>
<td>1.2%</td>
</tr>
<tr>
<td>Other Pacific Islanders</td>
<td>8,627</td>
<td>1.2%</td>
</tr>
<tr>
<td>Chinese</td>
<td>4,784</td>
<td>0.6%</td>
</tr>
<tr>
<td>European</td>
<td>4,196</td>
<td>0.5%</td>
</tr>
<tr>
<td>All others</td>
<td>810</td>
<td>0.1%</td>
</tr>
<tr>
<td>Total</td>
<td>715,375</td>
<td>100%</td>
</tr>
</tbody>
</table>


Urban areas such as Suva, Nadi and Lautoka have experienced the largest population growth. The movement towards urbanization has been rapid and costly. Many villagers from the smaller islands, i.e. Rotuma, Kadavu, Lau, etc., are migrating to these urban centers in search of employment, education and a modern lifestyle. As urban migration increases, so does the number of squatter settlements on the outskirts of urban centers. The squatter population is estimated to be about 7,847, or 12% of the total population of Fiji (1976 Social Indicators). About half of the squatter households are Indian, nearly 38% are Fijian, and the remainder are other Pacific Islanders. Poor hygiene resulting from crowding and a lack of piped water is creating new health problems among squatter homes. Soil erosion is another common problem which makes it difficult to maintain kitchen gardens. These houses often are often fragile structures built from foraged materials, i.e. wood, corrugated iron, plastic, and thatching.
Urbanization and development are changing the social and biological health of Fiji's inhabitants. The diseases of development are increasing in urban areas, slowly replacing infectious and parasitic diseases. However, infectious, parasitic diseases persist in the poor, rural areas. The next section looks at the current health status of Fiji's population.

A Health Profile of the Islands

Like many of the developing Pacific islands, Fiji's health status reflects an increase in non-communicable diseases such as diseases of the heart and circulatory system, diabetes mellitus, and cancer (Health and Social Welfare Annual Report, 1984). Until the 1950's, infectious and parasitic diseases were still the major causes of death. Although these are still prevalent, they are now secondary to non-communicable degenerative diseases. Table 4.3 shows the leading causes of morbidity and mortality in Fiji, for the 1984 population:
Table 4.3

Leading causes of morbidity and mortality in Fiji

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Hospital care</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of the circulatory system</td>
<td>3,807</td>
<td>316</td>
</tr>
<tr>
<td>Neoplasm (cancer)</td>
<td>1,147</td>
<td>117</td>
</tr>
<tr>
<td>Infectious and parasitic diseases</td>
<td>3,562</td>
<td>88</td>
</tr>
<tr>
<td>Diseases of the respiratory system</td>
<td>5,113</td>
<td>79</td>
</tr>
<tr>
<td>Injury and poisoning</td>
<td>4,003</td>
<td>75*</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>2,795</td>
<td>62</td>
</tr>
<tr>
<td>Diseases of the genito-urinary system</td>
<td>3,346</td>
<td>49</td>
</tr>
<tr>
<td>Endocrine, nutritional and metabolic Diseases and Immunity Diseases</td>
<td>1,417</td>
<td>47</td>
</tr>
<tr>
<td>Complications of Pregnancy, Childbirth and the Peurperium</td>
<td>21,336</td>
<td>1</td>
</tr>
<tr>
<td>Symptoms, Signs and Ill-defined conditions</td>
<td>1,868</td>
<td>26</td>
</tr>
</tbody>
</table>

*Includes 12 deaths resulting from motor vehicle accidents.

An interesting point to note is that while respiratory diseases, especially pneumonia and asthma, remain the major cause of morbidity, mortality from heart diseases and cancer have risen significantly. Since 1981, cancer has become only second to heart disease as a major cause of death in Fiji. Of the 860 deaths recorded for 1984, cerebrovascular disease was the leading cause of death. Table 4.4 shows the specific causes of mortality for 1984:
Table 4.4

Specific causes of death

<table>
<thead>
<tr>
<th>Cause</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular disease</td>
<td>64</td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>60</td>
</tr>
<tr>
<td>Urinary tract disease</td>
<td>41</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>33</td>
</tr>
<tr>
<td>Suicide</td>
<td>32</td>
</tr>
<tr>
<td>Heart disease</td>
<td>17</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>11</td>
</tr>
<tr>
<td>Stomach cancer</td>
<td>10</td>
</tr>
</tbody>
</table>


Similar changes in the health status of Pacific peoples have been noted for the Maori (Armstrong 1987) and the Cook Islanders (Prior 1981). Taylor, Lewis and Levy's (1988) recent epidemiological survey shows that noncommunicable diseases are among the primary causes of morbidity and mortality throughout the Pacific. The increase in suicide among teens also needs to be noted as a factor relating to social and economic change in the Pacific. Although chronic diseases are becoming prevalent, isolated epidemics of dengue, dysentery, typhoid fever, chicken pox and measles still occur in Fiji. And infantile diarrhoea and influenza remain the primary causes of morbidity amongst children (HSW 1984). Medical intervention has been most successful with leprosy which has been significantly reduced (only 28 new cases of leprosy were reported in 1984).

13 A dramatic rise in suicide has been noted in Micronesia by Rubenstein (1985, 1987). In November 1985, three Indian boys committed suicide within 8 days of each other by drinking the pesticide paraquat.
Dietary change among Fijians, Indians and Rotumans contributes to the current morbidity patterns. A diet which once relied on high protein root crops, fresh fish and vegetables, is becoming more reliant on tinned, imported foodstuffs high in salt, sugar and fat (Thaman 1984). White rice has now become one of the main staples of Fiji replacing root crops such as dalo and yams, although cassava (manihot esculenta)\textsuperscript{14} is still used widely due to its adaptability to poor soils. Large amounts of bread and cabin crackers are also consumed (Deo and Schoeffel 1987). Dietary change is most evident in the towns, where non-communicable diseases such as diabetes, cancer and cardiovascular disease are on the rise.

A growing concern for health care practitioners is sexually transmitted diseases (STD's) which are increasing dramatically. Both gonorrhoea and syphilis have been increasing steadily since 1975. The following statement by the Ministry describes the implications of attempting to control STD's in a society undergoing social and urban change:

The social implications of being detected with sexually-transmitted diseases continued to make tracing of contacts extremely difficult. The diseases occurred most frequently among sexually active young adults between the ages of 15 and 35. The spread of the diseases are closely related to economic and cultural phenomena, such as declining and changing moral values, unemployment, alcohol consumption and promiscuity. It is imperative that control measures should aim at educating the young people to recognize the dangers of this scourge (p.43).

\textsuperscript{14} Manihot esculenta or cassava, is popular among both Fijians and Indians, and is a serious nutritional problem since this root crop has very low and poor quality protein.
only vector borne disease which has been consistently reported every year thereafter. In 1985, a small outbreak of dengue occurred in the Western part of Viti Levu, affecting about 20 people (Virus Laboratory Reports, 1985). Nine cases of malaria were reported to the Ministry of Health in 1986. All of these cases were believed to have been brought into Fiji from abroad, e.g. Solomons, New Guinea, with malaria. Blood specimens from Ross River fever and filariasis patients collected in 1983 are still being analyzed; both diseases are continuously monitored by the Virus Laboratory. As indicated previously, filarial prevalence is believed to have increased in Fiji. Although studies are far from complete, the recurrent pattern in Rotuma and Lau calls attention to the seriousness of filarial (re)infectivity (Mataika et al. 1985). (The second half of this chapter addresses the current prevalence of filariasis.)

The health picture of Fiji is changing to reflect urbanization and development, and efforts are underway to improve this picture. Primary health care and preventive measures are two of the most advocated and well delivered aspects of the current national health program in Fiji. But Fiji’s health care systems also include the cultural variety of traditional medicines.

Health Care Systems in Fiji

In keeping with its multicultural population, Fiji also has a pluralistic health care system. Western biomedical care exists side by side with traditional health care. In some instances there is a unique blend of both the modern and traditional, while at other times the two are in direct conflict. Perhaps the most outstanding feature of health
blend of both the modern and traditional, while at other times the two are in direct conflict. Perhaps the most outstanding feature of health care in Fiji today is the combination of the old with the new and the indigenous with the introduced.

Traditional health care systems

Traditional health care in Fiji is truly multiethnic. The indigenous cultures of the Fijians and Rotumans maintain varying degrees of their traditional systems; the Indians have transplanted the Auyurvedic medical system, along with the lesser used Unani medicine; the Chinese, although few in number, have also imported their cultural medicines; and the Europeans imported their traditional medicines which have become the backbone of modern Fijian health care or biomedicine. With the exception of major urban areas, i.e. Suva, Nadi, and Lautoka, traditional health care still thrives in all parts of Fiji\(^\text{15}\). This is not to say that urban areas are without traditional healers but rather that the popularity of traditional healers, the demand for their services, and the economic survival of their practice is largely dependent on the rural communities. The "urban curandero" (Press 1971), however, is becoming more noticeable in Fiji; traditional practitioners who have found a way to incorporate their practice into urban life, have physically relocated closer to their urban clientele. These practitioners use old remedies combined with new materia medica to

\(^{15}\) The practice of traditional medicine is somewhat restricted by law also. According to the Fiji Health Commission, fines up to $1,000 can be levied against persons accused of practicing some forms of traditional medicine.
appeal to their urban customers. The urban healer is one of several modifications to traditional health care in Fiji.

Gathering data on the use of traditional medicines was often in the context of studying one specific disease - filariasis; therefore, the data do not represent the full range of traditional medical practices in Fiji today. The ethnographic chapters (5, 6 and 7) offer detailed discussions of traditional Fijian, Rotuman and Indian medicine. Modern biomedical care, on the other hand, is nationalized and the full range of its applications are easily seen.

Modern Biomedical care

Biomedical care has been available in Fiji for over a century. Colonial War Memorial Hospital was built by the British soldiers in 1891 and has since, remained Fiji's largest hospital. The newest and most technologically advanced hospital, however, was built 5 years ago in Lautoka.

The islands in the Fiji group are divided into four Medical Divisions; each division oversees the delivery of biomedical care for their respective regions (see figure 3.1). These four divisions are further divided into subdivisions, medical areas and nursing stations. There are also smaller divisions at the local level of health care delivery which vary with population size and geographical distance. Figures 4.1, 4.2, and 4.3, show the administrative structure, population, and facilities in the four medical Divisions:
Administrative Structure of Fiji Medical Department

Medical Superintendent
(Colonial War Memorial, Lautoka and Labasa Hospitals)

Divisional Medical Officer

Sub-Divisional Medical Officer
(sub-divisional hospitals)

Area Medical Officer

Health Centers Subordinate Staff
Nursing Station
District Nurse
Village/Community

Figure 4.1

Population Distribution by Division

<table>
<thead>
<tr>
<th>Division</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>249,468</td>
</tr>
<tr>
<td>Western</td>
<td>278,051</td>
</tr>
<tr>
<td>Northern</td>
<td>127,850</td>
</tr>
<tr>
<td>Eastern</td>
<td>45,033</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>700,402</strong></td>
</tr>
</tbody>
</table>

Source: 1984 Nurses Census Count

Figure 4.2
There are three special disease hospitals in Fiji: St. Giles Hospital which provides psychiatric treatment; Twomey Hospital which provides leprosy treatment; and Tamavua Hospital which provides treatment for tuberculosis. Twomey is the first such hospital to be established in the South Pacific and has been in operation since 1941. In addition, Makogai island still serves as a medical facility for leprosy patients.

Virology, epidemiology and medical research on infectious and communicable diseases are the responsibility of the Wellcome Virus Laboratory, which is under the jurisdiction of Prevention Services. The Wellcome Virus Laboratory was established by the New Zealand Army in 1963 and is under the direction of Dr. Jonu Mataika, a Fijian virologist. Originally staffed by New Zealand medical staff, it is now entirely staffed by local medical staff. The Filariasis Laboratory is a
satellite station of the Wellcome Virus Laboratory and was opened in January of 1986\textsuperscript{16}, with funds from WHO. The lab is on the same grounds as the Vector Control Unit and the Chemical Control Unit (which are all under different Medical sections).

Being a group of some 300 islands, transportation between the islands is a critical issue where health care delivery is concerned. Smaller islands which have nursing stations (and often no roadways) rely on boat delivered biomedical services; all of these nursing stations are equipped with a motorized boat. Larger boats such as the one belonging to the Ministry of Health sleeps up to 17 people and is used for monthly and annual visits to the outer islands. Land vehicles are the main means of medical care delivery on islands such as Rotuma which have good roads and rougher seas on the periphery. The doctor at Rotuma Rural Hospital has been provided with a car and jeep, and the public health team has been provided with mopeds. But engine power is second to human power, "foot" travel by the nurses on outer islands is certainly one of the most efficient means of delivering health care to the community.

Biomedical services provided or funded by International groups are numerous in Fiji. The World Health Organization is perhaps the most active provider and is largely responsible for preventive research on parasitic and infectious diseases. Along with the antifilariasis campaign, medical services during outbreaks of Dengue and Ross River Fever are almost entirely funded by WHO. Other groups include the South

\textsuperscript{16} The newly created Filariasis Laboratory reflects both the urgency of the problem as well as the lack of local monies for funding such projects.
Pacific Commission, Helen Keller Foundation (which funds primary health care programs for trachoma), and agencies which are interested in cancer and diabetes control.

Along with localized treatment, localized training for medical staff is available at the Fiji School of Medicine; Fiji trains its own doctors, nurses, dentists, radiologists, and medical support staff. Even though overseas training is seen as being superior, an extra effort is made to provide quality training locally, to Fiji residents. And although the placement of medical personnel, especially nurses, is most likely to be based on their ethnic background, all medical students receive basic language training in Fijian and Hindi. For instance, there are 4 Rotuman and 3 Fijian nurses currently on the island of Rotuma; in the past, Indian nurses have also been assigned to Rotuma. The placement of doctors, however, is seldom determined by ethnicity; Rotuma has had Fijian, Indian and Rotuman doctors in the last decade. Overall, biomedical care in Fiji is fairly extensive. People rarely travel overseas (New Zealand or Australia) for advanced medical treatment since such facilities are becoming available in Fiji. Specialized training and specialized care locally, are improving. But there are some problems with the use and delivery of biomedical care. The shortcomings in the delivery and availability of biomedical care in Fiji are twofold: 1) there is some cultural resistance to adopting the western biomedical structure, and 2) biomedical care is not equally
distributed throughout the islands. The implications of these circumstances will be explored throughout later chapters, as the efforts to control filariasis serve as an example of where biomedicine and island culture do not blend. First, the distribution pattern of filariasis which is established by biomedicine, needs to be addressed.

Filaria in Fiji: Age, Sex, Ethnic and Geographical Distribution

Although filariasis appears to have a fairly predictable distribution in terms of which age groups are most affected, the slow development of the disease raises the question of whether or not the age at which the disease manifests is the actual age of infection or onset. Symes (1956) found microfilaria in children during his 1954-55 survey and concluded that infectivity varied not so much with age but with the level of risk in a given community. Mataika et al. (1969) came to similar conclusions based on their survey of Vanua Levu and the surrounding islands of Taveuni and Qamea. The 1983 survey from Rotuma also reveals that children are microfilariae carriers but may have some natural immunity to the infection during early childhood. In general, however, the incidence (infection) of filariasis increases with age; infection increases dramatically from the age of 20 upwards, peaking at about age 55. Table 4.5 shows the average age and ethnic distribution of filariasis and elephantiasis based on samples from the earliest to the

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17 The 1984 HSW Report indicates that nearly 33% of the population lives in villages and rural areas where transportation difficulties hamper the delivery of medical care. Also the costs of biomedical care (transportation to, absence from work, money, etc.) keeps people from seeking it.
last microfilarial records of the antifilariasis campaign (such data has not been recorded for hydrocele):

Table 4.5

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Filariasis</th>
<th>Elephantiasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fijian</td>
<td>35-50</td>
<td>50-59</td>
</tr>
<tr>
<td>Rotuman</td>
<td>35-55</td>
<td>55+</td>
</tr>
<tr>
<td>Indian</td>
<td>40-50</td>
<td>50-59</td>
</tr>
</tbody>
</table>

Note: ages 0-4, in all ethnic groups, rarely show filarial infections.

Although elephantiasis is more common after the age of 45, the youngest elephantiasis patient known in Fiji (by medical staff) was a 14 year old Indian boy from Taveuni island. It is generally believed that basic filarial symptoms, i.e. fever, swelling of lymph nodes, etc., can develop after a single contact with a mosquito vector; however elephantiasis develops after repeated attacks from vector mosquitoes (Wilcocks and Manson-Bahr 1978). Other factors which affect estimating age onset are, lack of proper diagnosis and lack of reporting. There is also some indication that genetic resistance keeps one from developing the advanced stages of hydrocele and elephantiasis (Desowitz and Una 1976).

Vector contact is the single most important factor in determining the distribution of filariasis amongst males and females. Males, overall, have higher rates because of greater exposure to and contact with vector mosquitoes. However, in areas such as Taveuni and Savusavu where both men and women are known to work on copra estates, females
have been diagnosed with equally high rates because in these areas, females encounter vectors as much as their male counterparts.

The 1983 survey shows that Rotumans have the highest rates of filariasis in the islands. The same survey shows slightly lower rates for Fijian males in the Lau islands. Whereas filariasis rates among Rotuman females are nearly equal to Rotuman males, Fijian females in the Lau group showed significantly lower rates than their male counterparts. Although Indians were not included in the 1983 survey, they have shown lower rates than both Fijians and Rotumans in previous surveys. Indian females show the overall lowest rates. Table 4.6 shows the approximate ethnic distribution of filariasis based on an average of survey data collected between 1971 and 1983:

Table 4.6
The Ethnic distribution of filariasis

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fijians</td>
<td>25% (1983)</td>
<td>11.6% (1983)</td>
</tr>
<tr>
<td>Rotumans</td>
<td>29.5% (1983)</td>
<td>23% (1983)</td>
</tr>
<tr>
<td>Indians</td>
<td>9.3% (1971)</td>
<td>7.3% (1971)</td>
</tr>
</tbody>
</table>

*The year denotes the last study done on that particular group.

These rates are based on surveys done on small segments of the population and therefore are but samples of any given ethnic group; they do not represent the population as a whole. Also the last study to include Indians was done by Maguire, et. al. in 1971; more recent surveys have not included Indians. Indians have not always showed lower rates than their Fijian counterparts. For instance, Symes' 1954-56 survey revealed that 28% of Indians tested were microfilariae carriers, whereas 22% of the Fijians sampled tested positive. The most
significant find in Symes' study was the high rate of microfilariae among Part-Europeans, who showed rates as high as 55%.

The disease stages and the accompanying symptoms differ according to the body area affected, individual's state of health, age, etc. But the one stage and symptom most difficult to diagnose as well as treat, is hydrocele. Hydrocele is the swelling of the groin area and primarily affects men. Wilcocks and Manson-Bahr (1978) note that hydrocele and elephantiasis are the most common infections of *Wuchereria bancrofti*. Diagnosis is difficult for the simple reason that hydrocele is rarely reported. With the exception of hydrocele swelling in need of surgery (to drain the fluid sac), cases are rarely reported to medical staff. Dr. K. Gilchrist, who operated on many hydrocele patients from 1940 until his retirement in 1978, estimates the number of hydrocele cases amounts to three times those that are actually reported (personal communication). As witnessed in recent surveys, villagers would not reveal hydrocele infections even if they were directly being questioned about it. Not only is embarrassment a factor (especially when a female conducted the interview) but the clothing that islanders wear (sulu wraps) also it difficult to detect hydrocele. Thus, the lack of accurate figures on the actual number of hydrocele cases also questions the true prevalence of filariasis.

The geographical distribution of filariasis, based on current records, shows that the Eastern Medical Division is most affected. This Division consists of the smaller outlying islands of Rotuma, the Lau group, the Lomaiviti group, Ono-i-lau and Kadavu. Most of these islands are at the greatest distance from the main island of Viti Levu; some are
also the least developed and have the least amount of contact with the larger islands. Access and availability of biomedical care may differ significantly; in general, fewer supplies, equipment, and medical staff are available on the smaller islands. These smaller islands are also where filariasis vectors and human activity patterns are most likely to maintain the disease cycle. A general observation is that the more isolated the island, the higher the rate of filariasis. There are a few exceptions of smaller islands such as Kabara, Mago and the Mamanuca group, from where filariasis has not been reported. Geographical distribution, however, does not vary according to inland and coastal habitation. This was demonstrated by Lynch's (1905) comparative study of bush mosquitos from inland and coastal areas. Based on his findings, the distribution of filariasis appeared to have been equally prevalent inland as well as in provinces bordering the coast.

The distribution of filariasis is also affected by the periodic appearance of the microfilariae in human blood. Distribution may be under or over estimated depending on the time of blood collection. This periodicity factor was demonstrated by Lynch. Lynch and his associates (1905) illustrated the periodicity of microfilariae in hospital patients by taking both day and night blood collections, and as a result, were able to show that there were different distributions according to "time". His results are briefly summarized below in table 4.7:
Table 4.7

Microfilariae rates by periodicity

<table>
<thead>
<tr>
<th>Microfilariae present</th>
<th>day blood</th>
<th>night blood</th>
<th>both</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>present</td>
<td>20 (3%)</td>
<td>31 (5%)</td>
<td>105 (18%)</td>
<td>156(26%)</td>
</tr>
<tr>
<td>None present</td>
<td></td>
<td></td>
<td>452(74%)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>608</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These results indicate that there were more cases of microfilariae in night blood than in day blood. (Lynch does not indicate the exact night hours in which he took blood smears, however it can be assumed that these were evening hours before the patient fell asleep, a time which the subperiodic *W. bancrofti* would appear in heavy concentrations.) Although the blood samples were taken from hospital patients, the results of this turn of the century survey have significant implications for blood samples collected by more recent surveys; they clearly point out that day blood samples may be of little use when the pathogen's greatest concentration is in night (evening) blood. Shortly after Lynch, Manson-Bahr (1912a) also found higher counts of microfilariae in night blood samples of volunteers (not hospital patients). The surveys of the 60's and 70's, although using more random samples, have not collected evening blood; these surveys
involve the collection of day blood only\textsuperscript{18}. This brings into question the accuracy of current prevalence estimates.

Although recent filariasis surveys are conducted much more systematically and with greater cooperation from the community, the problem of not being able to collect evening blood remains a major challenge for health administrators. Inaccessibility due to distance in between islands, lack of finances, ineffective treatment methods, and proper education and training of both medical staff and recipients, constrain the efforts of the survey teams. These issues, which directly influence the prevention and control of filariasis, are discussed throughout subsequent chapters.

Of the five study areas - Rotuma, Beqa, Vunibau, Waidova and Wainibokasi, updated (1983) filarial prevalence rates were available only for Rotuma island. Filarial prevalence for Beqa is available from survey data of 1963. However, current medical records indicate that up to 171 people on Beqa are microfilaria carriers (Navua Medical Hospital Registry, 1985); this is nearly 10\% of the total population of Beqa. Wainibokasi is also known to be a high prevalence area but the last study which included Indians from Wainibokasi was done by Kessel et. al. in 1957. To my knowledge, Vunibau and Waidova have never been included in the filariasis surveys, but both are and have been known to have

\textsuperscript{18} The time of blood collection is very important in determining accurate filarial prevalence, and would also indicate the concentration of microfilariae (high or low). It is known that subperiodic \textit{W. bancrofti} appears during early morning and evening hours, therefore blood samples from these time periods would be the most accurate means of establishing accurate rates. However, due to manpower, time, and accommodations, the laboratory staff collect blood smears during their daytime visits to the villages.

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filariasis cases (Dr. Solano, SDMO Navua Medical Division, personal communication).

The current antifilariasis project (began in 1985), which is designed for the islands in the Eastern Medical Division, may include Rotuma, but not any of the other study areas. This project includes testing and treatment of what are believed to be the most infected areas in the Eastern Medical Division; it also includes monitoring areas which are believed to be in the high risk category. Because the project covers only one sector of the Fiji group, other potentially "risk" areas which have either never been adequately monitored or are inaccessible (distance, time, etc.) will be excluded from this 5-year survey.

Summary

The cession of Fiji by Britain brought about significant changes. The health of the islanders went through a radical transformation, from severe depopulation as a result of introduced diseases, to a fairly healthy comeback by the Fijian population. The introduction and establishment of biomedical care was among the most innovative of colonial actions; on the one hand modern medical care was needed for the problems that the Europeans themselves created, and on the other hand, the colonial medical system became a major source of health care delivery in the islands.

What we see today is a movement away from the endemic diseases such as yaws, tuberculosis, and leprosy, which plagued the pre-contact Fijian population. There is also a movement towards the ill effects of modernization. The deleterious effects of modern innovations are becoming evident in increasing morbidity and mortality from chronic
degenerative diseases, harmful dietary changes, substance abuse, and other factors which affect the overall well-being of the Fiji population. However, according to recent surveys, filarial disease still remains a major source of morbidity. The reasons for this morbidity pattern were discussed in terms of the age, sex, ethnic and geographical distribution of filariasis.
SECTION TWO
INTRODUCTION TO THE ETHNOGRAPHIES

The following chapters, V, VI, and VII serve as ethnographic sketches of the Fijian, Rotuman and Indian cultures. Each chapter is divided into four parts: 1) an historical introduction with particular emphasis on introduced (as a result of European contact) and endemic diseases; 2) a social and economic description of each culture area; 3) the health care system which defines filariasis, including traditional health care practices and disease theories; and 4) the quantitative data which were gathered by monitoring human activity patterns in the vector zones of each study area. The actual analysis of these data will be covered in the following section (chapter VIII), which addresses vector-host contact.
CHAPTER V
FIJIAN ISLANDERS

Historical Development

The debate on whether Fijians are to be classified as Melanesians or Polynesians is an historical one. As Frost (1979) has stated, Fiji stands alone as an apparently unclassifiable product of many influences. However, as time goes by and new discoveries answer old questions, the debate slowly fades. Today there is greater consensus among archaeologists, linguists and physical anthropologists about Fiji being one of the Pacific islands where the "twain did meet". According to Howells (1973), a physical anthropologist, Fijians are Melanesianized Polynesians. The appearance, behavior and language of present day Fijians shows that they are indeed a combination of Polynesian and Melanesian, and in some areas more or less so of either. As Nayacakalou (1978) notes, Fijians are a rare breed of people with Melanesian characteristics, and a culture resembling the Polynesians but with their own distinctiveness and traditions. In some areas such as the Lau Islands, the physical and social characteristics of the islanders are markedly Polynesian, whereas the characteristics of Fijians from the Yasawas are markedly Melanesian. In Moala (one of the Lau islands), Sahlins (1962) describes in detail the social workings of Polynesian society.

Fiji is believed to have been originally settled in 16th century B.C.; Lapita dates yield sites as early as 1000 B.C. (Green 1981). Lapita sites such as those in Sigatoka, indicate that the early Lapita culture was proto-Polynesian. Later Fijian ceramic traditions have no
Polynesian ties, but are similar to those of the remainder of Melanesia (Frost 1979). Subsistence activities also developed between the period 100 B.C. and A.D. 1600. Activities such as line fishing, pig hunting and horticulture (root crops) are all seen in the archaeological record. Taro is one of the oldest cultivated plants which was carried in from Southeast Asia (Barrau 1963). There are also remains of dog and chicken bones, indicating that domestication may have been an early possibility (Frost 1979). Later developments include fortification (implicating warfare), and naga or ceremonial sites. These naga sites are believed to be the equivalent of the Polynesian marae (Frost 1979).

Historical contact, on the other hand, leaves little question as to the cultures and peoples involved. The missionaries have had a profound influence in Fiji, as have the British, and other migrants such as the Indians. The consequences of contact has had significant implications for the health and well-being of the Fijians.

Depopulation as a result of early contact with Europeans

Fiji was first discovered by Europeans (Tasman) in 1643 (Derrick 1950). However Tasman narrowly escaped shipwreck off the coast of Vanua Levu, and as a result other mariners stayed away from the "treacherous reefs" of Fiji for over a hundred years (McArthur 1967). The next official visit was by Captain Bligh of the Bounty in 1789 (ibid). After these early explorer's made record of Fiji and its location, the next group of Europeans to visit were the sandalwood and beche-de-mer traders. It was not until 1835 that the first European Christian Mission arrived in Fiji.
In 1874, King Cakobau made his second and successful request to Queen Victoria, and Fiji became part of the British Empire. The population of Fiji at the time of cession was believed to be about 200,000. By the first official census (in 1881) the Fijian population numbered just 115,635 (McArthur 1967). As Lambert (1942) notes, in the 35 year period between 1870 and 1905, the population had been reduced to 87,000, or less than half.

Introduced diseases were undoubtedly the fundamental factor in depopulation. Early contact had disastrous results for the native Fijian population as introduced diseases ran amok in virgin territory. In their spatial reconstruction of the spread of measles in Fiji, Cliff and Haggett (1985) discuss how the control of new diseases was exacerbated by the traditional practices of the Fijians as well as the naivete of the colonial administrators. They trace the first measles epidemic (1875) to the return of King Cakobau and his sons from Australia, and note that, "the status of the passengers, political sensitivity over cession, the lack of formal quarantine arrangements in Fiji, and a complete underestimate of the likely impact of measles in a virgin community all played some part in this oversight" (p.31). Tippett (1974) notes that lila balavu (wasting sickness), or cholera, is

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McArthur (1967) discusses the discrepancies of population estimates in the early records. For instance, based on inland vs. coastal habitation patterns, J. Wilkes, commander of the U.S. Exploring Expedition, estimated that the Fijian population in 1840 was about 130,000. While J. Hunt, a missionary, did a more systematic study in 1844, which showed the population to be no less than 200,000 and as much as 300,000. Judging by Wilkes' followers and their methods, the latter estimates are probably more reliable.
associated with the arrival of the first European ship (1791) and the comet with three tails. He also notes that cokadra, or dysentery epidemic, was believed to have been brought ashore by one of the European sailors.

Many of the early Europeans noted how island diseases differed from those in their own homelands.

...in Fiji, as far as experience has yet gone, there exists a most extraordinary freedom from not only tropical diseases, but also from most of those diseases which, in England and other countries, yearly cause a large amount of sickness and death (a report by Dr. Messer, staff-surgeon on H.M.S. Pearl, in Cheeson, 1875).

The Europeans were not the only source of new diseases, the first boat load of Indian laborers brought small-pox into Fiji. The Indians also introduced the parasitic hookworm, anclystoma duodenale, and the intestinal roundworm, ascaris lumbricoides. Table 5.1 shows the diseases introduced into Fiji since the time of contact:

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### Table 5.1

#### Post Contact Diseases

<table>
<thead>
<tr>
<th>Date of Introduction</th>
<th>Disease</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1791</td>
<td>Cholera or Dysentery</td>
<td>Spencer 1966</td>
</tr>
<tr>
<td>1802</td>
<td>Dysentery</td>
<td>Commission (1896)</td>
</tr>
<tr>
<td>1820s</td>
<td>Vudi ccorp</td>
<td>(ibid)</td>
</tr>
<tr>
<td>1839</td>
<td>Influenza</td>
<td>Lyth (1846)</td>
</tr>
<tr>
<td>1840s</td>
<td>Gonorrhea</td>
<td>Wilkes (1845)</td>
</tr>
<tr>
<td>1864</td>
<td>Tokelau ringworm</td>
<td>Commission (1896)</td>
</tr>
<tr>
<td>1874</td>
<td>Whooping cough and Measles</td>
<td>(ibid)</td>
</tr>
<tr>
<td>1885</td>
<td>Dengue and Meningitis</td>
<td>Commission (1896)</td>
</tr>
<tr>
<td>1880s</td>
<td>Hookworm (A. duodenale)</td>
<td>Lambert (1928)</td>
</tr>
<tr>
<td>1870 to 1970</td>
<td>Typhoid</td>
<td>Hermant et. al. (1929)</td>
</tr>
<tr>
<td></td>
<td>Syphilis</td>
<td>McKinley (1935)</td>
</tr>
<tr>
<td></td>
<td>Diptheria</td>
<td>(ibid)</td>
</tr>
<tr>
<td></td>
<td>Rubella</td>
<td>(ibid)</td>
</tr>
<tr>
<td></td>
<td>Encephalitis</td>
<td>(ibid)</td>
</tr>
<tr>
<td></td>
<td>Rheumatic fever</td>
<td>(ibid)</td>
</tr>
<tr>
<td></td>
<td>Smallpox</td>
<td>Spencer (1966)</td>
</tr>
<tr>
<td></td>
<td>Chickenpox</td>
<td>(ibid)</td>
</tr>
<tr>
<td>1979</td>
<td>Ross River Fever</td>
<td>Mataika (1981)</td>
</tr>
</tbody>
</table>


Along with introduced diseases, missionary goals also added to the problems of the indigenous islanders. Rev. Durrad (1922) points out that among the new European measures which led to depopulation were: 1) the introduction of diseases; 2) introduction of alien customs (European style of dress); 3) prohibition of heathen customs (warfare); and 4) recruiting natives for plantation labor or blackbirding. Durrad goes on to make recommendations to the government as well as to other missionaries, to moderate changes and even help restore some native practices such as the wearing of lavalavas.
Stress from contact and disruption of native custom also added to the decaying health of the Fijians. Rivers (1922) points out that the primary evil as a result of contact was the islanders loss of interest in life. Cliento (1928) and Roberts (1969) also lay blame on psychological despair as a major cause of mortality among the Fijians. The "psychological" impact of such early disasters, I believe, are still seen today in the peoples response to health programs, such as the antifilariasis campaign. This issue becomes more evident in further discussions of islander attitude and response to filariasis.

While European intentions were to preserve native peoples, their initial methods because of ignorance and lack of foresight, often had the opposite effect. As social and cultural change led to psychological despair, introduced diseases, being more severe than endemic diseases, added to the declining health of the Fijians. As efforts continue to intervene and reduce the prevalence of endemic infectious diseases, a new group of chronic degenerative diseases are developing in Fiji.

Non-introduced diseases

The preceding section, while focusing on the effects of introduced diseases, has also pointed out the desire to preserve the Fijian's well-being. Along with carelessness, there was genuine concern to improve the health of the islanders. The agents of change were now faced with the dual problem of remedying old diseases while controlling the spread of newly introduced ones.

Fijians suffered from a series of epidemics lasting from the time of contact until 1921, when the last influenza epidemic struck (McArthur 1967). But Fijians were also confronting diseases which were already
prevalent amongst their people. Leprosy, dengue, tuberculosis and filariasis were endemic to Fiji prior to European contact. The first documented case of leprosy treatment was given by Lyth at a Methodist Mission in 1837 (Austin 1936). Soon afterwards, a leprosy colony was established on Makogai island; along with Fiji, this colony served the islands of New Zealand, Samoa, Tonga, the Cooks, and the Gilbert and Ellice islands (Legislative Council Paper 25, 1948). Tuberculosis facilities were set up at Tamavua hospital in Suva. Although hospital facilities have since expanded and provide out-patient services throughout the islands, tuberculosis is still prevalent in Fiji.

Control against dengue has proven especially difficult. Dengue has a variety of strains or "types", and with the introduction of each new type, the disease reaches epidemic proportions. Previous exposure and immunity to one type does not protect from exposure to the new strains. To date, four types of dengue, including haemorrhagic fever, have been introduced into Fiji (usually carried in by airline passengers). The dengue epidemic of 1983, which was the first exposure to haemorrhagic fever, resulted in 21 deaths (Mataika, personal communication). The variable nature of the virus is further complicated by the variety of mosquito vectors, many of which also serve as filarial vectors in Fiji. In general, control and prevention of vector-borne, especially mosquito transmitted infectious diseases including filariasis, have proven to be a relentless battle.

The early Europeans made numerous observations of filarial infections, especially elephantiasis, throughout Fiji. And there were an equal number of hypotheses as to the cause of this disease. In
regards to elephantiasis, Seemann (1862a), made the following observation:

The disease, however, is generally speaking, very local, and seems to be particularly prevalent in low, damp valleys...no one knowing the cause of the disease, there are of many hypotheses respecting it. Every white man has his own, and one pretty generally diffused is, that it is brought on by drinking cocoa-nut milk (1862a:21-22).

Perhaps because of the obvious (visible) disfigurement, elephantoid swellings and hydrocele were cited more often than filarial fever. Bahr (1912a), came to the conclusion that the scrotal form of elephantiasis (hydrocele) must have been a cause of infecundity. For Buxton (1928), however, fecundity was not of question since he found scrotal elephantiasis only in men beyond the age of reproduction.

Observations were often followed by medical treatment. Quinine was widely used for filarial fever and in surgical treatments for hydrocele and elephantiasis. As with dengue, environmental clean-up schemes and general sanitation measures were enforced to help control the mosquito vectors of filariasis. Mosquito contact was of great concern, not just for filariasis and dengue, but also for fear of malarial outbreaks.

Health education about the pathogenic environment, and prevention and control techniques, were also early methods. Hocart (1929), notes that Lau islanders knew that filarial swellings would eventually lead to elephantiasis and that this knowledge was probably due to European education. The first national microfilariae testing began in 1944; blood samples were collected from all of the 14 provinces. Of the
47,716 blood specimens collected between 1944 and 1948, 17.2% of the villagers were microfilariae carriers (Legislative Council Paper 25, 1948). Provinces such as Namosi showed rates as high as 33%, while other such as Ba, showed rates as low as 3.7%.

Other colonial health measures included: dental care; dietary and nutrition programmes; general hygiene and sanitation measures which regulated sewage, garbage disposal, and filtration of water; and quarantine measures along the ports of entry, e.g. seaports and airports. Maternal and child health care programmes were also initiated. Colonial War Memorial hospital remained the major health care facility for the Colony, however smaller rural hospitals and dispensaries were set up throughout the islands.

Even though biomedical care is nationalized, healing practices as well as other aspects of Fijian life, i.e. the social, political, and economic structure, still show remnants of traditional Fijian values. Traditional Fijian medicine also plays an important role in beliefs and behavior regarding filariasis.

Traditional Fijian medicine

Traditional Fijian medicine today exists primarily in the form of herbal remedies. Disease appears to be dealt with where it first occurs, in the home. Each household maintains some basic knowledge about home remedies. Thus the "popular sector" (Kleinman 1980), in the form of herbal-home remedies, still thrives in Fiji. Specialists are often consulted after home remedies prove ineffective or when supernatural causes call for expert-outside intervention.
Services provided by the Dauvagunu, the traditional healer, were once in great demand but today his practice is restricted more to rural-outer island communities. The declining popularity of the dauvagunu has largely resulted from missionary and colonial medical intervention. The dauvagunu was a healer of the traditional Fijian socio-religious system. His disease model was not only displaced by Christianity but he also had to compete with other medical specialists, such as Native Medical Practitioners (NMP) who were posted to rural-outer island areas.

Herbalists, some of whom have had training as dauvagunus, are still popular. A total of 32 herbalists were interviewed; the youngest was 22 years old, and the oldest was 75. Some of the younger individuals were apprentices. Recently, there has been great interest in the medicinal value of Fijian herbal remedies. Collections and studies by Siwatibau (1977), Waqanovonono (1980), and Weiner (c.1979), have shown the breadth of medicinal plant use by Fijians. The Institute of Natural Resources at the University of the South Pacific now has a full time botanist, who maintains the collection of medicinal plants.

In addition to herbal remedies, massage is a common healing technique. Almost any body pain, including those from flus and fevers,

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20 According to Spencer (1941), the dauvagunu along with his herbal skills, is also a spiritualist, sorcerer, and magician. In a sense his prominence and practice could be equated to a traditional Fijian doctor. The variety of the dauvagunu’s skills may no longer be in demand, but he is still known for his herbal skills.

21 The pharmaceutical value of native plants is slowly being realized by the scientific community. The first national conference on "The Uses of Native Medicinal Plants" was held in Suva in February 1986. This conference was attended by physicians, pharmacists and others who used and/or wanted to learn about the medicinal value of Fijian plants.
is believed to be relieved (at least temporarily) by massaging. Most Fijians have some interest in this remedy; children and young adults are often encouraged by parents to use massage. Fortune telling and various forms of what would be considered white magic, are also known of and/or occasionally discussed. Accusations of sorcery and witchcraft are perhaps not as uncommon as they are secretive. The identities of accused parties, including healers, are rarely revealed. While I was on Beqa, two separate accusations were made against healers practicing witchcraft. A warning was given in both cases to beware of such individuals and to keep away from their homes, for fear that I may fall victim to their spells. Therefore my encounters with traditional Fijian practitioners was often limited to those whose identity and practices were common knowledge throughout the village and those who treated filarial diseases.

Coping with Disease: Filariasis in the Fijian community

Filariasis appears to be prevalent in many Fijian communities, particularly in communities which are socially and geographically isolated from the main islands, and where vector prevalence is high, e.g. Beqa and Koro. But there are problems with identifying filariasis as one disease. This is not a reflection so much of the lack of proper diagnosis as it is of the variation in symptoms and disease stages. The fever which accompanies filariasis may appear to be due to a common cold or perhaps even mistaken for dengue. The short duration of the illness episode adds to the problem of differential diagnosis.

The Fijian term for filariasis is wagaga, which means fever with swelling. Wagaga is a common disease, however because diagnosis may
differ the disease can be labeled differently by different people. Disease labeling varies with the particular symptoms, i.e. swelling, the site of infection, as well as with diagnosticians. Treatment procedures (types of herbs, massage, etc.), on the other hand, are fairly routine regardless of how the infection is labeled.

Disease theories in Fijian society

Filariasis can fall into any of three distinct categories of disease theories: 1) the traditional disease categories which lay blame on spirits and bodily dysfunctions; 2) the scientific vector-host theory; and 3) exposure to specific environmental conditions. Explanations vary and can be influenced by a host of factors such as who actually has the disease, why their response is being solicited, who wants to know, etc.

The first category of disease theories was classified by Spencer (1941) as: 1) illnesses which are attributed to the spirits, "mate vaka vanua"; and 2) illnesses which are related to bodily dysfunctions, "mate vaka yago". "Mate vaka vanua" includes all diseases caused accidentally or purposefully by a person(s) or spirits with intent to harm. The symptoms vary from mild fevers to severe headaches, to complete incapacitation. The traditional healer is the only person who can properly diagnose and treat diseases caused by the spirits.

Diseases classified as, "mate vaka yago", includes those which effect the skin, bones, joints and muscles; all of which are somatic in nature (Siwatibau 1977). This group of illnesses is usually treated with herbal remedies, and this can be done in the home or by consulting an herbalist. "Mate vaka yago" are far less serious than illnesses
which are caused by the spirits, therefore, diagnosis and treatment of these are fairly routine procedures.

Filariasis or wagaga falls into the category of diseases caused by the "mate vaka vanua", or "mate ni vanua" which is the equivalent and more common term in Vunibau and Beqa. The causes of wagaga are generally social in nature, and the "mate ni vanua" have a variety of ways in which they can inflict their intended victim. The spirits may enter the body through food, water, yaqona, spells and spiritual possessions. Even the mosquito may be regarded as an agent merely delivering for the spirits.

The second category of disease theories relates wagaga to the scientific explanation, or vector-host transmission. However, such examples are not always reliable especially if they are solicited by medical personnel. Quite often someone who gives the scientific explanation will do so immediately after listening to a lecture on filariasis, after DEC treatment, and especially if they feel that the scientific response is the one expected of them. With the absence of such influence, people will resort to their "original" disease theories. This tendency to revert back to traditional explanations indicates that filariasis education is not always successful in the Fijian communities.

Another factor which questions the reliability of scientific explanations given by villagers is the lack of "actual" understanding about the transmission cycle. For instance even when a mosquito vector was implicated, there was little or no knowledge about the filarial parasite. The absence of such knowledge gives further grounds for
rejecting the scientific theory, which in turn detracts from effective treatment programs.

The third category, which is based on the response of people who have had filarial disease, attributes wagaga to exposure to cold air and cold water. There may indeed be a biological basis for this explanation, since exposure to cold is known to exacerbate the flulike feeling which accompanies all stages of the disease. Also people afflicted with elephantiasis show increased swelling after prolonged exposure to cold water, i.e. wading in streams, night showers, etc.

Disease theories for wagaga differ from those given for elephantiasis and hydrocele. Elephantiasis or tauna, is rarely associated with wagaga. The causes of tauna are always attributed to the spirits, and the cause, like the infection, is more severe. Tauna afflicts people who often are repeat offenders of serious wrongdoing, and/or are the victims of spells cast upon them by the nitu, or ancestral spirits. The causes of tauna are not to be mistaken with the causes of wagaga, since the former is generally irreversible, and the latter is only a temporary stage.

Disease theories explaining hydrocele differ from the explanations given for elephantiasis in one important manner. Hydrocele, because it affects the genital area, is believed to be caused by breaking sexual taboos. Adultery is most often cited as the reason why men develop scrotal swelling. Women are also accused of adultery, but are more likely to be blamed for breaking taboos relating to menstruation.

The degree to which these theories are used for diagnosing disease varies with: 1) the actual circumstances surrounding onset of the
illness episode, i.e. when and where did it happen; 2) individual and/or group experience with previous episodes; and 3) the opinion of the healer or person sought for consultation. Most diseases are easily identified and easily categorized, but changes brought on by biomedical care have altered some traditional explanations.

Health Seeking Behavior

Disease theories determine the choice of health care. Since the disease theories for filariasis are based in the traditional ideology, so is the choice of healing methods. Health seeking behavior of Fijians show the persistence of cultural traditions in spite of changing values. The traditional healer is still an important part of rural Fijian society, partly because he represents the traditions of the culture and partly because of his versatility and adaptability to the changing ways.

In order to find out just how often the services of a traditional healer were sought, village members, especially filarial patients, were asked who they chose and why they made that choice. Of the 83 people who acknowledged having had filariasis at one time or another, 49 sought the advice of a traditional healer first before turning to alternative methods. Table 5.2 shows the health seeking behavior of these 83 individuals by location, and Table 5.3 shows the reasons why a traditional healer was preferred over other methods:
Table 5.2

Health Seeking Behavior showing "Hierarchy of Resort"

<table>
<thead>
<tr>
<th>Filariasis cases</th>
<th>Traditional Healer</th>
<th>Medical Practitioner</th>
<th>Home remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beqa</td>
<td>12</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Taveuni</td>
<td>12</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Kadavu</td>
<td>11</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Savusavu</td>
<td>8</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Vunibau</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>49</td>
<td>15</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 5.3

Why Traditional Healers are Preferred

<table>
<thead>
<tr>
<th>Reasons</th>
<th>How often</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waqaqa is caused by &quot;mate vaka vanua&quot;</td>
<td>16</td>
</tr>
<tr>
<td>Upon the advice of others</td>
<td>11</td>
</tr>
<tr>
<td>Availability</td>
<td>8</td>
</tr>
<tr>
<td>Treatment is more effective/reliable</td>
<td>8</td>
</tr>
<tr>
<td>Treatment is easier/less costly</td>
<td>4</td>
</tr>
<tr>
<td>Do not have trust in biomedical staff</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>49</td>
</tr>
</tbody>
</table>

As table 5.2 shows, traditional healers are chosen more often than medical practitioners. And table 5.3 shows that shared beliefs/disease theory is the primary reason why traditional healers and traditional methods are preferred over medical practitioners. Based on the questions regarding choice, it would seem that "cultural familiarity" largely determines who is entrusted with providing health care. The confidence in traditional healers is undeniable. In contrast, there is less confidence in medical practitioners and in modern methods. Where treatment for filariasis is concerned, the negative (side) effects of DEC and the behavioral changes which are prescribed along with it
have discouraged villagers from the use of biomedical services. This increases their distrust of the biomedical system in general, and in medical practitioners particularly.

Of the 15 individuals consulting the medical practitioner first, 13 had previously been treated with DEC. Their treatment had little or no side effects, hence their experience with the medical practitioner was generally positive. Some of these patients received home treatment (DEC was delivered by the public health nurse), while others had to travel to the health center for their treatment.

As mentioned earlier, access to health care does influence health seeking behavior. All of the villages in Beqa had at least one, if not more, traditional healer, and two healers were known to practice in Vunibau. But preference may not always be for the local village healer, particularly when specialists are needed. Therefore, healers from other villages are often called upon. Specialized services can be as important as access in the decision making process. However, there is one clear distinction between traditional healers and medical practitioners - the healer often resides in the village (or nearby) and, therefore, is available at all hours, while a visit to the medical practitioner involves travelling to either a nursing station, clinic or hospital. The exception is when routine visits are made to the villages by public health teams. This usually occurs once or twice a year.

Rural or relative geographical isolation also has a significant impact on health seeking behavior. Beqa and Taveuni are somewhat isolated from mainstream urban Fijian society. Both have traditional healers throughout but access to biomedical care is limited to the
central town. Traditional healing practices are also common in rural Viti Levu. In a recent study done in Ba and Nadroga provinces (both of which are in northwestern Viti Levu and are known for their traditional culture), Waqanovonovo (1980) identified two groups of healers: 1) the yalewa vuku, or traditional midwives and birth attendants; and 2) the dauvagunu, who are the traditional herbalists in this community. Yalewa (Fijian word for woman) vukus are the female healers, whereas the dauvagunus are all male.

Age is yet another factor which can influence health seeking behavior. Most people with filarial infections are over the age of 25. But there is a marked division in age between those who choose traditional healers vs. those who choose medical practitioners. Like other changes taking place in Fiji, the younger generation is generally more favorable to introducted methods; they are also more likely to seek out the medical practitioner. Of the 15 people who initially went to the medical practitioner, 12 were under the age of 37.

Treatment methods - drugs, environment, technique - also influence health seeking behavior. Treatment methods vary and can become the means by which to identify a particular practitioner. Whether it be the prescription of aspre to help with filarial fever or the use of herbal poultices, the effectiveness and familiarity with the treatment method enhances the choice of a given healer. Both the medical practitioner and the traditional healer are experts on substitute formulas. In the absence of DEC, aspirin may temporarily soothe filarial fever, while plants may be substituted for one another in herbal concoctions. However, the traditional healer can provide a more familiar and
comfortable environment, whereas the medical practitioner is most likely to practice in a "sterile" clinical setting. Factors such as the context in which health care is received strongly influence the choice of health care.

Is there a notion of prevention?

Although mosquitoes are perceived as pests, Fijians do not associate them with filariasis. In some cases, clothing, smoke from kitchen fires, and the use of mosquito nets are measures deliberately taken against the threat of mosquitoes. But the notion of preventing filariasis is derived from the explanation of what causes filariasis. On the one hand there is the biomedical measure of DEC which has curative powers, but alone it is not a preventive measure. There is no apparent relationship between western curative and western preventive measures. On the other hand, prevention and cure by traditional methods are not separate applications; both are part of the healing process.

Those who have had successful DEC treatment have accepted the curative benefits of biomedicine. But accepting the medicinal value of a drug is not necessarily believing in the theory behind the drug; doubt and disbelief may continue even with compliance to DEC treatment. In other words, therapy need not always lead to a change in disease theories. But therapeutic measures which include education about cause and prevention, does increase the interest in disease prevention. Once again, the efficacy of western drugs is realized but the theory behind their application is often misunderstood and not accepted.

The concept of disease prevention does exist in Fijian society, but it is not formed on the basis of scientific data. Prevention to the
Fijian is part of his/her cultural repertoire of social and cultural codes which determine proper behavior. The cause is often related to a distraction from or nonconformity to these codes; therefore the prevention, naturally, lies in conformity.

Elephantiasis in the Fijian community

As mentioned earlier, Fijians make little or no association between filariasis and elephantiasis. The few cases in which recurring filarial symptoms included swelling, there was some notion that the onset of such swellings ultimately would result in the permanent stage of elephantiasis. But the permanent nature of elephantoid swellings are often enough to deny any association with filariasis, which is a short-term, recurring affliction.

Table 5.4 shows the response to the question of how people define filariasis and elephantiasis. The far column shows which of these people actually had elephantiasis:

Table 5.4

<table>
<thead>
<tr>
<th></th>
<th>Separate disease</th>
<th>Same disease</th>
<th>Have Elephantiasis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60+</td>
<td>17</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>45-60</td>
<td>19</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>20-45</td>
<td>10</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>13-20</td>
<td>6</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>52</strong></td>
<td><strong>41</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60+</td>
<td>21</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>45-60</td>
<td>9</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>20-45</td>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>13-20</td>
<td>3</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
<td><strong>24</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>
These responses were solicited from the "public at large", and varied with geographical location, economic status, and general health condition of the individual. Those who are under the age of 20 generally believe in the biomedical explanations of filariasis and elephantiasis (this is indicative of schooling and of a need to differ from "old fashioned" ideas). Several people made the association between filariasis and elephantiasis because in the course of their treatment and by continuous interaction with biomedical staff, they learned about (and accepted) the developmental stages of the disease.

Traditional herbal remedies used for elephantiasis give temporary relief from the fever, body aches and accumulation of fluids. They may or may not be the same remedies used for filariasis. Two of the common techniques used by traditional healers were surgical incisions of elephantoid swellings (Hocart 1929, Lambert 1942, and Spencer 1941), and bandaging the swollen area. Surgery is still used by medical practitioners but bandaging is usually applied for holding in the excess skin after surgery.

Perhaps what is most significant about Fijians with elephantiasis is their continued participation in village life. They are not outcast by the community. Quite often, children who heckle such individuals are scolded or slapped. These people are also not prohibited from anything except those activities which they themselves are physically incapable of performing. People with elephantiasis are 45 and older, and age may to some extent, determine the appropriate community behavior towards them. Even though the causes of tauna are attributed to the spirits, people with elephantiasis are not constantly reminded of their
wrongdoing; some of the reactions were in fact, expressions of sympathy. On four separate occasions, people mentioned that the swelling was punishment enough since these people would never be able to have a normal body.

The disease pattern throughout Fijian communities is greatly influenced by human actions. The preceding discussion has shown that Fijians cope with disease through a reliance on traditional beliefs and practices. Even in light of modern cures such as penicillin, which show remarkable results, biomedicine and its practitioners have not yet gained the full confidence of the people.

Vector density and Human behavior in the Study areas

The Fijian communities of Vunibau village and Beqa island were selected as study sites after an initial survey of several villages was undertaken on Viti Levu. Both Beqa and Vunibau are under the jurisdiction of the Central Medical Division (see figure 3.2) and administered by the Navua Medical Center. These two areas show differences in filariasis and elephantiasis prevalence, and have differential access to traditional and biomedical care.

Vunibau village

Vunibau village is in the district of Serua, in southern Viti Levu, and is less than two miles from Navua town (figure 5.1).
Figure 5.1 Vunibau Village
This area is known for its abundance of pandanus (P. tectorius and P. joskei) palms. Pandanus palms serve as the primary breeding grounds for the local vector Ae. fijiensis. Vunibau also has had a high prevalence of filariasis.

Vunibau is a coastal village, located between the Navua and Deuba rivers; the village faces across to Beqa island. The mud flats bordering Vunibau provide much of the daily subsistence needs of the village; during low tide shellfish are gathered and at high tide, small fish and shrimp fill up the waters. Women may also take paddle boats into Navua river to catch small fish.

Fishing is the primary economic activity in Vunibau. The fishermen take their catch to either Suva market or sell locally at the Navua market. The fish are often traded for rootcrops with inland villagers. Shellfish, especially crab and shrimp, are regularly sold at the Navua market by women from Vunibau (some of the crabs are trapped at a young stage and raised in the muddy-brackish enclosures bordering the houses). Since the quality of soil surrounding Vunibau is not adequate for cultivating dryland root crops, the marketplace provides much of these additional subsistence products. Tourist dollars also play an important role in Vunibau economics. Many of the young men and women are employed in the nearby resort town of Deuba. The rice, lumber and dairy mills in Navua also provide employment and income for the villagers.

There are at least 60 households in Vunibau, and a registered population of 269 (due to migration, this figure tends to fluctuate a great deal). All but 11 of the houses are traditional bures, the
remainder are cement, wood, aluminum, or a combination of the three. Village life centers around church activities; about 50% of the people are Methodist and the other 50% are Catholics. Most of the village children attend a nearby Fijian school, but those who can afford daily transportation into Navua, attend the primarily Indian school in the town.

Medical and health care facilities are only a couple miles up river and Navua hospital is just 10 minutes away by boat. The husband and wife team of a public health officer and a public health nurse reside in the village. She provides much of the health care services for those who cannot travel to the Hospital. Like other Fijian villages, Vunibau has a health worker and a health outpost from which basic medical supplies such as bandaids, gauze, and aspirin can be obtained. With the exception of filarial infections, the overall health status of the villagers appears to be pretty good. This is partially due to the services provided by the resident public health nurse, the traditional dietary patterns (fresh fish, root crops), and the level of physical activity maintained by the villagers.

Vunibau has another unique feature; it has close social relations with Beqa. Both groups trace their family lineage to the Nadroga Province of Viti Levu. During the pre-contact wars, many people moved from Nadroga to Vunibau, to help the Beqans resist takeover by Cakobau and Ma’afu. It is not unusual for close relatives to share residences in both locations and there is frequent travel and exchange between these families.
Filarial vectors in Vunibau

**Ae. fijiensis** - this vector is endemic to the southern flatlands of Viti Levu. It breeds in the large axil leaves of the pandanus palm, which trap small pools of water. Pandanus trees are found all through the Navua region; much of it grows wild and in unoccupied areas. However, some of it is cultivated (voivoi) and used by the villagers for mats and baskets. The encroaching pandanus groves have been a recurring problem for Vunibau. Public health teams have come through several times to spray the area for mosquitos and villagers have had to cut back the pandanus. However the rapid growth of both the palm and its mosquito inhabitant make it difficult for villagers to keep up control measures. As a result, **Ae. fijiensis** is highly endemic and highly prevalent in this area.

**Ae. pseudoscutellaris** - this mosquito was found in many of the households and in nearby bushes. The largest number collected were from the village outhouses, which provide good breeding conditions for this vector. It also appears that **Ae. pseudoscutellaris**, because of its large numbers, flourishes alongside **Ae. fijiensis**. The two species do not appear to compete for breeding sites.

Although Vunibau and Beqa have close social ties, the island of Beqa, because of its relative isolation, provided a unique study situation.

**Beqa Island**

Beqa island is only 7.5 km from the Navua delta (Viti Levu), but socially, it is at a great distance from Viti Levu (figure 5.2).
Figure 5.2  Bega Island
Historically, Beqa has been known for its isolation and continual migration of small hostile groups (Rajotte and Bigay 1981), and of endemic warfare with the surrounding islands. With the exception of firewalking\(^{22}\), for which the village of Daquibeqa is renown, Beqans still adhere strongly to traditional ways.

Beqa is a fairly small island, with a total land area of 56 sq.km, and a population of 1,253 spread throughout the nine villages. The villages of Lalati and Dakuni were selected as the primary study sites (figures 5.3 and 5.4).

\(^{22}\) Beqa is better known as the "firewalking" island because of the men who perform firewalking at the resorts in Deuba. However, on the Beqa itself, firewalking is done only as a ceremonial event.
Figure 5.3 Lalati Village
Figure 5.4 Dakuni Village

(Gardens and timber)

(Shifting cultivation)

Daquibeqa

Coconut and taro

Community

Hall

Dakuni Bay
The village of Daquibeqa, in the southern part of the island, is the government center; it is also where the medical clinic for the island is located. There are very few non-Fijians living on Beqa, and the island has never been open to tourists (although the nearby island of Yanuca, which is under Beqa's jurisdiction, regularly receives tourists from the Deuba resorts.

Although firewalking adds significantly to Beqa's cash economy, fishing and agriculture are the predominant economic activities. Beqa residents regularly sell root crops, plantains, mangos, duruka and a wide variety of fish at the Navua market. Much of the interior of Beqa is inaccessible due to the rugged terrain. There is little coastal land but the adjoining hill slopes are cultivated for root crops, fruits and vegetables. The fishing around Beqa's barrier reef attracts fisherman from all parts of Viti Levu. Beqa is also host to an annual fish drive, a major social and economic event.

Transportation in and around Beqa is a major problem. Recently a 4km road was cleared between the villages of Dakuni and Raviravi. There are pathways throughout the interior but boats with outboard motors remain the primary means of travel. Boat owners supplement their income by also providing taxi service to other residents.

Most Beqans are Methodists. Each village consists of a cluster of houses, at least one store, and a church which is centrally located, often being the largest building in the village (Rajotte and Bigay 1981). As in many Fijian villages, the church is the focus of social life. There are 2 schools on the island, one in Daquibeqa and one in Raviravi, which are approximately at opposite ends of the island. Both
of these are primary schools which offer education up to the 8th grade. Education beyond the 8th grade can be obtained only on Viti Levu.

The medical clinic in Daquibeqa has a 6-member staff consisting of a medical assistant, 2 staff nurses, 2 public health nurses, and a health inspector. The clinic has been provided with a power boat which the medical staff, primarily the public health nurses, use for their monthly visits to the villages. This boat is also the primary means of transporting emergency cases to Navua Hospital.

Beqa is known to have fairly high rates of filariasis. Although the only microfilarial survey of the island was done in 1953, nurses records have consistently reported a high incidence of hydrocele and elephantiasis. In their 1953 survey, Desowitz and Southgate discussed the extremely high rate of filarial disease on the island; Southgate made similar observations in 1986 (personal communication).

One reason for the high incidence of filarial disease may be due to the prevalence of vector mosquitoes. No village was found to be free of filarial vectors. Of the three vectors found on Beqa, each village had at least two in fairly large numbers.

Filariasis vectors in Beqa

*Ae. pseudoscutellaris* - based on sample collections, this is the predominant vector on Beqa island. *Ae. pseudoscutellaris* is primarily a bush mosquito and finds an abundance of breeding sites throughout the island. It is found both indoors and outdoors, near the village compound as well as in the distant plantations which are up to 400ft. elevation level. As in Vunibau, *Ae. pseudoscutellaris* is also found in large numbers in the outhouses.
Ae. polynesiensis - this vector was most common in villages which were furthest away from the bush areas and which occupy a wider coastal belt. As on Yanuca island, Ae. polynesiensis was found to be breeding in the trunks of the large ivi tree. Due to their coastal habitation, the villages of Soliyaga and Dakuni had the highest concentration of this vector.

Ae. fijiensis - this vector was found in Lalati and Nawaisomo villages; both villages have encroaching pandanus groves. The number of Ae. fijiensis was significantly less than Ae. pseudoscutellaris, and it was primarily an early evening biter.

Vector zones

As outlined in the methods chapter, the vector zones were created based on vector prevalence/density, as well as by defining specific spatial zones in which human behavior could be monitored (c.f. Roundy 1980). These boundary divisions were more meaningful in the fairly traditional subsistence-based Beqa villages, because each zone was actively used. In Vunibau, however, the garden/plantation zone was used only by a few families regularly because many of the Vunibau residents focus their activities on fishing and tourism.

Table 5.5 describes the four vector zone divisions for both Vunibau and Beqa:
### Table 5.5

**Vector zones in Vunibau and Beqa**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>household-indoor quarters</td>
<td>Area used as the living and sleeping area surrounding the house (bure), including kitchen, kitchen garden, crab enclosures, and voivoi patches.</td>
</tr>
<tr>
<td>household compound</td>
<td>Area surrounding the house (bure), including kitchen (usually 5-10 yards away), kitchen garden, crab enclosures, and voivoi patches.</td>
</tr>
<tr>
<td>kitchen garden</td>
<td>The entire area within the village boundaries; communal water taps, wash basins and rubbish piles; social, religious and work places; and boat canoe docks.</td>
</tr>
<tr>
<td>village compound</td>
<td>Includes pathways leading in and out of the village, vegetable gardens, coconut groves, pig sties, mangrove swamps used for shellfish collecting, and all areas of activity outside of the village boundaries.</td>
</tr>
</tbody>
</table>

**Human Behavior in the activity zones**

By monitoring human activity in the specific vector zones, the degree and amount of daily exposure to vector mosquitoes could be estimated. Human behavior was monitored in all four of the activity zones described above. The sample of "activity" times for Beqa were taken primarily from the villages of Lalati and Dakuni, from which most of the data was gathered. 5 households were selected from each village and activities of the household members were monitored for the remainder of my stay. Activities of the "economically productive" group were given special attention because these individuals spent time in several vector zones throughout the day and came into contact with more vectors. In contrast, activities of children and elderly individuals was often limited to the village area. Table 5.6 shows the hours of
activity/exposure of males and females from Vunibau and Beqa, respectively.

Table 5.6

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>1</td>
<td>1</td>
<td>.5</td>
<td>1</td>
<td>3.5</td>
<td>3.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>.5</td>
<td>.5</td>
<td>2</td>
<td>.5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>2.5</td>
<td>2.5</td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
<td>8.5*</td>
</tr>
</tbody>
</table>

*includes the average hours Vunibau men spent working in Deuba and Navua towns.

Table 5.6

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>1.5</td>
<td>.5</td>
<td>1.5</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>12.5</td>
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<tr>
<td>Vector zone 2</td>
<td>1</td>
<td>1.5</td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>.5</td>
<td>.5</td>
<td>1.5</td>
<td>1</td>
<td></td>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>1</td>
<td>3*</td>
<td>1*</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

*This includes the younger women who leave the village to work in Deuba.

Table 5.6

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
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<td>.5</td>
<td>1</td>
<td>2.5</td>
<td>3.5</td>
<td>9</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>1</td>
<td></td>
<td>.5</td>
<td>2</td>
<td>1.5</td>
<td>.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>3.5</td>
<td>2.5</td>
<td>3.5</td>
<td></td>
<td></td>
<td></td>
<td>9.5*</td>
</tr>
<tr>
<td>Vector zone 4</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>

Hours of Activity in Vector Zones - Bega Females

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>2</td>
<td>.5</td>
<td>1.5</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>2</td>
<td>1.5</td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>.5</td>
<td>1.5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>.5</td>
<td>2.5*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

*This includes the women who are head of the household and therefore worked their own gardens. The time zones are equivalent to the following hours:

T1 = 5-9am  T2 = 9am-1pm  T3 = 1-5pm
T4 = 5-9pm  T5 = 9pm-1am  T6 = 1-5am

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The division of labor was more pronounced in Beqa where traditional subsistence and child-rearing practices are still maintained. In Vunibau, however, many of the young adults, married and unmarried, worked in Deuba or in Navua (this is reflected in the amount of time spent in vector zone 4).

As table 5.6 indicates, men spend more daytime hours outside the village. Of the 19 men surveyed from Vunibau, 7 had full-time jobs in either Deuba or Navua; 8 were full-time fishermen; and the remaining 4 were either unemployed (seasonal laborer or too old) or between jobs. The men who worked outside the village tended to their gardens, household and community chores in their free time; they often relied on male relatives to do some of these chores for them. The fishermen, while ashore, were less predictable in their work patterns. Their fishing excursions were often determined by daily weather conditions. These men spent a considerable amount of time repairing their canoes, boats, spears and fishing nets. But they also tended to their gardens fairly regularly.

Of the 31 men surveyed on Beqa, 29 were fishermen. These men spent more time tending to their vegetable gardens than the men from Vunibau. This is partly because vegetable gardens cover much of Beqa’s landscape and gardening is relied on for daily subsistence as well as for commercial marketing. These men also spent more time travelling to and from the village to the garden plots; for instance, Lalati families have gardens which are up to 45 minutes away.
A total of 42 women were surveyed; 19 from Vunibau and 23 from Beqa. Of the 19 women from Vunibau, 5 worked in Deuba resorts; the three who were married and had children, relied on female relatives for babysitting. With the exception of these young women who work in Deuba, the division of labor is similar among women in Vunibau and Beqa. Older women tend to the small children, while younger women perform the heavier household chores as well as cook and clean. The kitchen garden is often a cooperative effort which is kept up by several generations of women. And middle-aged women were most likely to work the family gardens. One significant difference in daily activity patterns was that Beqa women spent more time in their family gardens than their counterparts in Vunibau.

Nearly all of the women including 2 of the 5 who worked in Beqa, spent some daily hours in subsistence activities on the reef; this varied between actual fishing and netting of shrimp to collecting urchins and sea cucumbers. Shrimp are also netted from the village streams, and fish ponds (stone enclosures bordering the village) are maintained for subsistence fishing when the reef is inaccessible. Vunibau has a "natural" fish pond; adjoining the mangrove swamps is a lagoon which at low tide traps small fish and these can be caught by just wading through the waist-high water.

The activity patterns of these Fijian villages show how the average day is spent. The activities or site of activities, show when and where exposure to mosquito vectors takes place. The implications of human behavior patterns, particularly those activities which were monitored,
will be analyzed and compared against Rotumans and Indians in Chapter VIII.

Summary

This chapter has provided the ethnographic basis for comparing filariasis in the Fijian communities with that of the Rotuman and Indian communities. Traditional subsistence activities of Fijians seem to most influence the disease pattern of filariasis. Daily activities vary according to sex and age group, which in turn is reflected in differential exposure and contact with vector mosquitoes. In addition, differential access to biomedical care (DEC treatment) may also add to the large number of filarial infections in areas such as Beqa.
CHAPTER VI

ROTUMAN ISLANDERS

Introduction

Rotuma is located about 390 km to the north-northwest of the main Fiji group. The island was first discovered in 1791 by Captain E. Edwards of the H.M.S. Pandora, in his search for the Bounty. Like many of the other Pacific islands, Rotuma was frequented by traders, missionaries, wayward sailors and deserters. Rotuma remained open to the ships and people crossing the Pacific seas until the Wesleyan-Catholic war erupted in 1878 (Gardiner 1898). The unrest caused by the religious war led the people of Rotuma to call upon Great Britain to take control of their island. In 1881, the paramount chiefs ceded Rotuma island to Great Britain. For convenience the British administered Rotuma from Fiji, from which time Rotuma has remained under Fiji's jurisdiction. Prior to cession Rotuma had no regular relationship with Fiji or its people.

Since little archaeological work has been done in Rotuma, knowledge concerning its prehistory is largely dependent on oral traditions. The linguistic data shows that the Rotuman language has much in common with other Polynesian dialects, especially Tongaic-Samoan (Green 1981); it also has close affinities with Fijian. Assessment of Rotuman ancestry has been difficult partially because of the island's isolation and because Rotuma underwent rapid change (Pawley 1979). Pawley classifies Rotuman as part of the Central Pacific language family which includes both Polynesian and Fijian.
The lack of written traditions and conjectures based on physical appearance and social forms have led to a variety of theories as to the origins of the Rotuman people. Based on language and cranial measurements, Eason (1951) proposed that the first Rotumans were probably Micronesians. And according to Gardiner (1898) and Forbes (1875), aboriginal Rotumans were invaded by Polynesian, Micronesian and Melanesian groups. The aboriginals in this case have not been identified. Some oral legends of Rotuman settlement point to Samoa as being the ancestral homeland. Raho, a Samoan chief, was thought to have been the first Polynesian invader to settle in Rotuma; he was followed by Tokaniua, another Samoan chief, and Ma’afu, a Tongan chief who also invaded Fiji (Gardiner 1898). A recent analysis of the Raho myth by Howard (1985), however, indicates that the Samoa in the legend may not be referring to the Samoan archipelago but perhaps to a generic homeland (Savai’i). Among other non-European invaders were Gilbertese castaways, Ellice islanders, Tikopians and cannibals from Futuna (Gardiner 1898).

The Effects of Contact on the Health Status of Rotumans

The change in the general health status of Rotumans has been affected by two primary agents of culture change - missionaries and colonial administrators. This is not to say that others passing through the islands did not affect the health of the islanders; diseases such as measles and influenza could have been introduced by any number of visitors.

As in Fiji, depopulation in Rotuma was also an early result of contact with Europeans. In 1880, the population of Rotuma was estimated to be about 2,200 (Russell 1942), however this population declined to
less than 2,000 over the next 31 years, primarily as a result of epidemics. The first dysentery epidemic, recorded by Father Trouillet, is believed to have occurred about 1861, when "there were not enough people to bury the dead" (Howard 1979). C. Mitchell, Resident Commissioner in 1882, reported a dysentery epidemic which resulted in 44 deaths (Minutes from the Rotuma Council of Chiefs). In addition to dysentery, epidemics of mumps, measles, and influenza occurred into the early 1920's. Perhaps the most severe of these epidemics was the measles outbreak in 1911. This epidemic was known to have spread to Rotuma from Fiji (Cliff and Haggett 1985), where it brought similar disaster.

Written accounts of the Resident Commissioners and Medical Officers assigned to Rotuma provide among the most interesting insights of Rotuman culture. Their reports are invaluable for having documented the history of a culture and society which was small and yet saturated by European-Christian values. The richness of this data can be seen in the following examples which not only deal with new health challenges but tell of "native" diseases, including filariasis and elephantiasis.

W. Carew, who was the Resident Commissioner in 1924, basically sums up the Commonwealth's perspective of Rotuman character as such:

It is true, of course, that these natives are at the infantile stages of civilization and that perfection cannot be attained or expected within the space of a few years, but, nevertheless, stringent measures, not necessarily of an extensively severe nature, are required to stamp out some of the old and useless customs prevailing (July 1, 1924).

While the missionaries were trying to do away with beliefs in pagan spiritualism, i.e. the spiritual powers of the atua, the Commonwealth guardians (Resident Commissioners) were trying to enforce
medical procedures, i.e. hospital care, sanitation measures, and disease prevention. Both groups were trying to change the traditional health care system of beliefs and practices, while at the same time introducing new diseases to the islands.

One of the Resident Commissioners assigned to Rotuma was a medical doctor by the name of Hugh MacDonald. MacDonald was more sympathetic and less authoritarian than his predecessors and followers. He was concerned with sanitary living conditions and developed preventive measures against yaws and leprosy (establishing seclusion "bush" huts for leprosy patients). He seemed to be more anxious about preventing disease and maintaining the overall health of the Rotumans than many others assigned to the post. The following is an example of McDonald’s cultural sensitivity towards the Rotumans:

The people I found were not at all backward in seeking advise but I think in some cases were not careful in following it. Medicines were often simply tested and if the flavour was not agreeable the bottle was set aside (MacDonald, July 26, 1902).

With regards to filariasis and elephantiasis, the first European observer to report on the medical conditions in Rotuma, Dr. George Bennett, made no mention of elephantiasis nor yaws (Howard 1979). Both of these diseases have received considerable attention from subsequent observers. Filariasis and elephantiasis were present, however, and the first mention of elephantiasis was by Edward Lucatt in 1841; the disease was called fe-fe by the Rotumans (Howard 1979).

Gardiner, a naturalist who visited Rotuma in 1886, notes surgical practices associated with filariasis and elephantiasis where a shark’s tooth lancet was used to drain the scrotum and limbs (1898).
addition there are many accounts of elephantiasis and several of filariasis by Medical Officers and Resident Commissioners who were assigned to Rotuma. In 1928, Dr. S.M. Lambert, examined approximately 85% of the population and found 30% of all adults showed signs of filaria.

Some of the changes resulting from contact have improved the health status of Rotumans, especially in the areas of sanitation, leprosy control and elimination of yaws. The epidemic diseases of influenza and dysentery are having less effect on the population today largely because of immune buildup (genetic resistance) and the use of modern medicines. Effective quarantine procedures are also helping to deter the introduction of disease agents.

Contact has also had some permanently damaging effects on the health status of Rotumans. The drastic alterations to indigenous Rotuman culture brought on by the missionaries, combined with economic and political change as a result of contact with the greater European world, lends to the problems facing Rotuman islanders today. An example is the prohibition of Catholic women from birth control techniques - a measure which today results in more frequent births and poor chances of survival for the newborn. (During my stay in Rotuma, 2 Catholic women delivered their 8th and 11th baby; the first woman had only 4 surviving children, and the second woman had 8 surviving children, including the newborn). Dietary change as a result of greater reliance on imported canned goods is also creating health problems amongst Rotumans. These are problems which stem from contact with the West and concern the current health status of the Rotuman people.
The effects on health status in general has been measured in terms of definable, biological, manifestations of disease. Little or no attention has been given to the possible psychological and social problems which developed as a result of continuous contact and the enforcement of western ways and religious change. But resistance to change, although not documented from the Rotuman perspective, was noted. H. E. Leefe, in one of his many frustrating moments reports a "heathen outbreak" during his administration. In February of 1900, Leefe noted that a group of natives who converted to Catholicism from Wesleyan, proceeded to defile the Catholic church by having intercourse with Wesleyan women. They preferred being pagans because "they find worship of their heathen deity more comforting, useful and refreshing than the God of the Missionaries; they also say that Ufigemalu (native spirit) has cured many who are sick" (in Outgoing letters from the Resident Commissioner).

Health and disease took a variety of forms in how contact with them affected the Rotuman people. At one extreme, there were epidemics which devastated the population, and at the other extreme, the work of people such as H. MacDonald was not in vain, since leprosy and yaws were significantly reduced. It is a wonder that the Rotuman people survived these early years; they have demonstrated their adaptability in making the best of any situation presented to them. Their success today as a group of people in Fiji is living proof of a "hardy" culture.

Rotuma Today

The current Rotuman population is 8,652 (Fiji census for 1986); 2,554 reside in Rotuma and the remainder are scattered throughout Fiji.
Rotuma island is divided into seven districts. There are a total of 35 villages (Census of the population for Fiji, 1966), which are overseen by their respective village and district chiefs. The government station in Ahau houses all service agencies, i.e. Rotuma Rural Hospital, District Officer's residence, Council meeting house, Post Office, Bank, Public Works Department, and the Visitors quarters. Figure 6.1 of Rotuma Island shows the 7 districts including Ahau, and Sumi and Upu Catholic Missions.
In regard to the current population of Rotuma, the issue of emigration, especially to the urban centers of Fiji, needs to be considered. Howard has discussed at great length the various factors which contribute to out-migration (1966, 1970, 1977). Population pressure, and the desire for social advancement, education and skills are primary reasons for these moves. Rotumans have settled into several urban pockets; the Raiwaqa area in Suva has perhaps the largest concentration of Rotumans in Fiji (Bryant 1974). The town of Vatukoula, where the Emperor gold mines are located, on the western end of Viti Levu is one of the original Rotuman settler communities (Howard 1966). A large number of Rotumans are employed in the mines. Suva, because of its educational facilities (University of the South Pacific, Fiji Teachers College, and Fiji Medical School), and employment opportunities (government services, retail shops, and tourism), is also a choice resettlement area. The newly developed town of Nadera, located 7 kilometers from Suva, also has a large number of Rotuman residents.

The movement to Fiji does not necessarily mean a permanent move from the homeland; people often travel back and forth and they usually join relatives already residing in Fiji. This is most evident in the enclaves of Rotuman communities in Fiji which are made up of individuals belonging to the same village or ho'aga¹ back in Rotuma. Social-obligatory ties in terms of residential patterns, ceremonial events, and

¹ The ho'aga is a village unit which usually consists of several households. For instance, village work groups are members belonging to one ho'aga.
church affiliation, between members of the kainaga\(^2\) (extended family) are still maintained in Fiji. Recently a large Rotuman Methodist church was built in Suva from donations made by the Rotuman community in Fiji.

The frequency of inter-island travel helps to maintain family and social ties between Rotumans in Rotuma and those in Fiji. Relatives, especially parents and grandparents, frequently visit their children in Fiji. Medical care, material needs, and vacations are among other reasons for temporary visits to Fiji. There is a marked difference between the age structure of the population remaining in Rotuma and the group migrating to Fiji. The population structure of Rotuma resembles an hourglass figure, consisting mainly of the very young and the old. Bryant (1974) notes that the primary age group migrating to Fiji is between 15 and 25 (usually post-high school). Those remaining in Rotuma are often the grandparents or adopting parents of the young children who are left behind by their working and schooling parents. In general, the raising of children appears to be a responsibility of the grandparents.

**Rotuma's rich resource base**

Rotuma is a volcanic island which has an abundance of both land and sea resources. The rich volcanic soil accommodates the variety of crops introduced into Rotuma. An aerial view of Rotuma shows that nearly two-thirds of the island lies under a canopy of coconut trees. Some of the offshore islets, such as Hauatiu off the coast of Oinafa, also have an abundance of coconut trees. The island (including the

\(^2\) The *kainaga* is the extended family which owns land and controls its use. This is the most basic social unit in Rotuman society.
smaller surrounding islets), has no primary forest growth; however secondary vegetation makes up the ground cover beneath coconut trees.

Fresh water has recently been obtained from an underground lens and is piped into homes. Previously water was obtained from ground wells dug near the shores and from water catchment tanks adjoining larger structures. Although piped water is available to nearly all of the homes on the island (a few still share common taps), water is often rationed. The sea serves as a bathing and washing pool, thereby making more fresh water available for drinking and cooking.

Shifting cultivation is the primary subsistence activity. Family gardens are located at some distance from the village; this distance varies with the location of kainaga lands. For instance residents of Malhaha have gardens across the road and up to 50 meters inland, but Motusa villagers have to travel past the neighboring village to an area further inland. However, because of the flexibility in land use patterns, it is fairly common for a family to rent land and work gardens much closer to their resident village. It is equally common to see individuals working more than one garden, either because they have divided up their crops between several gardens and/or because they are working the gardens for other members of their ho'aga.

The gardens, with the exception of the area surrounding coconut trees, are kept relatively free of other vegetation. The area surrounding coconut trees are not cleared, often serving as the grazing and tending grounds for the family livestock. Families with goats have a much easier time keeping coconut groves clear of secondary growth. Not all garden crops are cultivars; Fatiaki (1977) describes giant yams
weighing up to 200 lbs. which grow wild throughout the islands. Gardens which are not kept cleared of secondary growth often show "wild" plants and regrowth of earlier plants.

Isolation has not kept Rotuma from participating in the greater world economy. Copra export is a major source of income for Rotuma islanders. During the time of this study there were two large Cooperatives on the island - RCA and RAHO - which acted as brokers for the sale of copra. The Cooperatives collected the fresh coconut meat and paid participating households for the weight of copra derived from the drying process. Fresh coconut meat is collected on designated days from roadsides along the plantations, than transported to the copra dryers (which are operated by the various members belonging to that Cooperative). After drying, the copra is stored until it can be shipped to Suva.

There is a real need to participate in the copra trade since it remains the main source of income for many Rotuman households, and coconuts are probably the least labor-intensive crop to cultivate. All Rotuman households appear to participate in the cooperatives to some degree. Families with men of working age are more active and receive a greater part of their household income from copra. Households which do not have men to work the plantations rely on relatives and the ho'aga to work their land and cut their coconuts. Reciprocity among the kainaga and ho'aga is still an honored tradition in Rotuma. No household, even

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3 There are more than two cooperatives on the island and perhaps as many as thirteen. However, on his visit to Rotuma in 1987, Howard found that RAHO was no longer actively exporting copra.
those which are made up of widows and young children, is excluded from participating in the copra economy.

Local farmers are also encouraged to grow various vegetable crops such as especially bele4. There are but a handful of vegetables grown on the island. This is not a reflection of the quality of soil or the lack of manpower but is rather a lack of cultural preference for these vegetable products. Breadfruit, bok choy, cucumbers, tomatoes, bele, green beans, sweet potatoes, taro, cassava and green onions are the predominate vegetables which can be found in Rotuma. Most gardens will only have one or two of these crops, especially taro and cassava. Cooperative farms, as the one in Hapmak, and individuals who can otherwise sell or trade their produce, grow a larger variety of crops. In general, household consumption is limited to one or two crops.

The sea is no less productive than the land. However, seafood does not appear to constitute a dietary staple and is somewhat ignored as an economic base. Some families continue to use seafood as part of their daily subsistence, while others have nearly abandoned the gathering of fresh seafood. A general characteristic of the Rotuman diet seems to be a preference for meats rather than seafood. Losa may be the only "fishing village" remaining on the island; other villages have some amount of sea activity but these vary with individual families. Losa's traditions may be maintained because its reef is

4 The introduction of bele to Rotuma by the Fiji agriculture and health departments is an effort to improve the nutritional value of garden plants on the island. Since the bele plant is easy to maintain (very little care is needed) people are encouraged to grow it in their kitchen gardens.
abundant with fish and shellfish; the villagers have easy access to the open sea. The reefs along the northern and southern coasts bear less sea life, this along with the need for larger power boats may be other reasons for not using the sea to its full potential. Most islanders still use canoes for subsistence gathering and fishing along the shoreline.

Other than goats, people raise cows, pigs, horses and chickens. With the exception of pigs and chickens, other animals are kept in the family gardens; goats, however, are often brought onto household grounds to help in the upkeep of the yard. Pigs are kept in communal sties which are at some distance from the villages. These sties provide major breeding grounds for both mosquitos and flies. Coconut is the pigs main staple. As a consequence, coconut shells lay all about the pig sties. In addition to coconut, pigs are fed kitchen garbage.

Other means of disposing of household garbage is by burning, the use of trash pits, and even dumping into the sea. But some new measures have recently been developed. A New Zealand Army Medical team (whose arrival coincided with this research period) came to Rotuma for the purpose of installing environmental measures which would help reduce trachoma and intestinal infections. The team's efforts were focused on new methods for waste disposal which would reduce the vector fly population responsible for much of the disease transmission. The team installed new pit latrines at the schools and built incinerators at the missions and public areas. It is hoped that burning, although not a common Rotuman practice, will replace the use of trash-pits, and thereby reduce health problems.
While these new measures will reduce the transmission of trachoma and intestinal (as well reduce mosquito breeding in pit latrines), the transmission of filariasis is maintained primarily through subsistence activities. Traditional subsistence along with copra production, are the two activities most likely to influence the disease pattern of filariasis. The desire for a monetary economy is maintained through the production of copra; coconuts are the single most abundant resource on the island. And coconut groves are a primary breeding grounds for the vector, *Ae. polynesiensis*. Other traditions are also maintained. As among Fijians and Indians, traditional medicine still provides treatment for filarial disease in Rotuma.

**Traditional Rotuman medicine**

Traditional herbal medicine in Rotuma is very similar to traditional Fijian herbal medicine. This is not unusual since both groups share similar habitats and similar health problems. Medicinal plants and healing methods have probably been shared through trade and inter-island travel over the past century. Herbal remedies appear to be the most common form of Rotuman ethnomedicine. Massaging, known as *sarau* on Rotuma, is also commonly practiced in both groups.

Some of the medicinal plants used in Rotuma are the ivy (*Ficus vitiensis*), guava (*Psidium guajava L.*) and the nutplant (*Cleistocalyx eugeniodes*). The use of these plants vary only according to their availability, i.e. the ivy is less common in Rotuma, therefore guava is usually used for stomach disorders. During my stay I met with 8 Rotuman herbalists, one whose cure for jaundice was used by 2 of the New Zealand Army medical officers. The identities of these healers are well guarded.
from outsiders for fear of prosecution by Fijian law for practicing traditional medicine. Nevertheless Rotumans, including the local nurses, are well aware of these healers and the healing methods practiced on the island. In addition to herbal remedies, sarrao is commonly used as a healing method.

Overall, Rotumans use modern medicines more than Fijians. This is largely due to: 1) easy access and availability of biomedical care to island residents; 2) the relatively small population which the Rotuma Rural Hospital serves; and 3) the general familiarity of islanders with their medical staff. (Rotumans in Suva also use modern medical facilities more often than their Fijian counterparts.)

Rotuman acceptance of biomedicine may partially be attributed to their desire to learn about new ways and practices. Rotumans generally strive harder and take greater advantage of modern developments than their Fijian neighbors. This desire to learn and excel is perhaps best demonstrated by the high percentage of Rotumans in the professional, commerce and communication industries in Fiji (Bryant 1974). But acceptance of biomedicine can also be attributed to the changes which have been brought upon Rotuman society. As Howard explains, "despite the history of resistance, Rotumans did in fact ultimately accept most of the medical innovations forced on them through the authority of colonial administrators, and by 1960 their responses to most medical problems were distinctly secular" (Howard 1979:271).

Coping with Disease: Filariasis in Rotuma

Little change has taken place since Howard’s departure; if anything, the delivery of medical care has improved. The loss of
traditional healing methods is evident in the current medical system, which being of colonial origin, reflects little of past Rotuman traditions. As Gardiner observed in 1898, guarding tradition against Christianity also led to the loss of much valued information:

The Rotuman of the present day is singularly ignorant of even the most elementary medicine and surgery...this is attributed to the fact that previously, when priests were doctors, medical knowledge was carefully guarded. With the coming of Christianity, this information was so well guarded that it was lost (Gardiner 1898:491).

Thus Rotuman disease theories have been strongly affected by acculturation. Disease theory(ies) surrounding filariasis reflect both the vector-transmitted explanation and explanations which reflect cultural notions of disease causation. Some Rotumans recall the 1983 filariasis survey, and they remember the public lectures about disease transmission, treatment and testing. Therefore, it was not unusual for someone to give me the mosquito transmitted explanation for the disease (see table 6.1). But like Fijians, the association between the parasitic agent and the mosquito vector was made only by one individual who had elephantiasis. Also little or no association was made between drug treatment with DEC and the resulting chemotherapy of filariasis. Overall, participation in the DEC protocol appears to be better than in Fiji. The public health nurses (who administer and deliver DEC tablets to the villages), commented on good patient cooperation. Medical records from 1981 to 1985 do show, however, that one group - young Rotuman males - were the least compliant in DEC treatment (see discussion on p.21).
Filariasis is often referred to as wagaga, the Fijian term for the disease. Only 5 out of 43 people in my sample used the Rotuman term tau te'. Table 6.1 shows the responses of 43 people (22 men and 21 women) as to disease causation; filariasis was more often attributed to natural forces in the environment, than to social causes. Vector-borne explanations were the most common.

Table 6.1

Causes of Filarial fever in Rotuma

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosquito transmitted (as explained by the medical team)</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>A result of/associated with some other sickness</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Cold air</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Sea water</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Night air</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Excessive work</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Sharing living/eating quarters with filarial patients</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Drinking bad water/eating bad foods</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>22</strong></td>
<td><strong>21</strong></td>
</tr>
</tbody>
</table>

These explanations were elicited from the general public except hospital staff and teachers who had active roles in distributing information for the antifilariasis campaign. It is significant to note that 4 out of the 10 resident nurses (including 1 public health nurse)

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The current medical nomenclature used by Rotumans has been influenced significantly by Fijian words. The use of Fijian disease terms may reflect the degree of interaction between the two groups as well as the medical administration of Rotuma which is under the Fiji medical department. Wagaga is commonly used, and tau te' is used by individuals who spoke mostly Rotuman (instead of English or Fijian) and who appear to have greater knowledge and use for past medical practices.
were not aware of the parasite nor the specific mosquito vectors implicated in the transmission process.

There is great variation in the causal explanations given for filarial fever. Of the 43 individuals whose responses are shown in table 6.1, 27 (19 men and 8 women) had tested positive for microfilariae in 1983. Most of these individuals, though skeptical about the curing powers of DEC, were willing to participate in the treatment program. But at the time of this study, only 16 of the "positives" were actually participating in DEC therapy.

Treatment for filariasis

Of the 8 herbalists who were interviewed, 5 had treated tau te' or filarial fever with herbal teas. These herbalists rarely used the term tau te'; filariasis was commonly referred to as wagaga. Interestingly, many of the herbal remedies and use of plant and plant parts were said to have been learned from Fijians living on the island. There was also mention of massage (sarau) being used for some segments of the treatment process. As in Fiji, most healers were reluctant to divulge detailed information about their individual modes of treatment.

Biomedical treatment for filariasis on the island was fairly well documented. Between the period of 1981 and 1985, 57 individuals, 38 men and 19 women, had come to the public health station for DEC treatment (Rotuma Hospital medical records). Of the 57, 21 returned for a second dose, and 9 came regularly (monthly) thereafter. Although the dosage and length of treatment varies with infectivity and body size, only 9 of the original 57 completed their treatment course. Young men are least likely to seek treatment; the main reasons being that the drug brings on
additional discomfort, and if left alone, the fever will eventually pass. The prohibition of kava and other drugs and liquors (orange wine is a well known illegal drink among young Rotuman men), may further discourage DEC treatment. Another reason may be that young Rotuman men rarely visit the hospital. In my observations, the men who came to the hospital (except for the elderly) were in need of emergency care, i.e. needed minor surgery, sutures for cuts and wounds, antibiotics, etc. Both the public health and staff nurses commented on the fact that young men are less likely to participate in follow-up protocols because they do not wish to attend the hospital. Fridays are designated as "hospital day", and the buses travel around the island to transport individuals to and from the hospital. (Fridays are also "well-baby" clinic day, so many of the mothers bring in their infant children for check-ups.) For the four fridays that I remained on the hospital grounds to monitor DEC treatment, only 2 young men came to the hospital (for soccer wounds).

Use of preventive measures

Some protective measures such as the use of mosquito nets, are taken. With or without the fear of filariasis, mosquito nets were found in most of the households in Motusa, including those which have window and door screens. The turning of coconut shells has also been observed. But for the most part, the notion of disease prevention appears to be absent, indicating a lack of understanding about the causation of filariasis.

The 16 individuals who were presently being treated with DEC did believe that the medicine would heal their symptoms. But there was increased doubt about the association between DEC and therapy among
individuals who had a recurrence of filarial fever after DEC treatment was completed. This was the main reason given by 5 of the positives who chose not to restart DEC treatment. There were fewer references to the side effects of DEC than in Fiji; only 5 of the women and 2 of the men recalled their own or someone else's negative experience such as vomiting and lethargy as a consequence of taking DEC. Because the association between DEC and prevention is based on a long-term treatment plan, it is difficult to establish a relationship between the two. DEC is not easily "sold" to Rotumans since this drug, unlike aspirin or antibiotics, shows no immediate relief.

An interesting difference between the Fijian and Rotuman community is the latter's interest in public health education. Unlike Fijian villages, where the chief's permission is necessary to organize a group, in Rotuma, school teachers and women's groups have proven to be the best means of dispersing information to the community. At a presentation I gave on filariasis, all but 2 of the school teachers attended. Not only was the large attendance encouraging but these educators became very active participants in the discussion, showing a great deal of concern over suitable preventive measures, including taking a strong position against the introduction of Toxorhynchites, a mosquito which does not bite humans but whose larvae are cannibalistic towards other mosquito larvae. Similar enthusiasm was seen among the women's groups which were

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6 The school teachers recalled the introduction of E. indica, a weed which was supposed to enhance the growth of fruit trees in the gardens, into Rotuma by the Fiji Agriculture Department. E. indica is now widespread and difficult to control; in short, it has become a garden pest.
organized for health education on both filariasis and trachoma (their concern about trachoma, however, was greater than their interest in filariasis).

Elephantiasis

Several Rotumans on the island have elephantiasis. On the boat trip to Rotuma, two women with elephantoid swelling on the arm were returning from having received medical treatment in Suva. The most advanced case of elephantiasis observed during the one year study period was that of a school teacher named Kafoa, from Itumuta. Kafoa got elephantiasis while working in the Vatukoula mines in Fiji during the 1950s. And although he had various types of treatment, including the surgical and bandaging methods, none of these measures helped to slow the development on his leg.

Elephantiasis is referred to either as fefe (the Rotuman term) or tauna (the Fijian term). Few Rotumans make the association between elephantiasis and the earlier stages of filariasis. Of the 8 individuals interviewed who had elephantiasis, excepting Kafoa who was very knowledgeable about the disease stages, none of them made this association. Many others, including 2 public health nurses and 3 of the staff nurses, did not make an association between filariasis and elephantiasis. One thing that most people recalled about the lectures given by the antifilariasis team was the picture on the brochure which shows a Rotuman woman with elephantiasis. This brochure has recently been reprinted into the Rotuman language.

All of the men and women with elephantiasis are over the age of 40. One man has elephantiasis on both legs, the remainder have the
from Itumuta who both have elephantiasis of the leg, the others are the only member in their families to have been afflicted. In one case a woman who had just given birth in Malhaha had elephantiasis of the arm. The cause of her elephantiasis was said to be related to her giving birth at such a late age.

People with elephantiasis go about their daily activities no differently than anyone else. They are not teased or ridiculed. They may even have special services rendered because of their affliction, but only when the need arises. As in Fijian society, they are active members of their communities and receive little or no attention for their physical disabilities.

Although current behavior towards filariasis and elephantiasis tells little of traditional Rotuman medical practices prior to contact, there are remnants of beliefs and practices which still direct the course of the disease. One area where tradition determines behavior is in social and economic activities which bring people into contact with vector mosquitos.

**Vector Density and Human Activity in Motusa village**

Easy access to the villages - both because of the short distance and the lack of formal procedures for visiting with people - allowed me to gather data in a relatively short time period. The primary study area was Motusa village (see figure 6.2), however, interviews and observations were carried out throughout the districts of Malhaha and Ituti, which are on either side of the government station (Ahau). Although the basic physical structure of Motusa is similar to other villages, distance to the gardens, pig sties and other community
villages, distance to the gardens, pig sties and other community activities varies throughout Rotuman villages. I also had access to medical records and data for the entire island.
Figure 6.2 Motusa Village
Unlike Fijian villages, Rotuman villages are more dispersed. Houses in Motusa are spaced further apart and most outhouses are located at the regulation distance of at least 20 meters from the house. Kitchens often adjoin the main house, but some of the bure type dwellings, as in Fijian villages, still have separate kitchens. Sand or well maintained lawns cover the grounds surrounding the house. Landscaping is generally not a feature of Rotuman homes, but decorations with stones, shells, bottles and flowers are not uncommon. Plants used for medicinal purposes may also be grown in the household compound. Fruit trees and other edible plants are generally grown in the gardens.

Mosquito samples were regularly collected from Motusa and were taken from all the other areas visited. Two of the vector species, Ae. rotumae and Ae. polynesiensis, were easily identified. The remaining species (Ae. fijiensis) was identified after my return to Suva. The collection of these species took place over a two week period and periodically thereafter, especially after extreme weather changes, such as heavy rainfall. Vector density was calculated after the sample collections were completed.

Filariasis vectors in Rotuma

There are two known vectors of filariasis in Rotuma - Ae. polynesiensis and Ae. rotumae. Ae. rotumae, the local endemic vector, is believed to be a subspecies of Ae. pseudoscutellaris (Joe Kaisuva, personal communication), and is found throughout the island. A third

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7 Prior to this study, ae. fijiensis had not been found in either larvae or adult samples taken from Rotuma. And although there are numerous pandanus patches in Rotuma, there may be some doubt whether this is ae. fijiensis or another endemic subspecies.
suspected vector may be *Ae. fijiensis*, based on samples taken from Malhaha and Oinafa. In general the leeward side has mosquitos in greater numbers and greater density than the windward villages; samples from Pepjei and Juju villages on the windward side yielded very few mosquitos.

*Ae. rotumae* appears to be the most common vector in Rotuma. It was found in all villages, including several on the windward side. During daylight hours, *Ae. rotumae* is concentrated in and around bush areas and plantations, or in shaded areas. However shortly after rainfall, *Ae. rotumae* comes out in large numbers in the living areas, e.g. village compound, houses, and kitchens which are not being used.

Pig sties are also a popular habitat for *Ae. rotumae*. Here its concentration is in larger numbers than *Ae. polynesiensis*. These pig sties (each village has one) are covered with coconut shells, which virtually form a ground cover. Some of these sties border on the villages, e.g. Hapmak, but most often they are up to 50 meters from the nearest living unit, such as in Motusa.

A common problem I had with identifying *Ae. rotumae*, as with other subspecies of *Ae. pseudoscutellaris*, is the variation in size, shape and color between members of the same subspecies from one end of the island to the other. In Oinafa village which is subject to high winds and is at a far distance from the plantation area, the size of *Ae. rotumae* is much smaller than those in Malhaha, which is protected from heavy winds and the plantations.
are just a few yards from the households. These "smaller" mosquitos also tend to be lighter in color.

**Ae. polynesiensis** - this mosquito is found primarily along the coastal zone of northern Rotuma. The greatest concentration of **Ae. polynesiensis** is in and around Itumuta district, an area that is a popular home for land crabs which live in the sand flats adjacent to household compounds. These crab holes provide choice breeding grounds for **Ae. polynesiensis**; larvae can often be observed floating in water at the entrance to these holes. Other suitable breeding places such as tree holes, empty coconut shells (often scattered throughout the sand flats) and small containers were also found in large numbers.

In addition to Itumuta, **Ae. polynesiensis** was also found in smaller numbers in other areas. It was found in most houses and compounds bordering the sandy coastline, as well as in pig sties. Because of the locations in which it is found, this vector prefers natural (not man-made) breeding grounds.

**Ae. fijiensis** - this mosquito may be a possible vector in Rotuma, however the sample size was too small to determine its true prevalence and effectiveness as a vector.

**C. fatigans** has also been found in Rotuma during previous larvae collections. However, because of the lack of stagnant polluted water, Rotuma does not offer suitable breeding grounds for this mosquito. Also competition from the dominant **Ae. rotumae** may keep **C. fatigans** from becoming an effective filarial vector in Rotuma.
Following the collection and identification of vector mosquitos, boundaries were established for each of the four zones in which human and vector behavior could be observed.

Vector zones

The village of Motusa was the primary area in which human-vector interaction was observed. Social-recreational activities were also monitored at the communal sports grounds in Ahau. Since the people who use these grounds are from Motusa and other neighboring villages, the Ahau activities were grouped into zone 3. Table 6.2 describes the boundaries for each vector zone:

Table 6.2

<table>
<thead>
<tr>
<th>Vector zones in Motusa</th>
</tr>
</thead>
<tbody>
<tr>
<td>household-indoor</td>
</tr>
<tr>
<td>area used as the living and sleeping quarters</td>
</tr>
<tr>
<td>household compound, kitchen garden</td>
</tr>
<tr>
<td>area surrounding the house including</td>
</tr>
<tr>
<td>kitchen 10-20 ft away), kitchen</td>
</tr>
<tr>
<td>garden, latrine, tap water, and rubbish piles</td>
</tr>
<tr>
<td>village compound</td>
</tr>
<tr>
<td>the area within the village; communal,</td>
</tr>
<tr>
<td>social, religious and work places;</td>
</tr>
<tr>
<td>also includes the common sports</td>
</tr>
<tr>
<td>grounds in Ahau</td>
</tr>
<tr>
<td>garden/plantation</td>
</tr>
<tr>
<td>includes pathways leading to work areas,</td>
</tr>
<tr>
<td>pig sties, vegetable gardens, coconut groves,</td>
</tr>
<tr>
<td>and all other areas of activity outside the</td>
</tr>
<tr>
<td>village or on its periphery</td>
</tr>
</tbody>
</table>

Human behavior in vector zones

After the village was divided according to vector zones, human behavior was monitored in each of the four areas. There is a great deal of variation between male and female activities since division of labor
defines which activities are appropriate for which group. There is, however, a lesser degree of difference in activities between age groups, excepting small children and the elderly, who clearly cannot perform certain activities.

Village life is fairly active for six days of the week with the seventh day set aside as the day of rest. Work in the gardens generally took place for six days, although not continuously. The largest blocks of time spent in the garden were on copra collecting days (three days a week); the remaining days involved less time or travel to the gardens.

Activity patterns were monitored for 31 members from 8 households, 6 in Motusa, 1 in Ahau, and 1 in Itumuta. A total of 3 weeks was spent monitoring the daily activities of these individuals. Most of the activities recorded were based on actual observations, however, individual accounts of time expenditure were also included. Since many of the activities are communal, monitoring individuals from the same village was fairly easy. With the exception of copra collection days and pig feeding times, other garden activities were less consistent in terms of "hourly" schedules. Table 6.3 shows the average number of hours spent in a given activity:
### Table 6.3

**Hours of Activity in Vector Zones - Rotuman Males**

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>.5</td>
<td>.5</td>
<td>1</td>
<td>.5</td>
<td>2.5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>3</td>
<td>3.5</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

**Hours of Activity in Vector Zones - Rotuman females**

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>3</td>
<td>1.5</td>
<td>2.5</td>
<td>3</td>
<td>4</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>1</td>
<td>1.5</td>
<td>.5</td>
<td></td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>1.5</td>
<td>.5</td>
<td>.5</td>
<td></td>
<td>1</td>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td></td>
<td>1.5</td>
<td></td>
<td>1.5</td>
<td></td>
<td></td>
<td>2.5</td>
</tr>
</tbody>
</table>

* women who were observed in the garden/plantation areas gathering oranges, helping to carry vegetables and travelling to and from the household compound.

**women who were observed fishing in the lagoon and collecting shellfish along the reef.

The time zones are equivalent to the following hours:

- T1 = 5am - 9am
- T2 = 9am - 1pm
- T3 = 1pm to 5pm
- T4 = 5pm - 9pm
- T5 = 9pm - 1am
- T6 = 1am to 5am

As table 6.3 indicates, men spend more time outside the village compound and women spend most of their day in the household or within the village compound. The division of labor largely determines the use of time in Rotuma. These activity patterns did not vary significantly in the 3-week period. "How" time is used is fairly predictable but "when" a given activity is performed can vary with unforeseeable events such as, extreme weather conditions, sickness, death, and other social obligations. In general, women tend to the cooking, cleaning and caring for children, and men tend to the gardens, house repairs and other heavy...
manual chores. Both women and men enjoy some daily social activities, but these are confined primarily to the evening hours.

The use of time and specific activity patterns as they relate to vector activity are examined in chapter VIII. These activities not only correspond with vector times but also are similar to Fijian activity patterns. In chapter IX, the ethnomedical responses to filariasis as a disease is compared with the Fijian and Indian ethnomedical responses.

**Summary**

This chapter has provided the ethnographic basis for comparing filariasis in the Rotuman community with that of the Fijian and Indian communities. One of the most significant features in Rotuma, in relation to filariasis, is the reliance on copra production. Rotuma is a relatively small island and mosquito vectors are found in fairly large numbers. There can be little doubt about continuous exposure to filarial vectors. Except for young men, most Rotumans adhere to DEC treatment. Monitoring human behavior shows that Rotuman men are more likely to have contact with vectors than Rotuman women.
CHAPTER VII

FIJI INDIANS

The System of Indenture

Indian history in Fiji is comparatively recent. The British brought Indian "coolies" to Fiji in the late 1800's to work the agricultural plantations. As Derrick (1965) suggests, the economic potential of Fijian land may have set precedent for accepting Fiji into the colonial empire. The British hopeful on farming cotton in the islands, encountered problems with using "local" labor. Whether it was out of interest to preserve native culture (Gillion 1962) or to advance the economic powers of the elite Europeans (Robertson and Tamanisau 1988), the British had to look elsewhere for farm labor. Since the colonial government was already importing East Indian labor into Mauritius, Natal, Trinidad and other colonies, Arthur Gordon, then governor of Fiji, decided to bring Indian labor to Fiji. Thus began the recruitment campaign in India with promises of material wealth in a land full of golden opportunity.

Lal (1983) who has written extensively on the indenture process, notes that recruitment was sanctioned by the government of India and that many of the people recruited were already in need of change from their living conditions. Many Indians who came to Fiji were searching for ways to improve their economic status. But recruitment of laborers also involved trickery and deceit. According to Ali (1979), laborers were often tricked into indenture. He adds that some of the recruits were unaware that they were about to cross the great kala pani (black
waters) to a land which was not a part of India. Based on reviews of actual records of recruitment, Gillion (1962) describes the methods and reasons for such overwhelming deceptions by the Indian recruiters.

The laborers were recruited under a system of indenture known as *girmit*. Under *girmit*, laborers were obligated to work for the British for five years at minimal wages. An additional five years of "free labor" (without wages) would allow the laborer to remain in Fiji without having to return to India. After completing the ten years *girmitiya* were allowed to lease land for private use. Approximately 10% of the laborers returned to India (Naidu 1980), but the chance to lease and work their own land was not an option that many had back home. Therefore most Indians chose to remain in Fiji.

The indenture system began in 1879 and lasted 37 years, with 60,969 adults and children migrating to Fiji. According to Lal (1979), a total of 87 voyages bringing laborers were made between India and Fiji. The majority of the *girmitiya* were from the northern states of Uttar Pradesh (known as United Provinces then), Bihar, and Punjab; the remainder were from other parts of India (Mishra 1979).

Indenture was in essence a form of slavery. The labor recruitment process crossed all geographic, ethnic and caste barriers known in India. Once in Fiji, plantation life was geared towards the "group of coolies" and did not differentiate between ethnic, religious and linguistic backgrounds of the laborers. During the initial phase (1879 to 1880), women and children did not accompany their husbands and fathers to Fiji. By 1881 the quota system (initiated by the Indian government) of 30 women per one hundred men went into effect allowing
women to travel to Fiji (Ali 1979). In some cases children were also allowed to accompany their parents. Even prior to arrival in Fiji, boatlife challenged cultural and caste barriers which formed the backbone of Indian society. "Forced integration in dismal, crowded conditions, on ship during the voyages from India, and during the hard early days of indenture, dealt caste consciousness a heavy blow" (Wilson 1979:102). Plantation life was an extension of the cultural degradation experienced on the boats. Plantation houses were dormitory type barracks which were divided into family and bachelor quarters, with several single men sharing one room. Indians were not free to move about the island and were restricted to their "assigned" plantations. There were heavy penalties (beating, extra labor, etc.) and fines for breaking such rules (Naidu 1980). Exploitation of Indian laborers by the European plantation owner was not without assistance from the Indians themselves. Among the most notorious of these slave drivers was the sirdar, the Indian boss who served as the right-hand man for the owners. In the words of Ali:

the Indian sirdar was generally no less exploitative than his European superiors; in many ways he was even considerably worse being frequently their pimp and procurer. In the exploitation of Indians by Europeans the Indian collaborator played a significant role and this cannot be ignored. Indian suffering caused by Europeans was done through Indian collusion, and from the misery of many Indians, some Indians especially sirdars benefited immensely (1979:5).

The indenture system has left some deep wounds among the survivors but the majority of Indians in Fiji, especially those born in the islands, regard Fiji as their homeland. Current political events,
however, may change these feelings⁸. Along with socio-cultural disruption, indenture also had serious health implications for Indians. 

Health Consequences of the Indenture System

Like native islanders Indians were also greatly affected by contact diseases, including those brought onto shore by the girmityas themselves. Dysentery was the most frequent disease to reach epidemic proportions among girmityas (this may be attributed to general ill health resulting from migration and indenture). Unlike Fijians, Indians attended hospital facilities more often (hospital care was included in the indenture agreement), therefore morbidity and mortality data is more complete for indentured laborers than for Fijians. An example of the effects of early diseases on the indentured population is seen in the Legislative Council Medical Report for 1913; this report shows that the number of deaths were higher in the plantation hospitals than in either Colonial War Memorial and/or any of the provincial hospitals. Table 7.1 compares admissions and number of deaths in the various hospitals during 1913:

<table>
<thead>
<tr>
<th>Admissions</th>
<th>Hospital</th>
<th>CWM</th>
<th>Provincial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths</td>
<td>1,681</td>
<td>4,315</td>
<td>18,184</td>
</tr>
<tr>
<td></td>
<td>78</td>
<td>116</td>
<td>263</td>
</tr>
</tbody>
</table>

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⁸ Indian migration from Fiji has increased since the first political coup in 1987; leasehold land use and land ownership has reverted back to Fijian control.
Along with dysentery, tuberculosis and diseases of the respiratory and digestive systems, venereal disease was also common among girmitiyas. Indians were susceptible to the same diseases as native Fijians, but immunity built up as a result of prior exposure to some of the same diseases in India gave Indians an advantage over Fijians. Indians were, however, equally susceptible to new strains of old diseases i.e. dengue fever, and combined forms of old diseases, i.e. dysentery and hookworm infections, for which prior exposure offered little or no protection. Venereal diseases, especially syphilis, was one of the "new" diseases which easily developed into epidemic levels in the plantations (Manning 1985).

Filariasis is one disease to which Indians had some prior exposure. Both Brugia malayi and Wuchereria bancrofti are highly prevalent in India (Dasgupta 1978). The former is a urban infection, whereas the latter, as in Fiji, is primarily a rural infection. Filarial fever, lymphangitis, funiculitis, chyluria and elephantiasis are common forms of filarial diseases throughout India (Sasa 1976). Hydrocele infections are not found in India. Prior exposure in the case of filarial disease, gives little protection from new filarial infections. In fact it may have the opposite effect. Since there may be geographical variations in W. bancrofti (Ottesen 1984), it is quite possible that Indian laborers introduced new strains of microfilariae into Fiji. Although Indians seem to be equally susceptible to filarial infections as their Fijian counterparts (Nelson and Cruikshank 1955), Mataika (1971) found that elephantiasis was more common in Indians than Fijians. Also periodicity which may show variations in ethnic
microfilarial prevalence, has not been comparatively measured in both groups.

More so than any other factor, it appears that the poor health of Fiji Indians can be attributed to the living conditions on the plantations. The barrack type housing set up by the plantation owners were not intended to be comfortable living quarters. They were temporary structures to be used primarily as a place to eat and sleep. These houses were often very crowded and lacked proper sanitary measures, i.e. waste disposal, etc. (Coulter 1942). Indians who were no longer bound to indenture and could afford to settle on their own land, were healthier than their counterparts living in plantation housing. In his report to the Ministry of Health, A. R. McClurkin, then DMO of Bua District, submitted the following:

The time-expired Indians living in the district are mostly hardworking and optimistic and therefore, as may be inferred, comparatively healthy. Certainly the relative good health which most of them enjoy is not due to the sanitary conditions in which they live but is in spite of them, it is to be attributed in part to the fact that their houses are generally far apart and thus infectious and contagious diseases do not readily spread and partly to their industrious proclivities. The hopeful mental outlook of the time-expired Indian must also be a considerable factor in keeping them healthy (1913:49).

One aspect of Indian health which cannot be adequately discussed here is the social and psychological impact of indenture on the various ethnic groups. Some of this was evident in the breakdown of cultural and caste barriers resulting from sharing the same living quarters. However, the effects of psychological and social despair of Indian laborers have not been measured in terms of how these may have influenced the disease patterns in the plantations. This oversight may
taken for granted that Indians would eventually adapt, particularly if they did not desire to return to India. The British officials did, however, keep records of criminal activities for some of the plantations. By reviewing government records, Naidu (1980) found that rape, indecent assault and suicide were common both within the plantations as well against plantation laborers. He also found that suicide was a leading cause of death. In retrospect, morbidity and mortality due to disease should not be considered apart from the social and psychological despair experienced by Indians. Accounts of suicide and violence paint a very grim picture of plantation life.

Fiji Indians Today

India can live and grow by spreading overseas--not the political India, but the ideal India" (Tagore in Manoa, 1979).

Tagore's words are echoed throughout Indian migrant communities. Subramani (1979), discusses how Indian migrant communities, even several generations after resettling, retain cultural ideals of their motherland. In particular he addresses the Fiji Indians attachment to cultural ideals which were brought in by the first generation girmitiyas. Throughout the writings of novelist V.S. Naipaul (1984), traditions are found among Indian migrant groups who left prior to great social and economic changes (mainly those resulting from independence from Britain) which themselves no longer exist in India. The Indian community of Fiji exemplifies how tradition and culture are perpetuated by a migrant population. These traditions are equally important in matters concerning health and disease.

Among the Indian traditions easily replanted into Fijian society (and indeed the reason for migration in the first place) were economic
Among the Indian traditions easily replanted into Fijian society (and indeed the reason for migration in the first place) were economic practices used back in India. Economic practices relating to agriculture, commerce and trade, which continue today are examples of knowledge transferred from the motherland. Social and religious practices such as marriage ceremonies, kinship bonds, firewalking, etc., are all remnants of the Indian cultures of India. The use and persistence of the Ayurvedic medical system is yet another example of cultural practices which were transplanted to Fiji. Little cultural assimilation has taken place with Fijians or other islanders. After an initial decline of the population resulting from disease and other factors relating to indenture and migration, population growth/reproduction has stabilized.

Indians are the largest ethnic group in the islands. Prior to Independence, the Indian majority made up 52% of the population; however since Independence, migration to other countries, especially New Zealand, Australia, Canada and U.S. has escalated. In fact the only factor deterring a greater migration is the quotas which the host countries have set against the incoming migration of Indians. As of 1986, the Indian majority made up 49% of the total population.

Indians also outnumber Fijians and Rotumans in the urban settlements (although a higher percentage of the total Rotuman population are urban dwellers, Fiji census for 1986). Urban areas are characteristic of the movement away from traditional extended family networks towards nuclear individualized or egalitarian family units (Deo and Schoeffel 1987). This is partially reflected in the single-family
type dwellings which are common in the towns. Social change is also occurring in rural areas. Brenneis (1984) discusses how change is being incorporated into the traditional *pancayat* method of arbitration in a rural town in Vanua Levu. He addresses the ideological changes resulting from the teachings of the liberal Hindu sect known as *Arya samaj*.

Changes such as those observed by Brenneis are directed more towards men. Indian women still have a lesser voice in the public arena. Indian society is both patrilineal and patrilocal. Traditionally, Indian boys would marry and continue to live in their parents household. The eldest boy would eventually take the father's place as head of household in all matters concerning the family. It was, and still is, a system based on primogeniture. Traditions such as these are most likely to be maintained by rural households which are dependent upon family cooperation for income. Households dependent on agriculture as their primary source of income often involve participation by all family members, including women and children. A study by Anderson (1969) on labor investment on small farms in Southern Viti Levu, shows that rural Indian families rely on household labor for various aspects of agricultural production. The households selected by Andersen were typical of Indian small farms in Fiji. Ethnographic data also supports Anderson's findings. In rural areas, farming is the basis of economic survival. The rural situation is one which fosters

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9 The *Arya Samaj* is a reform movement founded in India in 1875. It is very critical of the elaborate ritual and some of the beliefs and social regulations of traditional Hinduism (Wilson 1979). This sect has played a significant role in education, especially of women.
cooperation by a large group of people. These households in general tend to be larger, i.e. the value of children is greater among farmers than among urban families.

The one prerequisite to living in the rural areas seems to be the acquisition of land. The majority of Indian land in use is leasehold property with 20 to 99 year lease agreements; only 7% of the land is actually owned by Indians in Fiji (Social and Economic Indicators for Fiji, 1984). Most Indians who maintain a traditional lifestyle and continue to live in rural areas are those who can make a successful living off the land on which they live. Thus the ownership/use of land may indirectly help to maintain traditional family networks found in rural areas.

Indians are a powerful economic force in the islands. Coulter's observations in 1942 which described the importance of Indians in commerce and industry are still true today. The economic practices of Indians has changed relatively little since they established themselves in the islands. For the most part Indians continue to be involved in indenture crops such as sugar cane and rice. Independent cane farmers have taken over supplying the sugar industry since the closing of the Colonial Sugar Refining Company (CSR) in 1973. Indians are also more involved in commerce than their Fijian counterparts. Their role in Fiji's economic industry is unquestionable.

Agriculture is the primary and often the economic mainstay of rural Indian families. Four types of agriculture predominate rural

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10 According to Ali (1979), 80% of all sugar cane farmers are Indian.
Indian settlements: 1) monoculture; 2) mixed agriculture; 3) mixed agriculture and animal husbandry; and 4) subsistence agriculture. The latter two are most common. Monoculture is an exclusive practice of a minority of Indians who are wealthy enough to maintain a large piece of land and hire wage labor. The most common monocrop is sugar cane, followed by rice and wheat (Anderson 1969). While sugar cane is grown on the dry sides of the island, rice is grown in rich alluvial valleys such as Navua and Nausori. Fiji is 50% self-sufficient in wheat flour and most of this is provided by local Indian farmers (Deo and Schoeffel 1987).

Most Indians living in the rural areas keep their own dairy animals. Dairy products are used for household consumption as well as for supplementing household income. Families are also known to borrow cows from relatives and neighbors in order to provide milk to children in the household. Bullocks may also be borrowed or rented for plowing the land. Bullocks still serve as the fuel efficient vehicles for plowing the fields, transporting farm supplies, and threshing rice (cows are also used for this). More so than cows, bullocks are a necessity for Indian farmers. Subsistence agriculture often takes the form of kitchen gardens and is a common practice for all rural families and many urban families who have enough yard space to maintain a garden. Indian families living in the urban areas maintain kitchen gardens for growing important herbs and medicinal plants, chili peppers, eggplant, tomatoes, etc. Kitchen gardens are larger in rural areas and may extend up to half an acre as seen in Wainibokasi. In addition to supplying basic herbal needs, vegetable products for daily household consumption are
also grown in these large gardens. Farmers whose gardens provide much of their household vegetable needs rarely travel to the marketplace to obtain fresh produce. Instead they frequent the marketplaces to trade or to sell their own products.

Where filariasis is concerned, methods used to transform the physical environment are critical to contact with disease vectors. By maintaining traditional means of material culture (house construction), economics (rice and sugar cane cultivation), and ethnomedicine (Ayuverdic rules for avoiding harmful disease agents) Indians have been more successful in avoiding contact with the mosquito vectors of filariasis.

Traditional Indian medicine

Traditional Indian medicine consists primarily of the Ayurvedic and Unani medical practices. Ayurvedic\(^\text{11}\) medicine is mostly used by Hindus, while Muslims subscribe to Unani medicine. There is also a limited amount of borrowing and exchange of medicines between the two groups of Indians, as well as with Fijians.

\textbf{Pundits}\(^\text{12}\) are the primary healers in Indian communities. Maulvis fulfill a similar priest-healer role in Muslim communities (however, the extent to which they serve as healers is unclear). Aside from their traditional religious role as priests, Pundits also perform the widest

\(^{11}\) Although aspects of the Siddha medical system still persists among Tamil speaking South Indians, it is difficult to distinguish how they specifically differ from Ayurvedic medicines.

\(^{12}\) People who have mastered the Vedas and the arts and sciences of the Hindus are called Siddha, Rishi, Yogi or Sanyasi (Iyer 1981). These are the teachers of the Pundits, and can themselves be sought out for health related needs.
outnumber all other healers in Fiji (Prasad 1974). Their specialties range from being strictly ceremonial, i.e. weddings, to including healing rituals. Therefore, not all Pundits are healers and a distinction exists between those who know and perform healing acts vs. those who only perform pooja (healing rituals) ceremonies. The terms pujari (masculine) and pujarin (feminine) are also used to describe one who performs healing rituals.

Other Indian healers include bonesetters, seers, practitioners of sorcery and magic, and dais (traditional midwives). There appear to be fewer herbalists in Indian communities than in either Fijian or Rotuman communities. However, the use and cultivation of medicinal plants are common knowledge in Indian households. The major difference between traditional Indian medicine and traditional Fijian and Rotuman medicine is that Indian medicine entails religious observances, practices, foods, etc. which the other two follow to a lesser extent. Like Hinduism, Auyervedic medicine, has persevered in spite of modern biomedicine and Christianity.

Coping with Disease: Filariasis in the Indian Community

While Indians differ from Fijians and Rotumans in their social and religious observances relating to health and illness, their use of biomedicine is equal to if not greater than the other two groups. Morse (1981) found that Indian women were more likely to seek out medical advice relating to pre-natal care than Fijian women. It is the use and persistence of traditional health care systems which differs between island cultures. The Auyervedic medical system is part and parcel of the Indian socio-cultural system. The strength and persistence of
the Indian socio-cultural system. The strength and persistence of traditional health care arises from a basic level of cultural foundation. It is difficult to compare the Ayurvedic medical system with indigenous forms of ethnomedicine since history, training and practice of Ayurveda makes it more comparable to the larger western biomedical system. The study of Ayurveda is a scholarly pursuit; vedic teachings differ little from formal training at institutions of biomedical training (c.f. Iyer 1981). Ayurvedic medicine is in text form and defines diagnosis and treatment for illnesses. This may be a major reason why Ayurvedic medicine survives among Indian migrants.

Disease theories of Indians reflect the beliefs of their socio-cultural world. Unlike the secularization of the traditional medico-religious beliefs of Rotumans and Fijians, Indians hold on to the sacred in their world. This can be both helpful and harmful. Morse’s (1981) conclusions were that even with greater use of biomedical services, traditional beliefs and practices of treating pre-natal health between Indian and Fijian women was the main reason for higher morbidity and mortality in the former. Because pre-natal health is associated with shame, pregnant Indian women receive little or no support from the family or community to help them through their pregnancy; the opposite is true for pre-natal health among Fijian women. Similarly, Indians are more likely than Fijians or Rotumans to cooperate and accept DEC treatment for filariasis. This may be due to the belief that mosquitoes are harmful and can carry disease but may also relate to the stigma attached to elephantiasis which most Indians wish to avoid (this issue is further elaborated on page 28).
The range of causal explanations for filarial disease varies with geographical, economic and social issues. People living in the urban areas were generally better educated and were more likely to associate filariasis with some natural cause, i.e. exposure to excess cold, rain, etc. These people were also more likely to seek out biomedical services because of their close proximity to medical centers. Another factor which shows a geographical variation in causal explanations is that people who live in areas where they are more likely to witness filarial infections such as in Wainibokasi, tend to associate Fijians with the disease more than Indians. Differences in causal responses may also be due to religious beliefs. For instance, one Muslim student stated that her Appa (father) often got ill with filarial fever like symptoms when he attended the mosque in Sigatoka, which is much further from their home in Navua. Similarly two Hindu women believed that their husbands had filarial fever because of their neglect of pooja ceremonies.

Explanations also differ with the choice of healer. A total of 67 individuals who either had filariasis or knew of others who had experienced the symptoms, were asked for their individual causal explanations. Table 7.2 lists the responses of these individuals:
Table 7.2

Causal Explanations for Filariasis

<table>
<thead>
<tr>
<th>Cause</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evil doing/wrongdoing on the part of the affected individual</td>
<td>10*</td>
<td>15</td>
</tr>
<tr>
<td>A native Fijian disease which only afflicts those who fraternize too much with the islanders</td>
<td>7*</td>
<td>2**</td>
</tr>
<tr>
<td>A symptom of an earlier disease which wasn’t treated properly</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Inherited from another family member</td>
<td>3*</td>
<td>1**</td>
</tr>
<tr>
<td>Caused by someone else seeking revenge</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Don’t know the cause</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Mosquito borne</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>36</td>
</tr>
</tbody>
</table>

* includes men who were referring to eyewitness examples
** includes women who were referring to eyewitness examples

Women attribute the disease to malevolent causes more than men who more often refer to eyewitness examples. Overall, evil or wrongdoing was thought to be the major cause of filariasis. The second most common explanation relates the disease to symptoms or problems relating to other diseases. For instance, of the men and women who gave this response, 8 of them recalled earlier forms of a disease (which may have been another disease but may also have been recurring filarial fever) including diabetes, which they thought led to filariasis. Two people also made the association of filarial disease (including elephantiasis) with the migration of indentured laborers. They recalled someone either having or being told of having symptoms similar to those of filariasis and elephantiasis.

Referring to filariasis as a Fijian disease was also a common response. Several people in the Wainibokasi area and two men from Navua
gave this response based on seeing "more" Fijians with the disease than Indians. None of these individuals themselves had experienced filarial diseases.

Treatment for filariasis

Of the 24 known cases of filariasis, 21 of these individuals had or were currently taking DEC. The remaining 3 either never completed the first course of DEC or did not return for treatment after the initial visit. Interestingly, all three individuals do follow the social behaviors prescribed by the traditional healer.

Even though biomedical care is more accessible in the urban areas, traditional healers are still widely used by all segments of Indian society. For filariasis both traditional and biomedical care are used; this may be a general pattern of health seeking behavior rather than one specific to filarial infections. To the best of my knowledge, no Indians had visited the Filariasis Laboratory in Suva during the first 6 months it had been in operation. This may be due to lack of medical referral to the Laboratory or because DEC is just as easily obtained at most local medical/health care centers.

There is no contradiction between biomedical care and traditional health care, the two complement one another as the power to heal the symptoms and the power to heal the individual. In short, traditional Indian medicine is highly personalized and in addition to treating the biological symptoms, it also aims to treat the social and psychological being. Since filariasis, like many persistent infections, is attributed to social causes, methods such as pooja ceremonies can involve entire
families and social groups. *Poojas* impose certain dietary and social restrictions and often the entire household will be affected.

Is there a notion of prevention?

Preventive measures against mosquitos are numerous. Measures are taken to prevent entry of mosquitos into the homes as well as to prevent against the bites of mosquitos. The perception that mosquitos are harmful pests is not necessarily based on their role in the transmission of filariasis; mosquito bites, because they break the skin and draw blood, are believed to cause sores. It is more difficult however, to conceive of mosquitos as vectors which carry other animal forms i.e. the filarial nematode. The small size of the mosquito may add to misconceptions about its ability as a transmission source. The recognition that mosquito bites can lead to infections, regardless of the lack of understanding about the transmission cycle of filariasis, acts as incentive for taking precautions.

Preventive measures which were recommended by the antifilarial team are still practiced. Household compounds are usually kept cleared of bush and discarded materials (although some households still empty trash close to the household compound). Clothing often serves as additional protection. Indian women often wear saris (which is a multiple wrap from waist down) in and around the households and long skirts when out in the gardens and farms. Indian men are not as fully clothed but are rarely shirtless when working in the farms. Observations of clothing patterns across the three cultures are discussed in chapter VIII.
Elephantiasis in the Indian community

There is little or no association made between filariasis and elephantiasis. Filariasis falls in the short-term curable category while the permanent disfigurement resulting from elephantiasis is thought to be brought on by more "serious" causes. Any chronic disease which manifests itself with disfigurement is automatically placed in a serious category. Fear and shame are common reactions to its symptoms. Death is often a lesser means of punishment than permanent disfiguring. A person who suffers from elephantiasis is viewed as a constant reminder of the punishment incurred for serious wrongdoing. As demonstrated by Sontag in *Illness as Metaphor* (1978), fear of diseases such as tuberculosis and cancer, increases with the mysterious nature of their occurrence. Elephantiasis is in many ways, a mysterious disease whose occurrence is unpredictable and invisible. Yet elephantiasis is also a disease which the Indian associates with a great deal of shame.

Those who suffer from elephantiasis are social outcasts. Reactions towards these individuals can range from unsympathetic to condemnation. They may be isolated by their own families. Public reaction towards elephantiasis is avoidance; even talking with these people may be considered improper public behavior. In sum, Indian reactions towards elephantiasis closely resemble Sontag's (1978) metaphorical descriptions resulting from the mystery (origin unknown, transmission not understood) surrounding cancer.

One Indian man who seems to have braved the reactions of the Indian community towards his illness is 49 year old Krishna Sami from Savusavu, Vanua Levu. He has advanced elephantiasis (the dermal layer
has become very thick) on one leg. He recalls getting fevers as a young man on the coconut plantation and attributes the disease to sharing food and sleeping quarters with Fijians who had elephantiasis. Because of his disability, he now works for the Public Works Department (PWD). Although one leg is much heavier than the other, Krishna peddles about town on his bicycle; he finds biking to be more comfortable and a more efficient means of transport than walking (he also cannot drive automobiles with foot pedals).

I met only 2 Indian women who had elephantiasis; both had swellings in the arm. These women lived close by one another in Savusavu but rarely visited each other, in fact they rarely left their homes for any reason. These women had almost no contact with the outside world including never having attended the hospital or the health clinic. They were also somewhat reluctant to speak with me but eventually both told me that their elephantiasis was caused by malevolent spirits. They were visited about once a year by the Fijian public health nurse.

The effects of elephantiasis on individuals and families has been well described by Rao, who notes that "psychological disturbances, marital problems and physical disability due to filarial swellings have serious socioeconomic consequences for the individual and the family in India" (1978:5). There is little reason to believe that the reaction to elephantiasis is any different in the Indian community in Fiji. With the exception of better economic standards for some, Indians in Fiji demonstrate similar attitudes and behavior towards this disease as the Indians whom Rao is describing.
Vector density and Human behavior in the Study areas

Two Indian communities - Waidova and Wainibokasi - were selected on the basis of their proximity to Fijian villages which have high prevalence of filariasis and because these communities themselves are known to have vector mosquitos. Waidova was selected especially because it borders on an area which has a high density of the endemic vector Ae. fijiensis. Because previous microfilariae surveys did not include entire Indian communities (only selected individuals were surveyed), it was difficult to determine communities which themselves had microfilariae prevalence. In the case of Waidova, hospital records indicated some individuals who had filarial disease.

Waidova settlement

Waidova is approximately 1.5 kilometers from Vunibau village, in the district of Navua. There are 35 households in Waidova, with a population of 252 (237 Indians and 15 Fijians, Navua Medical Center Report for 1985). Figure 7.1 shows a physical description of Waidova.
Figure 7.1 Waidova Settlement
This is a clustered settlement lying along the banks of Navua river, opposite Navua town. The primary means of transportation into Waidova is by boat; one-way fare is 10 cents. An unpaved road which Waidova shares with Vunibau village leads into town via the Navua bridge. Since the road itself is over 2 kilometers from the settlement and bus service is available only from the main road (1.3 km. from the settlement), boat transportation is the fastest and easiest means of transportation.

The flatlands of Navua with its rich alluvial deposits are best suited for rice agriculture, thus the primary economic activity in Navua is seasonal rice cultivation (harvested in the summer). Most Indian farmers own their land (farm sizes vary between 1 to 9.5 acres) and maintain the paddies, while the Rewa Rice Company seeds the fields, harvests the rice and compensates the farmers. The rice which is left behind by the harvesters are collected for household consumption. In addition, sugar cane and corn are grown on a large scale basis; there are also two dairy farms in the area. Supplemental income is derived from fishing, courier-taxi and boat-taxi services.

Most of these farmers are Mandrasis (South Indians), a few are Hindus. Although hindustani is spoken by both groups and both share the same mandirs (temples), many Mandrasis also speak malyalam. I have known most of these families for 30 years and although Mandrasis and Hindus have been neighbors for many years, intermarriage is rare between the two groups. There is a very strong community bond among Waidova residents which resembles exchange and cooperation much like kinship networks. Another interesting feature of Waidova is that most of the
married children still live with their parents; this includes both sons and daughters.

Most homes in Waidova have a household temple or shrine within the home or household compound (although 3 families have their shrines across the street on the banks of the river). There are no Christians in Waidova with the exception of the two Fijian families who are Methodists. Religious activities are part of the daily life in Waidova and celebrations such as marriages, baptisms, etc. are very important community events. Although such occasions are celebrated with much fervor, there appears to be less time spent in daily leisure activity in Waidova than in neighboring Vunibau (this may also differ because of the seasonal demands of farm labor). All of the children attend school in Navua town. Several boatloads of students are transported to and from school daily. As in Beqa, post high school education can only be obtained in Suva. Families often make arrangements for children to take up residence in Suva (usually with relatives) or provide daily transportation back and forth to Suva schools.

Waidova, like Vunibau, also has a health worker who provides the basic medical supplies. Waidova residents also have easy access to Navua hospital. In terms of modern medical care, health education with special emphasis on preventive medicine is a major part of health care delivery at Navua Hospital. The medical team, under the direction of Dr. Solano (originally of the Philippines), is required to practice and teach health education measures as part of the routine medical services. A miniature model home (showing approximate location of latrines, household compound area, kitchens, etc.) and home garden have been
erected next to the Hospital (on the hospital compound) as an example for Hospital patrons.

Filariasis vectors in Waidova

*Ae. pseudoscutellaris* - this is the most common vector in Waidova and is found in large numbers in and around homes. There are many potential breeding grounds, i.e. outhouses, small containers, drainage ditches and water catchments along the rice paddies. It may compete for breeding grounds with *Ae. vexans* (was found to have the highest density levels in the Navua area), which also prefers clean stagnant water such as that in the rice fields.

*Ae. fijiensis* - this vector is also very prevalent in Waidova. Pandanus groves which border neighboring Vunibau village serve as its principal breeding grounds. Some Indians also grow taro which may serve as breeding habitats for this mosquito. *Ae. fijiensis* can be found both in the houses as well as outdoors. It is, however, found in smaller numbers in Waidova than in Vunibau.

Wainibokasi Settlement

Wainibokasi settlement lies on the edge of the Rewa delta, in the district of Nausori. Unlike Waidova, Wainibokasi covers a large area with a highly dispersed settlement pattern. Farms sizes on the average are about 5 acres but some are as large as 50 acres. There are approximately 430 farmers (Wainibokasi Hospital records). Figure 7.2 shows the physical description of Wainibokasi.
Figure 7.2 Wainibokasi Settlement
The community borders on the Rewa river to the west and Wainibokasi river to the east but the primary means of travel is by car or bus; the rivers are seldom used by Indians. Rice farming is the primary agricultural activity in Wainibokasi. This area was once used exclusively for sugar cane (when CSR was in operation), however, heavy sedimentation from clay deposits have left the delta area suitable only for rotational crops (Anderson 1969). In addition to rice a variety of fruits and vegetables such as squash, beans, tomatoes and cucumbers are grown as cash crops. There are also several dairy farms in the area. Additional means of income come from jobs in nearby Nausori town, the Nausori Airport, and taxi-courier services. Like other large Indian communities, Wainibokasi residents vary a great deal in income and social status, from the very wealthy to the very poor.

With the exception of a few Muslim families, Wainibokasi residents are mainly Hindu. Social life revolves around family life (kinship networks are a strong element of Wainibokasi social structure) and religious activities, whether performed at home or in the community temples. There are 9 Pundits and 3 women healers in Wainibokasi, all of whose sole source of income comes from their medico-religious practices. The number of healers in Wainibokasi outnumber those in Waidova, where there is only 1 female healer (she’s also a fortune teller) and 2 Pundits; the remainder are in Navua town.

There are several schools throughout the Nausori area, which are attended by Wainibokasi children. In Wainibokasi itself, there is only a small school (56 students) for grades 8 through 10. Most of the students travel to and from school by bus, family car or taxi. Although
the town of Nausori is bordered in all directions by Fijian villages, segregation still exists in the schooling system; Fijians attend Fijian schools and Indians attend Indian schools.

Wainibokasi Hospital is in the center of town, along the banks of Wainibokasi river. The medical staff consists of a doctor, a dentist, 6 public health nurses and 8 staff nurses. This is a very small Hospital and emergency cases are usually referred to Nausori Hospital, which is just 7 kilometers away. Wainibokasi Hospital has a small motorboat which allows the doctor and the public health nurses to visit the many villages in the Rewa delta. Indian residents of Wainibokasi mostly attend Nausori Hospital or private doctors in Nausori town because they feel that Wainibokasi Hospital is primarily a service for the villages in the Delta.

Filariasis vectors in Wainibokasi

Ae. pseudoscutellaris - this vector is highly prevalent throughout the settlement and neighboring villages. Again, encroaching bush, vegetable gardens, small containers, and water catchments are all probable breeding sites. The dumping of household rubbish alongside the compounds is very common, this includes cans and containers which provide breeding grounds for Ae. pseudoscutellaris. Also this mosquito has been known to breed in brackish water which is characteristic of the water channels throughout the delta.

Ae. polynesiensis - this vector is more common in the villages and in Indian households which border the villages. It was also found on household compounds which have a large number of coconut trees.
C. fatigans - this vector was found in very small numbers in several collections throughout Wainibokasi. It was also found indoors during evening hours. Drainage ditches alongside the houses may be serving as a main breeding grounds since mosquito larvae, assumed to be C. fatigans, are abundant in these ditches.

Vector Zones

Rural Indian settlements differ from most Fijian villages in land use patterns. Wainibokasi typifies Indian settlements in Fiji, in both the amount of land area and the wide dispersal of homes. Prior to the Rewa Rice Mill’s cooperative scheme, Waidova was also a dispersed settlement. Farmers resettled along the river as a way of freeing their land for rice cropping. One of the most significant differences between Wainibokasi and Waidova is that in the former gardens and plantations may serve as the boundaries between household compounds, whereas in the latter the row of homes is separated from the gardens and plantations by a levee. Because of its small size and proximity of homes to one another, Waidova resembles the smaller and closer communities which are characteristic of Fijian and Rotuman villages. Table 7.3 shows the boundaries for vector zones in Wainibokasi and Waidova do not differ significantly.
Table 7.3
Vector zones in Waidova and Wainibokasi

<table>
<thead>
<tr>
<th>Zone</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>household-indoor area</td>
<td>used as the living and sleeping quarters, including indoor kitchens</td>
</tr>
<tr>
<td>household compound area and kitchen garden</td>
<td>surrounding the house, including, kitchen garden, prayer shrines, chicken enclosures, outhouses, and showers</td>
</tr>
<tr>
<td>community compound</td>
<td>the entire area within the settlement, including social, religious and work places, boat docks and milking areas. Wainibokasi settlement boundaries include the high school and Wainibokasi hospital</td>
</tr>
<tr>
<td>garden/plantation</td>
<td>includes pathways leading in and out of the settlement, vegetable gardens, rice and sugar cane plantations, and rivers and irrigation ditches used for fishing and gathering shrimp.</td>
</tr>
</tbody>
</table>

Human Behavior in the vector zones

Human behavior was monitored in all four of the activity zones described above. This was done by selecting 5 households from each of the settlements and following the activities of the household members for a period of 7 days each. Activities of the "economically productive" group were given special attention because these individuals spend time in several vector zones throughout the day and hence come into contact with all of the vectors in their given environment. Whereas exposure of children and elderly caretakers was often limited to the settlement compound, household and schoolyards. Table 7.4 shows the hours of activity/exposure of males and females from Waidova and Wainibokasi, respectively.
Table 7.4
Hours of Activity in Vector zones - Waidova Males

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>.5</td>
<td>.5</td>
<td>1.5</td>
<td>3.5</td>
<td>4</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td></td>
<td></td>
<td>.5</td>
<td>.5</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>3.5*</td>
<td>4*</td>
<td>3.5*</td>
<td>1</td>
<td></td>
<td></td>
<td>12/24</td>
</tr>
</tbody>
</table>

*hours spent working in the rice, sugar and corn fields, part-time work providing taxi-service in Navua town, and time spent in one's own garden

Hours of Activity in Vector zones - Waidova Females

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>2</td>
<td>1</td>
<td>1.5</td>
<td>3.5</td>
<td>3.5</td>
<td>4</td>
<td>15.5</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>.5</td>
<td>.5</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td></td>
<td></td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td>.5</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>1*</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>5/24</td>
</tr>
</tbody>
</table>

*includes women tending to animals and working in the rice fields.

Hours of Activity in Vector zones - Wainibokasi Males

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>1</td>
<td>1.5</td>
<td></td>
<td>2.5</td>
<td>2.5</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td></td>
<td>.5</td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>2.5</td>
<td>3</td>
<td>3.5</td>
<td>1</td>
<td></td>
<td></td>
<td>10/24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector zone 1</td>
<td>2.5</td>
<td>1</td>
<td>2</td>
<td>2.5</td>
<td>4</td>
<td>3.5</td>
<td>15.5</td>
</tr>
<tr>
<td>Vector zone 2</td>
<td>1.5</td>
<td>.5</td>
<td>1</td>
<td>.5</td>
<td>.5</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Vector zone 3</td>
<td>1.5*</td>
<td>.5</td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>Vector zone 4</td>
<td>1*</td>
<td>.5</td>
<td>.5</td>
<td></td>
<td></td>
<td></td>
<td>2/24</td>
</tr>
</tbody>
</table>

*includes time spent tending to animals
**includes women who spent time in the town and market areas.

The time zones are equivalent to the following hours:

- T1 = 5-9am
- T2 = 9am-1pm
- T3 = 1-5pm
- T4 = 5-9pm
- T5 = 9pm-1am
- T6 = 1-5am

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The sample included 17 men from 6 households in Waidova, and 20 men from 7 households in Wainibokasi. The activity patterns of Indian men from both Waidova and Wainibokasi indicate that they spend most of the daytime hours away from the settlement. Men from Waidova, in particular, spend more hours away from the household because they often have part-time jobs, i.e. taxi-service, in Navua town. Seven of the men in the sample, 4 from Wainibokasi and 3 from Waidova, were bus drivers for the local bus company. Their hours varied from 9 to 11 hours per day.

A total of 34 women were surveyed - 18 from Waidova and 16 from Wainibokasi - from the same households as the men. Indian women spend more time in and around the household than in any other vector zone. Women from Waidova spent more time working in the gardens, rice fields and tending to goats and cows than the women in Wainibokasi. The women from Wainibokasi tend to have more leisure time to visit the town, neighbors, etc. Women from both communities, however, spend an average of 30 minutes to an hour performing morning or evening poojas. The shrines are located both indoors and outdoors.

Summary

This chapter has provided the ethnographic basis for comparing filariasis in the Indian communities with that of the Fijian and Rotuman communities. Indian settlers have retained and replanted their social and economic traditions into Fiji. Their economic practices are such that they have little exposure and contact with vector mosquitos. Indians also retain traditional medico-religious practices which are
used in treatment and prevention of filarial disease.

In the following chapter, human behavior - activities and times spent in each of the four vector zones - in these Indian communities is compared with human behavior observed in the Fijian and Rotumans communities. In addition to actual activity patterns, other cultural practices such as the amount of clothing, location of kitchens, and household types, are also compared in order to determine the differential contact and exposure each of these groups have with vector mosquito.
SECTION THREE

THE SIGNIFICANCE OF HUMAN BEHAVIOR IN THE ECOLOGY OF FILARIAISIS

A cross-cultural comparison of human contact with vector mosquitos and health seeking behavior reveals that exposure to the same disease in the same place does not necessarily lead to the same disease pattern. The two chapters in this section look at specific ways in which the disease cycle of filariasis is maintained. Based on an analysis of the data presented in the previous chapters, the following questions are examined: 1) why is there a difference in the prevalence of filariasis amongst Fijians, Indians and Rotumans?; and 2) why does the disease persist (and recur) in spite of knowledge about its cause, cure and prevention?

Following a discussion of how islands serve as biological sanctuaries for vector-transmitted diseases, the results of vector-host contact are presented. The main focus of this chapter is on the dynamics of human behavior (based on activity in vector zones) which result in exposure as well as behavior which acts to prevent exposure and contact with vector mosquitos. In conclusion, the Kadavu study which demonstrates the correlation between high vector density and high microfilariae infectivity is presented. Chapter IX examines the cultural perceptions of and reactions to filariasis as a disease. Culture bound disease theories, health seeking behavior and health care systems show how people react differently to the same disease. In addition, experience, both positive and negative, directs peoples willingness to participate in intervention programs.
CHAPTER VIII

VECTOR-HOST CONTACT

Introduction

Filariasis is endemic in Fiji because the filarial parasite finds an available supply of both vector and host. Though the origins of the disease are unknown, filariasis may have become a human disease (anthroponosis) with the advent of agriculture (as suggested with malaria), the domestication of animals (and thereby increasing contact with a zoonosis), or by the migration of humans and vectors into areas lacking other animal hosts. It appears that in the course of evolution, humans initiated changes which have brought them into direct contact with infectious disease agents (Cockburn 1963). Changes to the environment as a result of cultural adaptation are the most significant (Armelagos and Dewey 1970) as far as exposure to vector mosquitoes and filarial parasites is concerned.

Although filariasis was known in 600 B.C., as Buddhist texts referred to the exclusion of people with elephantiasis from the priesthood (Laurence in Mak and Dennis 1985), in Fiji, the written history of filariasis began with European contact. Archaeological data reveals settlement dates to at least 1000 B.C. (Green 1981). If we assume that filariasis developed along similar lines as malaria, then the settlement and horticultural practices of the Lapita people may have increased their contact with potential mosquito vectors. It is also very likely that humans introduced the parasite into the mosquito population of Fiji. Introduction of certain strains of W. bancrofti into Fiji could have been as late as the 1800's when Indian laborers,
who were often exposed to filarial disease in India, arrived. Equally important to the human role in disease transmission is the biophysical environment in which disease occurs. Islands provide the biophysical features which are most suited to maintaining infectious, tropical diseases such as filariasis. Therefore some consideration has to be given to the role of the island environment in the transmission and persistence of filariasis in Fiji.

Islands as Biological Sanctuaries

In discussing the viable nature of island populations, Doumenge (1983) points out that islands can serve as biological sanctuaries protecting their inhabitants from the introduction of parasites and pests. He acknowledges that not all introduced species are harmful since some can inhabit ecological niches in which the natural productivity has remained unused as a result of isolation. (In this way humankind is singularly unique because in the process of habitation, humans can dramatically alter and create new ecological niches.) While islands can buffer/protect from introduced species, for the very same reason, they also maintain indigenous species in an endemic status. This is most evident with infectious diseases such as filariasis, which are of a recurrent nature. Filariasis persists in Fiji because it is a recurrent and not an acute infection. What creates this biological sanctuary for endemic diseases, other than physical isolation, is relative population stability, a continuous supply of hosts and vectors, and suitable climactic features. These factors need some elaboration because of their importance in the ecology of filariasis.
The demographic viability of island populations has been demonstrated in the epidemic death rates among Fijians, Rotumans and to some extent the Indians, resulting from European contact. Filarial disease shows a different sort of vulnerability among island populations. Filarial parasites, because they do not directly affect mortality, do not upset population stability (even though they contribute to the morbidity of island inhabitants). Recurrent infections of this type develop into endemic forms because a dependent-cyclic relationship is established between parasite and host(s). Filarial infections also, in general, do not affect fecundity levels of the vector and host population\textsuperscript{13}. (Based on Rossignol's finds, it would appear that parasites in fact, enhance reproductive behavior of mosquito vectors). Rather filarial parasites have adapted to the vector and host population in the islands. The opposite is true for diseases such as malaria (falciparum) which can act as population regulators by determining population distribution (Riley 1983). Similarly, when dengue occurs in Fiji it rapidly reaches epidemic proportions (due to the intensity/acuteness of infection), and cannot survive because the host population is severely affected.

While population stability is very important, parasitic diseases can only reach endemic levels if suitable vectors (if transmission involves an intermediate host) and hosts are available. Filariasis and the recently introduced Ross River Fever demonstrate: 1) how parasitic diseases

\textsuperscript{13} Researchers such as Sasa (1976) and Rao (1978) suggest that hydrocele infections can affect fecundity, however, studies on human reproductive ability, family size, etc., have not yet been done for filariasis.
agents can thrive when large numbers of vectors and hosts are available; and 2) how introduced parasitic agents succeed in new environments which have suitable vector and host. The filarial parasite has adapted to several vectors in Fiji, thereby increasing its success. The wide geographic distribution of hosts also adds to the success of filariasis. There are five known filariasis vectors in Fiji; the four major vectors are members of the *Aedes* group, and *C. fatigans* is the minor vector. Filarial parasites also have little competition for vector or host with other infectious disease agents such as malarial sporozoites, because the latter does not occur in Fiji (except on the rare occasion that malaria is brought in by a traveler). Fiji is likely to remain free of falciparum malaria because it does not have anopheline mosquitoes. But members of the *Aedes* group have been known to act as vectors for other introduced diseases such as Ross River Fever, which has a fairly recent history in Fiji.

Ross River Fever which causes polyarthritis, is a mosquito transmitted disease originally confined to mammalian hosts in Australia, New Guinea and the Solomon Islands. This disease has been known to occur in humans though in rare sporadic instances. In 1979 this disease occurred in epidemic form in Fiji, affecting over 30,000 people (Fenner 1985). Blood samples taken from effected individuals revealed infectivity levels high enough to infect mosquitoes (ibid). This was among the reasons why the disease spread so rapidly. Other reasons why Ross River Fever reached epidemic proportions in the human population were: 1) it was introduced into a non-exposed population; 2)) the vector, *Ae. vigilax* has a wide distribution in Fiji; and 3) humans were
the only suitable hosts. While this example points out the
vulnerability of animals (vector and host) to introduced pathogenic
agents, it also points to the ease with which new disease agents can be
transported from place to place. With air travel being so easy, there
is little to keep anopheline mosquitos from being introduced into Fiji.

Climactic features of the tropics is yet another reason why
islands can serve as biological sanctuaries for vector-transmitted
infectious diseases. Temperatures in the tropics rarely fall below 60F
or rise above 90F; humidity ranges between 65% to 90% (Symes 1956).
While these are ideal temperatures for Culicine mosquitos, they are also
ideal for humans who do not have to take protection against the extremes
of temperate climates. Subsistence and social activities tend to be
fairly stable throughout the year which reassures continuous contact
between the disease agents. Also many of Aedes mosquitos rely on rain
water which is abundant in the tropics. Aedes mosquitos act as vectors
not only for human filariasis in Fiji, but also for other filarial
infections such as Dirofilaria immitis, a zoonosis infecting dogs, minah
birds and fruit bats (Pteropus hawaiensis). The parasite may also be
most adaptive to tropical atmospheric conditions. As discussed earlier,
filariae find an abundance of suitable intermediate and ultimate hosts
in the islands. But atmospheric conditions may also affect the
periodicity of microfilariae. Whether or not this is a result of vector
activity is not yet known. However, Nelson and Cruikshank (1955) found
that microfilariae incidence was highest in areas which had heavier
rainfall and denser vegetation.
In addition to these natural biological features, disease agents are also enhanced by cultural, human-altered features. In a comprehensive review of insect vectors Spielman and Rossignol (1984) discuss how human activity in the tropics creates the disturbed conditions most exploited by mosquito vectors. They found that mosquitoes of the genus *Aedes* adapt most readily to the "transient breeding conditions" created by human activity, and are therefore more dependent upon human hosts for food. These transient breeding conditions are abundant in Fiji. Disturbance of the natural environment, in part by introduced materials, i.e. containers, tires, drainage ditches, etc., occur in rural as well as urban settlements. However, it is within the rural population of Fiji that microfilaraemia and filarial infections are most prevalent. Rural Fiji is also home for most of the *Aedes* vectors of filariasis. Thus, given the biophysical features of the island environment, it is fairly safe to assume that the epidemiological pattern is determined by the frequency and degree of contact between humans and vector mosquitoes. The remainder of this chapter presents the results of the quantitative data gathered on vector-host contact, and explores how frequency and degree of contact leads to differential microfilariae rates.

**Vector Density - When and Where Vector-Host Contact Occurs**

Whether it be a result of need or chance, filariasis is a disease which is highly dependent on the symbiotic relationship between the various disease agents involved in the transmission process. By following vector behavior (search for food), contexts for when and where
contact takes place between human and mosquito were identified. The
four major vectors were found in the following study areas:

- **Ae. pseudoscutellaris** Beqa, Vunibau, Wainibokasi, Waidova
- **Ae. polynesiensis** Beqa, Rotuma, Wainibokasi
- **Ae. fijiensis** Beqa, Vunibau, Waidova
- **Ae. Rotumae** Rotuma

Table 8.1 shows the average vector density (times when the
mosquito vectors are active) based on 10-day\(^{14}\) sample collections in
each study area:

\(^{14}\) According to Symes (1956), the standard sampling method for
vector mosquitos is 7 catches taken every 5 minutes.
Table 8.1

Vector Density

<table>
<thead>
<tr>
<th>Time zones</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ae. pseudoscutellaris</td>
<td>*</td>
<td>***</td>
<td>***</td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ae. polynesiensis</td>
<td>***</td>
<td>*</td>
<td>***</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Ae. fijiensis</td>
<td>***</td>
<td>*</td>
<td></td>
<td>***</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Ae. rotumae</td>
<td>*</td>
<td>***</td>
<td>***</td>
<td></td>
<td>**</td>
<td></td>
</tr>
</tbody>
</table>

T1 = 5:00 to 9:00 am  T2 = 9:00 am to 1:00 pm  
T3 = 1:00 to 5:00 pm  T4 = 5:00 to 9:00 pm  
T5 = 9:00 pm to 1:00 am  T6 = 1:00 to 5:00 am

* = density levels are lowest/sporadic with a mosquito count of 1-5 in a 5-minute interval

** = density levels are moderate with a mosquito count of 6-20 in a 5-minute interval.

*** = density levels are the highest during these hours, with a mosquito count of 21 or more in a 5 minute interval.

It should be noted that mosquito behavior, although not uniform across time and space, is fairly predictable in the tropics except under conditions of extreme atmospheric changes. Density levels in table 8.0 are based on average temperature days. To avoid biasing, extreme weather changes such as unusual levels of humidity, heavy rainfall, floods, etc. had significant effect on vector density levels and are not reflected in these samples. Also C. fatigans, a night biter, is not included here since this mosquito was found only in two samples. C. fatigans role as a filariasis vector, however, may be underestimated since it has a wide distribution and does not compete with Aedes vectors.
since it has a wide distribution and does not compete with *Aedes* vectors for food or breeding environments.

Table 8.1 indicates that *Ae. pseudoscutellaris* and *Ae. rotumae* correspond in their activity hours; both mosquitos appear in greatest concentrations during midday. Similarly, *Ae. fijiensis* and *Ae. polynesiensis* appear mainly in early morning and evening hours.

A very important factor in regards to vector density is that at least two of the vectors in any given study area do not have corresponding activity hours. In Rotuma, for instance, *Ae. rotumae* is most active during the hours when *Ae. polynesiensis* is resting. The same pattern was found in Vunibau, Beqa, Waidova and Wainibokasi. Based on table 8.1, the hours between 5:00 a.m. and 9:00 p.m. are the "critical" exposure hours. These hours, in fact, correspond well with human activity. Figure 8.1 shows how each vector's active hours corresponds with the hours when humans are most active, in a 24-hour cycle.

**Correspondence between Vector and Human activity**

\[
\begin{array}{ccc}
\text{Ae. pseudoscutellaris} & & \text{.... Ae. polynesiensis} \\
\text{Ae. rotumae} & & \text{.... Ae. fijiensis}
\end{array}
\]

\[123456789101112123456789101112\]

(hours during the day when humans are most active)

Figure 8.1
Vector zones were established to: 1) identify environmental features which show the concentration (density) of vector mosquitos; and 2) as a means of controlling the parameters of comparative data. Of the four vector zones, the garden/plantation (zone 4) and household compound (zone 2) areas had the highest concentration of vector mosquitos. Vector zone 1, the indoor-household area, and vector zone 3, the village-community compound, had the lowest concentration of vector mosquitos. Table 8.2 ranks the four vector zones in order of the highest to lowest number of vector mosquitos collected. Also shown are the vector species, study site, and environmental features in which vectors were concentrated.
Table 8.2
Vector Habitats

<table>
<thead>
<tr>
<th>Zone</th>
<th>Vector</th>
<th>Site</th>
<th>Environmental Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td><strong>Ae. poly.</strong></td>
<td>Rotuma</td>
<td>Pig sties and coconut plantations (highest concentrations (with 30+ mosquitos per interval)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Ae. rotumae</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Ae. poly.</strong></td>
<td>Beqa</td>
<td>coconut plantations, crab holes</td>
</tr>
<tr>
<td></td>
<td><strong>Ae. pseudo.</strong></td>
<td>Beqa</td>
<td>vegetable gardens, tree holes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wbk</td>
<td>bushes, pathways</td>
</tr>
<tr>
<td>2</td>
<td><strong>Ae. pseudo.</strong></td>
<td>Vunibau</td>
<td>outhouses, water containers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waidova</td>
<td>(pots, cans, oil barrels, tires, coconut shells, etc.)</td>
</tr>
<tr>
<td></td>
<td><strong>Ae. poly.</strong></td>
<td>Beqa</td>
<td>water containers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotuma</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wbk</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Ae. rotumae</strong></td>
<td>Rotuma</td>
<td>water containers</td>
</tr>
<tr>
<td>1</td>
<td><strong>Ae. pseudo.</strong></td>
<td>Waidova</td>
<td>indoors throughout the day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vunibau</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beqa</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wbk</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Ae. rotumae</strong></td>
<td>Rotuma</td>
<td>indoors throughout the day</td>
</tr>
<tr>
<td></td>
<td><strong>Ae. fiji.</strong></td>
<td>Beqa</td>
<td>indoors, greatest concentration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vunibau</td>
<td>in early morning and early evening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waidova</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>Ae. fiji.</strong></td>
<td>Beqa</td>
<td>most consistently found in the community zone, resting in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vunibau</td>
<td>pandanous, huts, and small trees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waidova</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Ae. poly.</strong></td>
<td>Rotuma</td>
<td>sporadic occurrence around houses and social areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beqa</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wbk</td>
<td></td>
</tr>
</tbody>
</table>

Wbk = Wainibokasi

The environmental features listed in Table 8.2 do not exhaust the number of places/items in which vector mosquitoes can be found, since
these samples are based primarily on adult collections. Mosquito larvae
were collected and identified in some of the areas but not consistently.
If both adult and larvae were sampled concomitantly, then the list of
environmental features would increase. This list represents only those
environmental features in which adult mosquitos were observed feeding or
resting, and where larvae could be observed (and identified) floating
near the surface.

Exposure by Sex and Ethnic Group

Although vector mosquitos were often collected while blood-feeding
on individuals, actual contact between host and vector was not the means
of establishing the correlation between vector-host contact. Rather
exposure to vector mosquitos was measured in terms of when and where
humans and vectors were most likely to come into contact. And exposure
varied between ethnic groups as well as between men and women.
Behavioral data, that which was observed, forms the bases for this
analyses but actual contact between vector-host and pathogen may also be
influenced by biochemical mechanisms. Although the analyses of these
mechanisms is beyond the scope of this study, they need some
consideration.

Beyond the need for a blood meal for survival purposes, host-
seeking behavior of infected mosquitos may be encouraged by the
parasitic agent. This enhances the infected mosquitio’s chances of
locating a blood meal. The reverse is also applicable. Rossignol
(1988) found that parasites enhance transmission in a way which leads
the vector to feed more on infected hosts. The hosts either become
lethargic and less defensive towards mosquitos during infection or they
are more attractive because of a modified parameter such as body temperature. Therefore factors such as body temperature, which rise in individuals with filarial fever, significantly affect any measurement of vector-host-contact because infected individuals may have more contact with vector mosquitoes.

In addition to body temperature, other attractants include carbon dioxide, color (possibly skin color) and light. Ribeiro also found that once in contact with their hosts, mosquitoes must locate blood before they can feed: "in searching the host tissues for a blood source, mosquitoes repeatedly thrust their mouthparts through the skin until they sense the phagostimulants that signal contact between their feeding stylets and blood" (1988:18). Ribeiro suggests that probing does not determine bites; rather actual feeding takes place only after the mosquito is able to draw blood based on its specific feeding stylets (fascicle). This further suggests that beyond the biological differences between Fijians, Rotumans and Indians, as well as between males and females, individual blood chemistry is also very important in determining contact between vector and host. In order to fully understand the disease transmission process, such biological mechanisms for filariasis need to be studied.

Observable, behavioral differences between human populations also reveal factors involved in the disease transmission process. Table 8.3 shows how much time men and women spent in each of four vector zones.
### Table 8.3

#### Exposure according to time spent in Vector Zones

**Number of hours spent in vector zone I**

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotuma</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Vunibau</td>
<td>10.5</td>
<td>12.5</td>
</tr>
<tr>
<td>Beqa</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Waidova</td>
<td>10</td>
<td>15.5</td>
</tr>
<tr>
<td>Wainibokasi</td>
<td>11</td>
<td>15.5</td>
</tr>
</tbody>
</table>

**Number of hours spent in vector zone II**

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotuma</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Vunibau</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Beqa</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Waidova</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Wainibokasi</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

**Number of hours spent in vector zone III**

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotuma</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Vunibau</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Beqa</td>
<td>4.5</td>
<td>3</td>
</tr>
<tr>
<td>Waidova</td>
<td>1</td>
<td>.5</td>
</tr>
<tr>
<td>Wainibokasi</td>
<td>2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**Number of hours spent in vector zone IV**

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotuma</td>
<td>9</td>
<td>2.5</td>
</tr>
<tr>
<td>Vunibau</td>
<td>8.5</td>
<td>5</td>
</tr>
<tr>
<td>Beqa</td>
<td>9.5</td>
<td>4</td>
</tr>
<tr>
<td>Waidova</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>Wainibokasi</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 8.3 demonstrates that:

1) Women of all groups spend more time indoors than men

2) Women spend more time around the household compound zone, tending to kitchen gardens, cleaning, working and tending to animals, etc.
3) Men spend considerable amounts of time working in the gardens and plantations.

4) Both men and women spend the least amount of time in the intermediate or community zone.

Susceptibility of women to mosquito contact

Based on these results, it can be concluded that women are most likely to come into contact with vector mosquitoes within the household and in the immediate area surrounding the house. *Ae pseudoscutellaris*, *Ae. rotumae*, and *Ae. fijiensis* are the main vectors which feed indoors. *Ae. polynesiensis* is the only vector which does not appear to feed indoors. However, all four vectors were found in the area immediately surrounding the household; this was the one area where contact is most likely to occur with all four vectors.

Another point to note about women’s behavior is their clothing patterns, which may serve as protection against mosquito bites. Women in all three cultures are more fully clothed than their male counterparts. A shirt and sulu are the most common clothing items for Rotuman and Fijian women. Indian women, when not wearing saris, wear shirts with ankle length skirts. The clothing of Indian women is probably most protective because of the layering effect of long skirts (usually have petticoats underneath) and saris. However, light fabrics such as the cottons which sulus are made from, do not appear to deter mosquitoes. Mosquitoes were often observed penetrating directly through such lightweight fabrics. A measurement of the amount of body area exposed and the frequency of mosquito bites, would reveal more specifically the degree to which clothing protects against bites.
Daily activities indicate who has more or less contact with vector mosquitos. Fijian women are shown to be involved in activities (outside the household) where vector mosquitos are present. In contrast, the daily activities of most Rotuman women and nearly all Indian women do not take them far away from the household. The most contact Rotuman women have with vector mosquitos in the daylight hours is when they are gathering pandanus (which is usually done once or twice a week). And although feeding pigs (travelling to the sties) is usually a man’s job, some Rotuman women share in this responsibility. Pig food consists primarily of coconut meat, leftover grated coconuts and household garbage. When leftovers are not available, women may pick and husk the coconuts themselves to take to the sties. The open-sided communal sheds where women gather to socialize and weave mats, is another area outside the household where contact with mosquitos was very likely. These sheds provide shade cover and block out heavy winds, thereby making it an ideal feeding environment for mosquitos.

Fijian women travel the furthest to perform daily activities such as pig tending (which is primarily a woman’s job). Along with men, they participate in taro, cassava and vegetable gardening. The only activity not performed by Fijian women, is coconut gathering in the plantations; they do however, husk and grate coconuts for cooking and oil. Most Fijian women maintain their own pandanus patches. Subsistence fishing is a major part of the daily activities of Fijian women living in coastal villages. Fishing along the riverbanks, mangrove swamps, as well as in open water (in small canoes and boats), is quite common. Those who fish in the open water are less likely to be bothered by
mosquitos but those who sit and fish along shorelines or near mangroves, as observed in Vunibau, are repeatedly bitten. Cleaning and washing activities of Fijian women also take them away from the household. Unlike Rotuma where all of the households have access to communal or private tap water, most villages in Beqa and Vunibau share communal taps. In these villages, tap water may be reserved for cooking while fresh water streams may be used for bathing and cleaning. Because several vector species inhabit the bush, coconut, and pandanus (and possibly taro) surrounding the streams, vector contact is very likely in these areas.

Of all three groups, Indian women were least likely to travel away from the household compound for any major activity. Older women help in the rice fields, in the vegetable gardens and in tending to the farm animals, especially goats, but this is done when men and boys are unavailable to help out. During and after rice harvests, young women were observed helping in the rice fields. Maintaining kitchen gardens (a feature of all rural Indian households) is the main activity outside the house; these gardens provide the necessary vegetables and spices for daily use. Women and girls also performed chores within the household compound such as weeding, tending to the chickens and ducks, and cleaning outhouses. In Wainibokasi, Indian women were observed accompanying their husbands to family gardens which are at considerable distances from the home. Depending on the need for labor, Indian women may participate in other economic activities. For instance, the two Indian women with elephantiasis (in Savusavu), worked alongside their
husbands in the copra plantations in Savusavu (which is where they may have become infected).

The Susceptibility of men to mosquito contact

It can also be concluded that men are most likely to come into contact with vectors in the garden/plantation zone. With the exception of Ae. fijiensis, the garden/plantation area is occupied by the three remaining vectors. The concentration of Ae. polynesiensis, Ae. pseudoscutellaris, and Ae. rotumae was highest in this area, thus men and boys who spent most of their time in subsistence activities in the garden and plantation zones, were the most susceptible to vector contact.

Men in all three groups are more often and more consistently in contact with vector mosquitos than women. The higher rate of filariasis among males confirms this. In Rotuma, where the male population is more than half (approximately 1500), copra is relied on either as the major source of income or as supplementary income. Even the 7 paramount chiefs rely on copra for some of their income. In Motusa, depending on which co-op the household belong to, coconut meat was collected 2-3 days per week. The coconuts are gathered, shelled and husked in the gardens, on the same day that they are collected. The remaining days, with the exception of Sunday which is a day of no activity, was spent in the vegetable gardens, working around the home, in communal labor and other social activities. However, the time spent in the coconut areas is the single most important activity in terms of vector-host contact.

Fijian men are equally susceptible to vector contact. The difference in filariasis rates between the Rotuman and Fijian men is
comparable to the differences in living environments and activity patterns. Likewise, similarity in microfilariae infection rates may be due to similar environmental conditions. First, higher microfilariae rates are found among Fijian men living in smaller islands such as Beqa which are furthest away, both socially and geographically from the main island of Viti Levu. This is due to the physical and economic features of the environment, i.e. smaller islands are heavily vegetated with coconut trees and bush lands (less clearing of the land has taken place in these islands). A survey in 1983 showed that Fijian men on the islands of Matuku and Lakeba have rates of 19.4% and 12.1%, respectively. These are the highest rates found among Fijian men on a single island (as opposed to a village).

Secondly, on larger islands, there are a wider variety of job (economic) opportunities. The men on these islands have other sources of income available to them, which allows them to continue coconut (copra) farming on a supplemental basis or abandon it altogether. Even with more sources of income, some degree of subsistence cropping still take place on such large islands. In addition to copra/subsistence farming, Fijians have a wider choice of activities than Rotumans.

Thirdly, islands such as Beqa which are geographically close but are socially isolated from the greater community of Viti Levu, share more in common with Rotuma. Beqa has a greater resource base, e.g. a variety of crops are cultivated and sold at the Navua and Suva marketplaces and fishing is a major economic activity. Because of the large number of breeding habitats, it also is an environment where *Ae. pseudoscutellaris* and *Ae. polynesiensis* vectors can thrive. The success
of the vector(s) in such isolated areas where a constant human reservoir is available, leads to higher filariasis rates.

Indian men, like Indian women, have far less exposure to mosquito vectors than their Rotuman and Fijian counterparts. The areas in which Indian and Fijian men have shown similar rates of filariasis and elephantiasis have been where the two groups also share the same living and working conditions. On the islands of Taveuni and Vanua Levu, filariasis among Indian men is as common as among Fijians, part-Europeans, Chinese, and other islanders. These men also work on the large coconut plantations owned by European landowners, some of which are still in business. However, with the development of resorts on both islands, the economic industry is shifting more towards tourism and away from copra and other agricultural products. This shift can also be seen in the fewer cases of elephantiasis and fewer reported cases of filariasis (based on medical records reviewed at Taveuni hospital).

In areas such as Navua, where both Indians and Fijians live in close proximity to the vector *Ae. fijiensis*, there is great difference in activities between the two groups. Indians cultivate rice and sugar cane and work in the dairies, none of which are areas in which the vector occurs with frequency. In contrast, Fijians work in areas surrounded by coconut trees and pandanus groves in which more than 1 vector finds a suitable home.

The significance of the amount of time spent in a given vector zone can be illustrated by the importance of certain activities. Most of the activities observed and discussed can be sorted into three general categories - primary subsistence, secondary and household.
Except for the importance of activities performed within the household, these categories allow a means to conceptualize the economic and social significance of such behavior. Table 8.4 uses these categories to demonstrate the "priority" of a given activity and how it correlates with each filarial vector.
### Table 8.4
Activities according to Vector Zones

#### Activities in *Ae. pseudoscutellaris* zones

<table>
<thead>
<tr>
<th></th>
<th>Primary</th>
<th>Secondary</th>
<th>Household</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fijians</strong></td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
</tr>
<tr>
<td><strong>Rotumans</strong></td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Indians</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

#### Activities in *Ae. polynesiensis* zones

<table>
<thead>
<tr>
<th></th>
<th>Primary</th>
<th>Secondary</th>
<th>Household</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fijians</strong></td>
<td>XX</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Rotumans</strong></td>
<td>XX</td>
<td>XX</td>
<td>--</td>
</tr>
<tr>
<td><strong>Indians</strong></td>
<td>X</td>
<td>X</td>
<td>--</td>
</tr>
</tbody>
</table>

#### Activities in *Ae. fijiensis* zones

<table>
<thead>
<tr>
<th></th>
<th>Primary</th>
<th>Secondary</th>
<th>Household</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fijians</strong></td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
</tr>
<tr>
<td><strong>Rotumans</strong></td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Indians</strong></td>
<td>XX</td>
<td>XX</td>
<td>--</td>
</tr>
</tbody>
</table>

#### Activities in *Ae. rotumae* zones

<table>
<thead>
<tr>
<th></th>
<th>Primary</th>
<th>Secondary</th>
<th>Household</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fijians</strong></td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Rotumans</strong></td>
<td>XX</td>
<td>XX</td>
<td>XX</td>
</tr>
<tr>
<td><strong>Indians</strong></td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

**X** = sporadic, less consistency in activity patterns  
**XX** = daily/continuous activities

(a) **primary subsistence** activities i.e., farming, kitchen gardens, fishing, pig feeding, husking rice

(b) **secondary** activities i.e., school, leisure, play, other social activities such as mat weaving

(c) **household** activities i.e., cooking, cleaning, resting

These activities highlight the importance of cultural behavior in the transmission of filariasis. For Fijians and Rotumans, contact with vector mosquitoes takes place primarily in food gathering areas. Coconut, which is a basic staple for the island diet, is equally
important to the vector *Ae. polynesiensis*. Coconuts are also an important source of food for *tui lairo*, the coconut crab, which bores holes into the trees in which mosquitos can breed. Other farming and food collecting areas are either in or surrounded by habitats in which *Ae. pseudoscutellaris*, *Ae. fijiensis*, and *Ae. rotumae* breed. It would be as difficult to control vector reservoirs in coconut groves as it would be to cut back on encroaching bushes which border the villages. In order for environmental control measures against mosquitos to be effective, the subsistence activity patterns would have to be altered to account for these "additional" activities.

An example from Rotuma, where subsistence activity is combined with conscious mosquito control, is the turning of coconut shells and husks upside down so water cannot pool within, thereby eliminating a possible home for the larvae. But out of the 12 households from Motusa village which have gardens in this area, only 2 have incorporated such action into their daily coconut gathering activities. When other farmers were asked why they did not do the same with their coconut shells and husks, they replied that it was "too time consuming" and often pointed out other additional breeding sites.

But one does not have to go beyond the household area to encounter mosquitos. Many of the vector mosquitos breed and inhabit areas around the household compound. Much of this is unavoidable contact, especially since mosquitos are carrying out their "subsistence" activities during hours which humans are most available - early morning and early evening. Whereas agricultural activities are performed primarily by men, who in turn have more contact with vector mosquitos, the early morning and
evening hours are when all household members may be present, thereby making everyone equally susceptible.

Activities in themselves only determine where contact can take place. It is the way in which these activities are performed that initiate how contact is made. In order for the mosquito to successfully penetrate the human skin there has to be little movement on the human’s part. Activities which demand more time standing still or sitting still are those in which mosquitoes have enough time for a blood meal. Activities which demand constant movement are met by unsuccessful attempts by the mosquito. Resting is possibly the most threatening human activity in terms of contact. Many of the farms and plantations have a resting hut; these not only provide ample shade cover for the mosquito but also have lots of empty coconut shells lying around in which eggs can be laid.

Travelling to and from the work areas are also primary contact activities. As long as the individual moves at a fairly slow, even pace, the mosquito can latch on. These frequently traveled areas/paths are often surrounded by bushes where the mosquito has been breeding and resting. The distance travelled, the surrounding bush and the discarding of empty coconut shells and containers, all contribute to human-vector contact. Papao (1976) has noted that in Samoa, the paths between work areas and the living compounds are the most likely area for human-mosquito encounter.

Mosquitos are unavoidable in many of the activities which are of primary importance to people. Therefore it would appear that taking actions to protect oneself while being exposed would be the most
plausible solution. In theory this is true, but it is not a practical solution.

**Human Behavior which acts to decrease/protect against Mosquitos**

There are a variety of direct and indirect protective measures taken against mosquitos. The direct measures are intended to protect the individual from mosquito bites; the indirect measures are environmental features and cultural practices which in themselves are not intended to serve as protection but often have such benefits. Table 8.5 compares the more apparent/observable protective features of the cultural and physical environment in which the Fijian, Rotuman and Indian live:

**Table 8.5**

**Direct and Indirect Protective Measures**

<table>
<thead>
<tr>
<th>Direct Measures</th>
<th>Fijian</th>
<th>Rotuman</th>
<th>Indian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosquito nets</td>
<td>*</td>
<td>**</td>
<td>***</td>
</tr>
<tr>
<td>Mosquito coils, sprays, repellent and incense</td>
<td>*</td>
<td>**</td>
<td>***</td>
</tr>
<tr>
<td>Window screens</td>
<td>*</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Clothing</td>
<td></td>
<td></td>
<td>***</td>
</tr>
<tr>
<td>Bush clearing</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

**Indirect Measures**

<table>
<thead>
<tr>
<th></th>
<th>Fijian</th>
<th>Rotuman</th>
<th>Indian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kitchen smoke</td>
<td>**</td>
<td>**</td>
<td>*</td>
</tr>
<tr>
<td>Clothing</td>
<td>*</td>
<td>*</td>
<td>***</td>
</tr>
<tr>
<td>Bush clearing</td>
<td>*</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Location of outhouse</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Indoor plumbing</td>
<td>*</td>
<td>**</td>
<td>*</td>
</tr>
<tr>
<td>Incense</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of pets/farm animals</td>
<td>*</td>
<td>**</td>
<td>*</td>
</tr>
</tbody>
</table>

* rarely used  
** used when available  
*** used regularly
Table 8.5 indicates that Indians take more direct protective measures as well as have greater protection from indirect measures. This is partially due to the fact that Indians feel the need to protect themselves from mosquitos. However, equally important is the desire to have indoor plumbing and windows with screens (both are social and economic indicators of status). These direct and indirect measures are further elaborated below.

Protective measures are a matter of social and economic importance

Social and economic status are not necessarily synonymous concepts but they are often inseparable, and very important to all three groups. It is the degree to which material wealth establishes social status for either group, that differs. One’s home - what is in it, what is on it and what surrounds it is a primary means of showing status. An example is owning a cement or two-story house which is for many Indians, Fijians and Rotumans alike, a demonstration of wealth and status.

Of the five areas included in this study, Rotuma has the greatest number of cement houses. This is primarily due to the hurricane relief funds and supplies given by the New Zealand government after hurricane Bebe devastated the island in 1972. But the one item missing in nearly all of these houses is screening on windows and doors. Other than the government quarters which are all screened, few Rotuman households had window/door screens. Screens are not only difficult to afford but transportation of building materials to Rotuma is also difficult.

Many of the houses in Beqa, particularly in the firewalking villages, are also built of cement. Firewalking has proven to be a
highly profitable market. Again, with the exception of 2 of the chiefs' houses, the windows do not have screens but some do have shutters. In Vunibau village, there are very few cement houses, yet many wooden ones with hurricane windows. Several of the Vunibau villagers commented that they do not want screens on their windows because the screens trap dirt and block the free flow of air.

In Waidova, there are only 3 cement houses, the rest are wooden. However, many of these wooden houses have both screens and hurricane windows. Wainibokasi has about an equal number of wooden and cement houses; again, screens along with hurricane windows are a common feature.

Along with having a cement house, indoor plumbing and indoor kitchens are also indicators of social and economic status. Some cement houses still have outhouses, as in both Beqa and Rotuma, and nearly all of the wooden houses have outhouses. There is a general feeling among all three groups that the toilet area should be separate from the household, even if it is attached to the side of the house. The distance of the outhouse (with the exception of the prevailing wind direction) is not as important as the separation of it. Wainibokasi was the only study area in which nearly half of the cement homes had indoor toilet facilities.

Indoor kitchens are a must for Indians but not for Fijians and Rotumans who prefer the cooking area separate from the household (their cooking styles also differ a great deal with lovos or earth ovens being more common). Again, the exceptions reflect the affordability of having indoor kitchens as opposed to the social desire to keep the cooking area separate.
The use of mosquito nets, sprays, coils, incense, etc. is again a matter of economics and social desire. Nearly all Indian households use mosquito nets (these nets are not necessarily store bought but may be made from old saris) as do most Rotuman households. Nets are least likely to be found in Fijian homes. Nets in Fijian homes were most likely to be used by privileged family members (father and eldest son) and guests.

Mosquito coils, sprays and incense are items which can be costly and therefore are not commonly used. Also there are instances of fires starting from coils which deter many people from using them. The smell from the smoke when coils are burned is also a reason why they are not used. For such reasons, these protective items were not used.

Clothing is both a direct and indirect measure of protection. Men and women may at times wear specific clothing to protect themselves against getting bitten; however, at other times the usual clothing items are worn without giving any thought to mosquito bites. As mentioned earlier, Indian women generally are more fully clothed than their Fijian and Rotuman counterparts. This is partially a protective measure, but it is also a cultural custom regardless of mosquito pests or the weather. It is questionable how much clothing can protect against bites, since the easily penetrated cottons are most likely to be worn in these humid tropics.

In sum, protective measures may reduce contact and exposure to vector mosquitoes. Direct protective measures are taken by those who perceive the need to protect themselves from mosquitoes. Related to these perceptions are social and economic factors which influence such
behavior. The indigenous groups appear to have a greater sense of practicality, whereas Indians follow cultural customs which may be less practical but more protective. One way in which behavior, both human and mosquito, can be observed to affect filariasis distribution is to study a population where blood test results and vector-host contact can be directly correlated. Kadavu offered such an opportunity.

As mentioned previously, there is a direct correlation between high vector density and high microfilariae rates. By working on the current antifilarial project, I was able to look at the direct correlation between high vector density and high microfilariae rates in areas currently under study. Kadavu island is a case in point where high microfilariae rates have led to retesting the population and to the present DEC campaign. This project began in 1985, under the direction of Dr. J.U. Mataika, whose goal is to conduct a 5-year study, including yearly follow-ups, of selected islands in the Eastern Medical Division where there is a high prevalence of filariasis. I accompanied the filariasis team during their first follow-up survey in February, 1986. The following is a synopsis of the initial survey results.

Kadavu - an Island Under Study

At the time of the survey, Kadavu had a population of 10,167; it is the third largest island in the Fiji group. Of the 43 villages on Kadavu, 41 have microfilarial carriers (tested in January 1985). Since the only means of traveling around the island is by boat, the team decided on covering 4-5 villages per day (depending on the terrain we had to cover once on shore). Kadavu is divided into Northern and Southern Divisions which are connected by a 4km isthmus at Vunisea.
Roughly two-thirds of the population (7,162) lives in the southern half, while the remaining one-third (3005) live in the northern villages. The government station, Kadavu Hospital and other public service agencies are in Vunisea, the island center. The north-south division is very significant in terms of the distribution of filariasis.

The southern half is heavily vegetated with both primary and secondary forest and has a less pronounced coastline. This is the leeward side of the island and many of the villages are set deep into the interior region and are often not visible from the shore. Other physical features characteristic of the southern half, e.g. mangrove swamps, wetland agriculture, are absent from the northern half. The northern half, by contrast, shows dramatic environmental changes, i.e. soil erosion as a result of intensive swiddening has left many of the northern hillsides bare and unproductive. Within the last 10 years, pine trees have been planted on these sloping hills in an effort to prevent further soil erosion. The villages visited lie along the coast, occupying the wide sandy shoreline characteristic of the northern half.

Out of the 587 positive tested cases, 486 are in the southern division whereas only 101 are in the northern division. Although the southern division has the larger population, this difference is still significant in terms of the factors which lead to a higher distribution on one side of the island. Table 8.6 shows the percentage of positive microfilariae cases in 13 of the village/sectors in the southern division. The population figures are based on actual counts taken during the survey. The positive cases in the northern division are not
shown according to each village/sector because this half served as the control group for the study.

Table 8.6
Kadavu Island survey

<table>
<thead>
<tr>
<th>Village/sector**</th>
<th>Population</th>
<th>Microfilariae Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Namalata sector</td>
<td>324</td>
<td>52*(91 absent)</td>
</tr>
<tr>
<td>Richmond Mission settlement</td>
<td>210</td>
<td>27</td>
</tr>
<tr>
<td>Nalotu sector</td>
<td>257</td>
<td>26</td>
</tr>
<tr>
<td>Nasau</td>
<td>109</td>
<td>23</td>
</tr>
<tr>
<td>Naikorokoro</td>
<td>73</td>
<td>21</td>
</tr>
<tr>
<td>Nukunuku village</td>
<td>66</td>
<td>19 (29%)</td>
</tr>
<tr>
<td>Naqara village</td>
<td>112</td>
<td>13</td>
</tr>
<tr>
<td>Dagai and Tawawa villages</td>
<td>159</td>
<td>11</td>
</tr>
<tr>
<td>Natokalau</td>
<td>71</td>
<td>11</td>
</tr>
<tr>
<td>Davigele</td>
<td>79</td>
<td>10</td>
</tr>
<tr>
<td>Kabariki</td>
<td>67</td>
<td>4</td>
</tr>
<tr>
<td>Drue sector</td>
<td>166</td>
<td>2</td>
</tr>
<tr>
<td>Church of the Poor</td>
<td>24</td>
<td>refused to test</td>
</tr>
<tr>
<td>Villages/sectors not visited (20)</td>
<td>5445</td>
<td>267 (55%)</td>
</tr>
<tr>
<td>Total</td>
<td>7162</td>
<td>486</td>
</tr>
</tbody>
</table>

Kavala (north Kadavu) 3005 101 (56 females and 43 males)

*Absentees = includes both positive and negative individuals, who had not returned for follow-up.

**Village/Sector = these boundaries were established by the survey team so as to make the population more accessible and manageable.

The Kadavu survey revealed the following similarities with the other study areas:

1) The environmental features of the southern villages provide suitable breeding grounds for *Ae. pseudoscutellaris*. As a result, *Ae. pseudoscutellaris* is found in very large numbers around the villages and in homes during all times of the day. Northern
villages have considerably less density - only 6 out of 11 mosquito samples were vectors of filariasis. Of the known (reported) elephantiasis and hydrocele cases, 38 are in the southern villages and 11 in northern villages.

2) Activity patterns between the northern and southern divisions in general reflect resource exploitation and resources available in that area. Northern villages rely primarily on fishing with limited agricultural activities, whereas the rich soil base of the southern half of the island allows for subsistence crop farming, i.e. taro, cassava, yams, etc.

3) Other cultural/physical features of the villages differ significantly. Villages in the southern division are more clustered than villages in the north. The encroaching bush area is also characteristic of the villages in the southern half. As a result, outhouses and cleaning areas are closer to the household and within the village compound.

4) Nukunuku, which has the highest percentage (29%) of positive microfilariae cases, is a remote inland village surrounded by mangrove swamps. The only path leading in and out of the village crosses through the mangrove swamp. Even at 11:00 a.m., it was difficult to ward off the large number of mosquitos which inhabit the swamp.

Thus in Kadavu, the higher rate of microfilaraemia among inhabitants of the southern villages appears to be due to the larger number of vectors in this division. Environmental features in the southern division also provide the habitats most suitable for mosquitos.
vectors. The proximity of vector zones and activity patterns further illustrate how cultural behavior can enhance vector-host contact, and ultimately, maintain the disease cycle.

Summary

This chapter has taken the quantitative data, i.e. vector samples, and activity times, gathered from each of the study sites and combined human behavior with vector behavior to show when and where humans are most susceptible to exposure and contact with vector mosquitoes. By using specific vector zones as a way of measuring the amount of time spent performing specific types of activities, conclusions were drawn as to who (male or female) and which ethnic group (Fijian, Indian or Rotuman), had the greatest degree of contact with vectors of filariasis. Human behavior which acts to limit exposure and contact with mosquito vectors was also taken into account. (Although many of these protective measures are taken against the mosquitoes to eliminate being bitten, they indirectly help to control the spread of filariasis.) The biological factors involved in the transmission process, though beyond the methods of this research endeavor, were also addressed. Lastly, the Kadavu island study was used to exemplify a case in point where high microfilariae density does correspond with human exposure and contact with the mosquito vector.
CHAPTER IX
CULTURAL PERCEPTIONS AND REACTIONS TO FILARIASIS

There are an infinite range of possible solutions to a given problem...thus the course of cultural adaptation, like that of organic evolution is indeterminate (Dobzhansky 1962:7)

Adaptation is unique to a species or culture, but solutions, unlike Dobzhansky states, are not infinite. Rather there are boundaries and limits to each solution. Human disease is an example of social and environmental constraints placed on cultural adaptation. Cultural behavior not only influences the occurrence but also the distribution of disease. Health seeking behavior is guided primarily by the beliefs and practices of the particular culture. In the case of filariasis in Fiji, the course of events which takes place after the individual has become ill is important in determining the outcome of the disease. Furthermore, cultural perceptions of what is and is not disease may directly influence differential prevalence rates as well as recurrence patterns. This study assumes the biomedical explanation of filariasis as being a vector-borne disease. However, biomedical-scientific explanation may not be sufficient in the cultural context in which filariasis occurs. Fiji provides a unique situation demonstrating that one problem - filariasis - can indeed have several solutions; solutions adapted by each culture.

The persistence of filariasis, in light of knowledge about its cause and cure, is significantly influenced by people’s beliefs and attitudes toward the disease, and by the modes of treatment to which
control in a tropical setting need to be examined. This chapter addresses all of these issues in the following sections: 1) culture-bound explanations of filariasis; 2) health seeking behavior which is influenced by geographical factors; 3) the adaptive value of cultural behavior in relation to filariasis public health control programs; and 4) cultural perceptions of biomedical control measures as the bases for compliance and cooperation with filariasis control programs.

Culture Bound Explanations

Culture bound explanations of disease differ from scientific explanations in that they include cultural perceptions of good health as well as explanations of ill health. Regardless of the kinds of alterations made to traditional ethnomedical systems as a result of culture contact and change, people continue to experience health and disease through their own cultural view. In Fiji, biomedicine is nationalized, and therefore, the dominant form of medical care in terms of its geographic spread. However, biomedicine is not the dominant model of health care since people still rely on traditional ethnomedicine.

In the traditional cultures of Fiji, good health is maintained by observing and following appropriate behavior; likewise, the recovery process back to good health involves a more complex process than simply taking a pill. For Fijians, Indians and Rotumans alike, filariasis and elephantiasis have a variety of traditional explanations, which do not relate to mosquito vectors. In the instance where people accept the mosquito transmitted explanation, they were likely to have been influenced by their current association or familiarity with the
influenced by their current association or familiarity with the government antifilariasis project. Traditional disease theories reflect explanations which are culturally accepted. More specifically, culture bound explanations have been affected by (a) the historic existence of the disease among the island cultures; (b) the unpredictable nature, from invasion to infection, of disease development; and (c) the non-rural focus of current biomedical treatment in Fiji. All of these factors in turn, directly affect the biomedical community’s knowledge about the true occurrence and prevalence of the disease.

As discussed in the previous chapters, the history of filarial disease amongst Fijians, Rotumans and Indians predates contact with Europeans. In contrast, the introduction of biomedical knowledge and treatment of filariasis followed Western contact. It is not surprising that Indian explanations for health and disease differ significantly from Rotumans and Fijians, for they are from a different cultural, linguistic, and social tradition.

Thus, the precontact existence and treatment of this disease created a special cultural (medical) lore for each ethnic group. Disease explanation and treatment were dealt with in the physical and social surroundings which were already known to the person. Except for Indians, the familiar physical and social environment has changed little since contact. Healing in the traditional health care setting was, and continues to be, more of a social than a biological process. Biomedical measures of treatment and control, on the other hand, involve unfamiliar methods in unfamiliar environments (usually a clinical setting). Even though health education about the transmission of filariasis has been
fairly comprehensive\textsuperscript{15} in terms of reaching many of the affected communities, biomedical treatment of the disease has been less comprehensive. Many of the people who visit the Filariasis Laboratory for checkups and DEC tablets have been tested and treated during previous antifilarial campaigns. There are few individuals who come to the Laboratory on their own initiative, which may be partially due to the lab being located in Suva town.

The fact that the scientific explanations of the disease organism and vector transmission were introduced by Westerners also contributes to disbelief. Additionally, Fijians and Rotumans do not see mosquitoes as harmful agents. Indians, in contrast, believe that mosquito bites can lead to infections but not in relation to filariasis. The mosquito theory of filarial disease is not part of the cultural repertoire of health and disease in any of these cultures. This is not to rule out the role of mosquitoes as disease agents altogether since one example of mosquito associated infection amongst all three groups is scabies, which is a very common problem in young children. Infection (secondary) of scabies can often be recognized as resulting from the scratches of mosquito or other insect bites. However, none of these three cultures treat scabies as a "serious" illness, rather it is an illness of temporary nature afflicting only the surface area. Severe cases of scabies, however, in both Indian and Fijian communities, are not

\textsuperscript{15} In November of 1985, Dr. Mataika began an hour long radio program on filariasis, in which he updated the Fijian community about the transmission, control and cure of filariasis. This program aired on the local Fijian station and was within reach of most of the smaller islands.
attributed to insects but rather to malevolent spirits. As with elephantiasis, the degree of severity can change the causal explanation behind the disease.

The second issue which underlies culture bound explanations of filariasis is the lack of association between invasion and disease onset. The time differential between exposure and the initiation of symptomatology, as the disease progresses, makes it difficult to associate exposure to mosquito vectors with filarial fever, as well as relating filarial fever to hydrocele and elephantiasis. Disease stages are identified by their clinical or recognizable manifestations. But most symptoms, particularly in the later stages, are slow to develop, making it difficult to conceive the relationship between all the stages of filariasis. Thomson (1908) observed that yaws was not considered a fatal disease for children because of a lack of recognition of early manifestations. Similarly, filarial disease is also defined by its symptoms. In addition to filariasis-specific symptomatology, individuals who have microfilarial infections may be susceptible to a variety of other infectious agents due to weakened immune response. These concomitant infections can, in turn, change the course of disease development, i.e. individuals who maintain poor health may develop actual symptoms in a shorter length of time, fevers may be of a longer duration, etc.

If there is a relationship made between hydrocele and elephantiasis, it is only because both lead to enlargement of body tissue. However, hydrocele is most often associated with illnesses related to reproduction and sexual misconduct because it is restricted
to the genital area and the mammary glands. Also the disease is often referred to as a male problem because hydrocele primarily affects men. In this study, explanations for hydrocele were difficult to obtain from non-medical people, especially in the Indian communities. However, in all three groups, hydrocele infections were attributed to sexual causes. Hydrocele and elephantiasis are both considered to be in the more serious categories of terminal illnesses. Filarial fever, on the other hand, unless it is accompanied by swelling of the lymph nodes, is often treated like other fever inducing illnesses.

The third issue underlying culture bound explanations of filariasis in Fiji is that it commonly occurs in the traditional rural setting. Biomedical measures often fail because of their unsuitability and inappropriateness for the rural environment, i.e insecticide is sprayed in village compounds, while vector breeding pools abound in the nearby bushes. For the most part, biomedical care is situated in the non-traditional urban settings, where problems resulting from filarial diseases rarely occur. Thus, the availability and accessibility of biomedical care, which includes drug treatment with DEC, are central to questions regarding effective treatment and control of the disease.

Most village meetings on filariasis education appear to be successful, at least on the surface. Medical staff are well respected by Fijians, Indians and Rotumans alike. Disagreements with them may be interpreted as questioning their authoritative status. Medical personnel tend to make the association between humans and mosquito, but in an attempt to make the problem simpler to understand, the pathogen was rarely brought up in the community lectures which I attended. These
are individuals who are educated in the biomedical setting, who are not likely to be local community residents, and who may be of different ethnic origin. As a participant and observer of community health discussions, I often wondered how well the educator's models translated into the model of the community. It was not simply an issue of semantics, but rather the transplanting of a belief system which has to fit into the cultural and physical context best known by the community. For example, mosquito breeding sites can be pointed out to a community, but encouraging environmental/behavioral change so as to eliminate that breeding site necessitates demonstrating how such as change will bring about healthier consequences. For a disease which does not quickly manifest its symptoms, future projections of the benefits from clean-up schemes, are rarely convincing. On Kadavu for instance, puddles created by man, animals, and heavy rains were observed to have collected enough water in which mosquitos could lay their eggs. These puddles were most noticeable in pathways leading in and out of villages and other heavily used areas. The villagers expressed the difficulty in trying to eliminate these breeding sites, as well as the difficulty of changing daily behavior patterns so as to avoid using these areas. Behaviors, particularly those which existed prior to the antifilarial campaign, are difficult to change because they have occurred as a means of adaptation to other factors in the environment.

The persistence of culture bound explanations of filariasis may also be related to resistance to culture change. Similar to Ward's (1989) observations on the island of Pohnpei, Fijians, Indians and Rotumans all believe, to varying degrees, that traditional diseases can
new medical beliefs, in this aspect, appears to result from historical and social familiarity with the disease. This is only a partial explanation for why filarial diseases persist in Fijian, Rotuman and Indian communities; health seeking behavior also affects the prevalence of filariasis.

**Health Seeking Behavior**

One factor which influences the persistence of filariasis is the lack of a successful treatment (cure) of microfilaraemia. It has already been discussed that no biomedical therapeutic measures have been developed for filarial treatment other than DEC, which is chemotherapeutic but not chemoprophylactic. Although the social value of using traditional medicines and traditional healers has been well-studied (c.f. Romanucci-Ross 1977), ethnomedical remedies and their biomedical efficacy have yet to be examined. It is often assumed that most ethnomedical remedies do not work simply because of the endemicity of a disease.

With filariasis the choice of traditional health care treatments significantly affect what we know today of the prevalence of filariasis in Fiji. As discussed in the chapter III, there are a variety of individuals who are not members of the biomedical community, i.e., traditional healers, individuals with filarial infections, community leaders, etc., who have knowledge of the occurrence of filarial disease in their individual communities. This information on disease occurrence, does not reach the biomedical community which is determining prevalence rates of the disease. Therefore, health seeking behavior
influences who does and does not have accurate knowledge about the occurrence of the disease.

Based on ethnographic data, it appears that health seeking behavior in response to filariasis, especially in rural-traditional communities, is not likely to contribute to the knowledge of filarial prevalence rates except through survey data. There are communities such as on Beqa, Kadavu, and communities around Wainibokasi in the Rewa delta which have filarial disease but biomedical knowledge of such disease prevalence is lacking. Health seeking behavior in response to filariasis is related to the general pattern of health care services available and accessible to the community. The treatment and prevention of disease, in addition to the perception and knowledge of it, also depends on geographical (availability of and accessibility) factors. Geographical factors affecting the distribution and availability of health care

There appears to be a correlation between distance from urban centers and the utilization of government health care facilities in Fiji. For instance, inhabitants of urban areas which are often the closest to medical centers, will use the facilities more than rural residents who have to travel significant distances. Fijian villages which are furthest away from the urban areas, and islands which are at greatest distance from the main islands of Viti Levu and Vanua Levu, rely primarily on traditional healers; whereas the urban population takes advantage of the easy access to biomedical care and show lesser reliance on traditional medicines. On islands such as Kadavu and Beqa, which have either a hospital or health center, but lack roads and other
means of easy access to medical services, it is the villages where biomedical services are located which become most reliant on biomedical care. Similarly the use of biomedical care decreases, and the use of traditional medicines increases on islands and districts which only have nursing stations.

An example of how access to biomedical care influences health seeking behavior is seen in hospital records. Table 9.1 shows attendance at Navua Medical Center by residents of Beqa and Vunibau over a 42 day period:

Table 9.1

Attendance at Navua Medical Center between 10-26-85 to 12-6-85

<table>
<thead>
<tr>
<th>Number of Visits</th>
<th>Bega</th>
<th>Vunibau</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week of 10-26</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Week of 11-2</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Week of 11-9</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Week of 11-16</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Week of 11-23</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Week of 11-30</td>
<td>7*</td>
<td>4</td>
</tr>
<tr>
<td>Total Population</td>
<td>1,250</td>
<td>269</td>
</tr>
</tbody>
</table>

*Two of the seven women were attending the ante-natal clinic with their infants.

Since Navua Medical Center is the only fully equipped source of modern medical care available to both Beqa and Vunibau, these data illustrate the affect of distance on utilization of health care facilities. Vunibau is only two miles away by boat (5 miles by car)

\[16\] The health center in Daquibeqa provides routine treatment, i.e. minor surgeries, medications, etc.. The health center does not have X-ray equipment or laboratory and dental facilities. Patients in need of these services are referred to Navua Medical Center.
from the Navua medical center, whereas Beqa island is 12 kilometers from
the Viti Levu coast. Vunibau residents use modern medical care more
than Beqa islanders who rely more on traditional health care. Overall,
Beqa residents use traditional medicines much more than any of the other
study groups. This is partially due to inaccess to biomedical care on
their own island. The medical staff at Daquibeqa have only one power
boat which limits their travel to one area or one person at a time.
Some villagers will ride in for outpatient treatment, while others may
go directly to Navua. Therefore, both geographical distance, and access
to biomedical care on Beqa, appears to influence the reliance on
traditional medicines.

Efforts are made by the Ministry of Health to provide medical
services to outlying communities. Boat and air transportation are two
such measures. Medical service by boat is a necessity considering the
number of islands that are covered in the Fijian archipelago. Most
nursing stations on the outer islands have been provided with a power
boat. Emergency cases may also be flown into Suva by airplane. Air
transportation for medical reasons is available from Rotuma and other
outliers such as Ono-i-lau, which have airstrips for the smaller planes.

In Rotuma, biomedical care seems to be used far more than
traditional medicines (with the exception of home herbal remedies).
Increased utilization is probably related to the easy access to the
hospital and the "housecall" service which the doctor and nurses
provide. Being a small island, travel by car, horse and foot is
relatively easy (it takes approximately 6 hours to encircle the island
at a medium pace). The small population of Rotuma also makes medical services easier to deliver.

Whereas geographical proximity has a direct influence on degree of biomedical care usage in the Fijian and Rotuman communities, proximity has little influence over the use of biomedical care in the Indian community of Wainibokasi. Wainibokasi is a dispersed agricultural community. Wainibokasi Hospital is located in the southwest end of the settlement. In addition, a larger and better equipped hospital is just 9 kilometers from the settlement in Nausori and is accessible by bus. Taxis are another source of transportation available to Wainibokasi residents. Many farmers own vehicles which sometimes serve as part-time taxis or couriers. The health center itself is within walking distance from most of the households and villages, and is easily accessible by boat from villages in the Rewa delta. Even with such easy access to biomedical care, however, Indian residents still show greater preference for traditional healers. The demand for such services is seen in the significantly large number of traditional practitioners whose services are used throughout the Nausori region, of which Wainibokasi is a subdivision.

Unlike Wainibokasi, Waidova residents seem to utilize the services of Navua medical center as much as their Fijian neighbors. Waidova is a small clustered settlement with a total of 35 households. There are several traditional healers in the Waidova area (including the greater Navua region) whose services are well used. But the services provided by the Medical center are also regularly used. Overall there is a
fairly equal distribution of both traditional and biomedical care in the Navua area, and Waidova residents take equal advantage of both.

As mentioned earlier, biomedical care in Fiji is nationalized, therefore the cost for such care is relatively small. With biomedical care being available for relatively little or no cost, it would be assumed that all of the island groups would quickly take advantage of free medical services where available. There is little doubt that biomedical care has gained popularity over the years, both by choice and imposition. However, traditional health care, even when it is more costly, still thrives in Fiji. The changes which have occurred are in the degree of use and the combination of different forms of health care available to each cultural group/community.

A review of health seeking behavior shows that availability and accessibility influence the choice of health care. These factors also influence health seeking behavior for the treatment of filariasis, which in turn directly effects the estimated prevalence of the disease in Fiji. If treatment is out of the biomedical realm, the chances of the disease being reported as filariasis are virtually non-existent. This also questions the recurrence patterns of the disease. In addition to the social and geographical factors which influence the distribution of filariasis, recurrence rates should be examined and compared with prior figures for: 1) cases which may have gone undetected in previous campaigns; 2) demographic changes resulting from the continual migration patterns of the islanders; and 3) genetic factors which may be implicated in the detection of microfilaraemia (age of infection appears to differ from the age of onset). Along with an evaluation of
introduced prevention and control measures in areas which show recurrence, areas such as Beqa where filarial disease is endemic also need to be examined. Recurrence rates may possibly be due to the ineffectiveness and failure of the measures which are believed to have brought the disease under control. The next two sections in this chapter use data gathered during this study to assess the effectiveness and feasibility of antifilarial projects.

The Adaptive Value of Cultural behavior

How effective can biomedical measures be, if as demonstrated, the acknowledgement of the disease and the treatment of the disease differ significantly from the scientific model of disease and treatment? Furthermore, chemotherapy is based on the presence of microfilariae, and not necessarily the presence of filarial disease. This casts doubts about the value of the chemotherapeutic measure itself.

Fiji's is not unique in that many Pacific islands, i.e. Tonga and Samoa, as well other tropical areas such as Africa, Malaysia and India also have a high prevalence of filarial diseases. However, Fiji's cultural situation is unique, particularly in the differential ethnic distribution of the disease. Two primary means of filariasis control are applied throughout the tropics, (a) chemotherapeutic treatment with DEC and (b) biological and environmental measures taken against mosquito vectors. Both of these involve significant change in human behavior. Specific methods, i.e. use of larvivorous fish, vary according to the cultural and biophysical features of the environment. And methods which show success in one area, i.e. the pilot project in French Polynesia which all but eliminated the incidence of filariasis, often serves as an
example for others. The following is an evaluation of the effectiveness of control measures used in Fiji.

Chemotherapeutic treatment with DEC

DEC is a filaricidal drug which attacks microfilariae; similar filaricides are used for other nematode infections. As mentioned earlier, exactly how this drug takes affect and how it works against adult filariae, is still unknown. It has only been shown to help remove microfilariae. DEC dosage varies with the person's body weight and level of infectivity (microfilarial density in the circulating blood). The smallest dosage which I noted was 2 tablets (150mg) per day for a 15 year old boy; the largest dosage was 8 tablets (1200mg) per day for a 54 year old man. In addition to its questionable biochemical value, DEC treatment may be ineffective for several other reasons.

First, the dosage prescribed to individuals may not be sufficient enough to reduce the infectivity level. The accuracy of blood sampling is critical because DEC dosage is partially based on microfilarial density, and density is determined by blood sampling. As mentioned previously, true levels of infectivity may go undetected since blood sampling is most often conducted during the mid hours of the day when the microfilariae may be resting. Hence the periodicity factor may disguise the true level of infectivity and the dosage, if too low, may be inadequate for effective removal of microfilariae. Testing during early morning and evening hours may reveal greater concentrations of microfilariae in the circulating blood, which in turn would change the prescribed dosage of DEC.
Secondly, although DEC is used in mass chemotherapy to remove the human reservoir of infection, in actuality the drug does not remove the reproductive units from the human reservoir. "This drug exerts no direct lethal action on the microfilariae, but modifies them so that they are engulfed by phagocytes of the endothelial system and thereby removed from circulation...the microfilariae rapidly disappear from the blood but reappear after 6 months since the adult worms are not affected" (Manson-Bahr 1978:214). Since the adult worms are not affected and also cannot be detected, the human reservoir, in essence, remains.

Thirdly, DEC causes side effects which may be serious enough to cause people to discontinue its use or to not use it all. Sasa (1976) notes that the removal of microfilariae from the blood often induces fever, vomiting, dizziness and swelling of lymph nodes. These symptoms are the same as those which accompany filarial infection in the absence of DEC. Also, pregnant women, after the first trimester, are not allowed to take DEC because of the harmful effects the drug may have on the fetus. An incident occurred in Richmond, Kadavu, where a pregnant woman took DEC and later had a miscarriage. The villagers related this directly to the DEC treatment and used this example as a basis for refusal to participate themselves. In addition to its side effects, participation in the DEC protocol is also refused for social reasons. DEC cannot be taken with many of the local beverages. Because drinks such as yaqona, alcohol, coffee and tea can act as diuretics, people on DEC are prohibited from drinking these on the days when the drug is taken. The dosage regimen is also difficult to follow because it is
lengthy and involves timing oneself throughout the treatment phase. The
treatment course can take from a month to a year and the tablets have to
be taken spaced throughout the day, i.e. morning, noon and night. Work
and migratory patterns of many Fijians and Rotumans make it difficult to
observe such strict time-treatment plans.

Another reason why previous microfilariae tests and the DEC
administration treatment cannot be relied upon as indicators of
recurrence patterns, is the lack of follow-up procedures for monitoring
the effectiveness of DEC. Based on ethnographic accounts of DEC
participation, compliance and completion of treatment appear to be the
individual's responsibility. In Rotuma, DEC tablets are obtained from
the hospital; these can be picked up or delivered to the patient by the
public health nurse. And as mentioned, young men in Rotuma rarely visit
the hospital and they also express some dissatisfaction with the
treatment protocol and side effects. This may have contributed to the
recent recurrence rates found in Rotuma. In Beqa, DEC treatment was
even less consistent and almost entirely dependent on individual
initiative. DEC tablets are only available at the Health Center in
Daquibeqa or at Navua Medical Center. Distance and time are two reasons
why Beqa islanders, other than those residing in Daquibeqa, do not seek
out biomedical care. In addition, several people experiencing symptoms
of filarial fever and elephantiasis were totally unaware of the
existence of DEC treatment. Unlike Beqa residents, Vunibau villagers
could easily obtain DEC. If they could not travel to Navua Medical
Center, then the resident public health nurse would bring the tablets to
them. In the Indian communities of Waidova and Wainibokasi, individuals
have to take initiative to request testing (or show symptoms which can be diagnosed by medical personnel as filariasis). Although these areas have not been tested by the survey teams, there are individuals who believe or demonstrate filarial symptoms. There are also several who receive DEC from the local medical centers. One man in Wainibokasi obtains his DEC and receives checkups at the Nausori hospital.

A final issue which needs to be addressed is the population which receives DEC treatment. The treatment population comprises individuals who have tested positive for microfilariae. Theoretically this method should treat all those who are infected, but some are not available during the surveys and others show no microfilariae during the time of the test. For these reasons Cardines (c.1965) recommended that the pilot project in French Polynesia include the entire population and not select only the positives. He attributes initial problems and signs of recurrence due to the fact that "non-positives" were not included in the treatment plan. Although the population size between French Polynesia and Fiji differs significantly, areas which are being surveyed and treated could, and should, include non-positives.

The issues surrounding chemotherapeutic treatment with DEC in Fiji brings into question the effectiveness, both biochemical and cultural, of this measure. Administrative difficulties are combined with the cultural (dis) beliefs and attitudes toward this treatment measure. Similar problems are seen with the implementation of environmental control measures.
Biological and Environmental Control Measures

Biological and environmental control against the vectors of transmitted diseases have also met with great difficulty. The difficulties of implementing such measures against vectors is accentuated by the climactic features of the tropics. New bodies of water in which the Aedes vectors breed, the warm, humid climate as well as the large number of filariasis vectors in Fiji, all contribute to the difficulties of initiating and maintaining such measures. Insecticide spraying is perhaps the most common method of larval control, yet time and again, it has proven ineffective because of its harmful effects on other animal life, and because with time, mosquitos become resistant to such chemicals. Among the biological measures used to reduce mosquito vectors in Fiji are:

1) Toxorhynchites - this is a predator mosquito which feeds on the larvae of other mosquitos. As part of my work with the filariasis laboratory, I assisted in gathering and monitoring toxorhynchites on Yanuca island (a very small island with approximately 98 inhabitants). Six months after this mosquito was introduced to Yanuca, the number of Ae. polynesiensis was significantly reduced. However, the second follow-up (9 months after introduction), showed a small numbers of toxorhynchites, and very large numbers of Ae.polynesiensis, including larvae. The reduction in the number of toxorhynchites may be due to its inability to adapt (breed) in such environments, since other Pacific islands, such as Tahiti, Hawaii and Samoa, show similar results with this mosquito (Toohey et al. 1981).
2) Larvivorous fish - *Tilapia mossambica* has recently been introduced into fresh water streams as well as Monasavu reservoir. This may have led to the reduction of *Ae. pseudoscutellaris* and *Ae. vexans* in the interior regions of Viti Levu. However, net trapping of tilapia in Monasavu reservoir in April, 1986, produced only 3 fishes, indicating that its population is declining. One possibility for its declining numbers may be that tilapia is used for food (Ryan personal communication 1986).

3) *Coelomomyces* - this is a fungi of the water mold genus which is parasitic towards mosquito larvae (Toohey et. al. 1981). *Coelomomyces* has proven to be a very important endemic biological control agent for mosquitos breeding in treeholes and containers. However, its distribution is limited in Fiji.

4) Insecticides - there have and continue to be a variety of insecticides used in dense mosquito areas. Insecticide spraying can be initiated by the Health Department or the community can request spraying to be done when mosquito numbers become intolerable. Insecticides, however, show only short-term results and are most effective when used with other means of mosquito control, such as clean-up schemes to eliminate breeding sites.

In addition to biological measures, various environmental steps have been taken to eliminate mosquito breeding sites. Removal of containers which serve as artificial breeding sites is encouraged by the health authorities. But these measures need continual reinforcement, since all too often, communities which begin such programs do not follow through or keep up these practices. Natural habitats (not man-made)
such as treeholes, crabholes, ground pools, leaf axils and hoof prints are more difficult to control because these can result from the behavior of other animals in the environment. Among the natural breeding sites which are most difficult to control are: 1) pandanus which provides raw materials for household and handicraft items both for Fijians and Rotumans; 2) Colocasia, which is a staple food among Fijians and Rotumans, and is increasingly used by Indians; and 3) the crab species Cardisoma (coconut crab or Tui lairo) which digs holes into the coconut trees but is also a food delicacy for Fijians.

Some biological control measures may be more effective against mosquito larvae than human behavioral response. Changes to human behavior, in general, meet with more resistance than changes taking place in the environment which do not directly involve the residents of an area. But what is more important, is the need to combine biological and environmental control with filarial testing and treatment. The present antifilarialis campaign which tests for microfilariae and provides DEC treatment, does not include biological and environmental preventive and control measures. In Fiji, such a comprehensive project would involve the cooperative efforts of several public health programs. Currently, the Filariasis laboratory, the Vector-Control Unit and the Chemical Control Unit, are all separately administered. A cooperative effort among the three units would, perhaps, yield better results, both in terms of actual reduction of parasites and vectors, as well as in terms of greater community cooperation.

Consideration also needs to be given to the adaptability of the mosquito to the changing environment of humans. It would appear that
movement away from subsistence activities such as copra production, would lessen contact with vector mosquitos. But the vectors of filariasis in Fiji are showing their own adaptability to human changes. The adaptability of bush mosquitos such as *Ae. pseudoscutellaris* (which is identified as peridomestic in some areas of the Pacific) to urban environments raises questions about the possibility of an urban strain of Bancroftian filariasis in Fiji. Similarly, *C. fatigans* (abundant in urban, semi-urban areas throughout Fiji), which is believed to be a minor vector of filariasis, is also increasing in number with urban development. Mak and Dennis (1985) have pointed out that while there has been a decrease in the prevalence of filariasis in some countries as a result of control programmes, urban *W. bancrofti* infections increased in some areas concomitant with the proliferation of *C. quinquefasciatus*. *C. quinquefasciatus* was found in several of my collections throughout Fiji, and has also been found in Rotuma during previous larvae collections. Therefore, in addition to human behavior, vector behavior and adaptability also needs close attention.

Compliance and cooperation with filariasis control programs depend largely on the noticeable, positive effects from participation. There are certain etiological aspects of this disease, which along with governmental control measures detract from the ultimate benefits of human cooperative efforts.

**Cultural Perceptions of Biomedical Control Measures**

How people rationalize change, beneficial or detrimental, depends largely on experience. Early encounters with the Europeans, which were often detrimental, could have set a precedent for doubting the goals of
biomedical health care including the filariasis control measures. Resistance is resulting partially from previous experience with biomedicine, however, recent history also shows numerous examples of where biomedical measures went wrong.

An example of a biological measure which failed in Rotuma is the introduction of Eleusine indica, a weed which is believed to help in the growth of other garden crops. Since its introduction, E. indica has become widespread in Rotuma and is overtaking indigenous ground cover plants. Not knowing of this, I asked a group of school teachers about their feelings towards the introduction of toxorhynchites, as a means of controlling filariasis vectors. I learned that because of their experience with E. indica, they were against the introduction of any other animal or plant species to their island.

Experience also determines how people rationalize their behavior towards unfamiliar biomedical measures. For instance, one of the reasons why there is little incentive to participate in DEC programs is that unlike other modern drugs such as aspirin and penicillin, which have proven their relative instant powers, DEC does not show such immediate efficacious results. DEC does not fulfill the expectations that people have towards modern drugs. The results of DEC may not ever become clear, particularly since taking the drug can induce symptoms similar to filarial fever. Also this drug treatment does not guarantee future incidence of filarial infections. Thus the value of the drug is questionable since its effects cannot be readily observed nor predicted.

There are also instances where modern drugs have backfired through misuse, incorrect diagnosis, etc. These "negative" experiences can be
used as reference against other treatment methods. Such negative experience is quick to spread through communities; word of mouth is a very effective means of inter-island communication. Along with actual failure of the treatment mode, i.e. medicine, the person(s) recommending its use also share blame for its failure. The use of specific medicines is also determined by their availability. Pharmacies and pharmacists play a major role in distributing medical remedies, including herbal medicines, in Fiji. Pharmacists have a unique rapport and reputation in the community and are generally entrusted with medical knowledge. DEC is not available at pharmacies, it is only available at the medical dispensaries. Thus the use of DEC might increase in Fiji if pharmacists were educated about its purpose, and if it were made available through the local pharmacies.

Another factor, discussed extensively throughout this thesis which influences peoples perceptions of filariasis control methods is the apparent threat this disease poses. Whether or not an illness is to be treated as a threat to one's health depends on the seriousness and length of the illness or symptoms. Contrary to laboratory tested biomedicine which can indicate disease before it even develops, Rotumans, Fijians and Indians determine disease by the presence of symptoms. Symptoms include physical manifestations of disease as well as social and psychological problems. All three groups define disease primarily through experience (Auyurvedic medicine also includes written descriptions of disease). Each culture reacts differently to filarial disease because each perceives a different level of threat from filariasis. Indians treat filarial infections with caution and are
perhaps more willing to participate in control efforts because the
disease is considered harmful to one's well-being; in other words it is
threatening. Filarial disease is less threatening to Fijians, it is not
a serious health problem but a common problem in the rural villages.
Filaria is also less threatening in the Rotuman community. But
Rotumans, unlike their Fijian counterparts, show more concern over
preventive and treatment measures.

Elephantiasis, on the other hand, is treated as a seriously
debilitating illness by all three groups. Reaction and behavior towards
individuals who have elephantiasis, however, significantly differs
across the three cultures. Whereas people suffering from elephantiasis
are not excluded from Fijian and Rotuman community life, they are often
shunned by the Indian community. Fijians and Rotumans who are afflicted
with elephantiasis can lead fairly normal lives without fear of being
outcast by their family and neighbors. Indians, on the other hand,
treat elephantiasis sufferers with distrust and fear, to the extent
where they may exclude family members who have the disease.

Since elephantiasis is treated as a serious illness, perhaps if
culturally acceptable associations could be made between the earlier
stages of filarial fever and the eventual development of elephantiasis,
people would be more willing to cooperate in control efforts. As it is,
cross-cultural responses to the disease stages reveals a near absence of
the association between filarial fever and elephantiasis. This lack of
association, however, occurs among some medical personnel as well.
Brochures distributed by the Wellcome Virus Laboratory which show
pictures of people with elephantiasis, do relate wagaga as a earlier
form of tauna. However, these do not reach all of the communities which are affected by the disease.

A final issue that needs to be considered is the intervention of medical-governmental programs which require cultural-behavioral change. Changes needed to reduce the risk of contact with vector mosquitoes require alterations of behavior which have become central to island life. Much of the behavior, i.e. subsistence agriculture, which leads to exposure and contact is basic for survival. For many isolated rural areas and small outliers, behavior which results in human-vectors contact is the only means of survival. A change would mean that suitable alternatives need to be available. Since behavioral changes do not bring about immediate results, i.e. reduce the level of filarial infection, since some stages of the disease are tolerated and not serious enough to change behavior, and since there are doubts about biomedical measures, behavioral change is unlikely. If perhaps, filarial fever immediately led to elephantiasis, and in all instances, then perhaps there would be greater concern. But as it is, the threat from filariasis is relatively minor. It is a health problem to which the Fijians, Rotumans and Indians, alike, have adapted. Rationalization of their behavioral responses to the disease are culturally meaningful and accepted ways of dealing with health and disease.
CHAPTER X

SUMMARY AND CONCLUSIONS

Our great vulnerability lies in our confidence that we know and understand both nature and ourselves (Audy 1970:53).

This study has looked at the prevalence of filarial disease in Fiji. Microfilariae tests indicate a differential ethnic prevalence of filariasis, with Indians having lower rates than Fijians and Rotumans. These tests also show an increase in the number of microfilariae carriers in areas such as Rotuma and Eastern Fiji, where control measures were thought to have effectively reduced the infected population. All three groups live under similar environmental conditions but differences in cultural behavior in relation to the environment, help create the differential disease pattern. The cultural context in which disease is defined also influences differential disease patterns. Ethnographic data shows that all three cultures still adhere to traditional patterns of social and economic behavior, including the practice and use of traditional ethnomedicines. Historically, religion and medicine were intricately woven into the social structure of the island culture; Indian religion and medicine are similar in this way. Except for the perpetuation of Indian religions, island religions began to disappear with the advent and subsequent conversion to Christianity. The loss to Christianity was greater in some islands than others; Rotumans who closely guarded their traditional medical practices (Howard 1979), lost much of their ancestral medical lore. Beqa islanders on the other hand, retain traditional ethnomedical practices more so than their neighbors on Viti Levu. Even with European contact extending well over
a century, the social structure which reinforces traditional beliefs and practices, has withstood many of the changes resulting from culture contact. Thus the introduced western-based, biomedical model of health and disease, which is responsible for the governmental filariasis prevention and treatment program, differs from the disease-theory model of Fijians, Rotumans and Indians.

The problems of differential prevalence and recurrence raises the question what is it about cultural behavior which creates these specific disease patterns? An answer to this question was pursued through monitoring the observable disease agents - mosquito vector and humans - involved in the transmission of filariasis.

Four mosquito vectors were found in the five study areas. By collecting samples throughout various hours of the day, vector density levels were established. Vector density and space use patterns of humans were grouped into four vector-zones. Human behavior (activity) was then monitored in terms of the frequency and duration of time spent in each vector zone throughout the day, for each of the study area.

First, the compound area immediately surrounding the household (zone 2) and gardens/coconut plantations (zone 4), were found to have the largest number of mosquito vectors. This varied with the species of vector but often 2 or more vectors were active in the same area. There also was a correspondence between human and vector activity. Humans were most active between the hours of 5:00 a.m. and 9:00 p.m., the same hours that the vector appearance (concentration) was the highest. Consequently, these are the same hours that the pathogen, *W. bancrofti*, appears in peripheral blood.
Secondly, the division of labor between men and women contributes to which group has more contact with vector mosquitos. Women from all three groups come into less contact with vector mosquitos than men. Men spend more time in the garden/plantations and pig sties; areas with the highest vector density. Women had more contact with vectors in and around the household compound, an area which showed the second highest levels of vector density. Vector density indoors was ranked third and women spent more time indoors than men. Both men and women spend roughly the same amount of time in the fourth area - the village/community zone, which also had the lowest concentration in vector mosquitos.

Thirdly, exposure and contact differ between the three ethnic groups. Primary subsistence activities of Fijian and Rotuman men take place in the coconut plantations (reliance on copra), family vegetable gardens and pig sties. Indian men farm sugar cane, rice and other vegetables, which are grown in areas not suitable breeding habitats for filariasis vectors. Large family gardens, however, do bring some Indian men into frequent contact with vector mosquitos. Fijian and Rotuman women participate in similar types of subsistence activities, some of which do not take them far from the household. Other activities such as maintaining pandanus gardens, collecting land crabs, fishing in fresh water streams which border bushlands, as well as gardening, increase their chances of coming into contact with vector mosquitos. Indian women were least likely to travel into areas which have a large concentration of vector mosquitos. In addition, their clothing patterns protects them from mosquito bites. But these women are susceptible to
vector contact in the kitchen gardens, which are often within the household compound.

Along with high densities in open areas, outhouses are also a primary site of exposure and contact. Families who rely on outhouses (the majority of the houses in the study areas) have frequent contact with *Ae. pseudoscutellaris*, which inhabits these structures. These outhouses are small, dark, covered sheds which serve as both breeding and feeding grounds.

Contact and exposure was reduced by the use of various protective measures, some which are deliberately taken and others which are unintentional. People who use and rely on mosquito nets (found in all Indian homes, most Rotuman homes and some houses in Beqa and Vunibau) are relatively free from mosquito contact during sleep hours. This protective measure significantly reduces exposure and contact for Indians. Window screens also help in keeping mosquitoes from entering the household; however, this is not economically feasible for many rural families. Smoke from indoor kitchens also deters mosquitoes from entering the house but *lovos* and outdoor kitchens are the culturally preferred ways of cooking among Fijians and Rotumans.

Based on observations of human behavior in communities known to have high microfilariae rates, i.e. Rotuma and Beqa vs. those which indicate low microfilariae rates, i.e. Waidova, exposure to and contact with vector mosquitoes may be the primary reason for this differential distribution. The types of human behavior which contribute to maintaining the disease pattern are those which people depend on for their basic economic and subsistence needs. For instance, copra is the
primary source of income in Rotuma as is the reliance on market crops in Beqa. Kitchen gardens, particularly in Indian households, provide some of the daily subsistence needs. Pandanus plants serve as fiber for handicraft items which satisfy both social and economic requirements. And most houses which are not part of an urban scheme, use outhouses.

All of these behaviors, though different within and across cultures, are adaptations made to the local environment of humans. The physical environment is often altered for gardening schemes, animal husbandry, housing structures, etc., to meet the needs of each group. These alterations are not seen as increasing contact with disease agents but are necessary for human survival. The issue is twofold: a) behavior which enhances vector-host contact forms the culture's socio-economic base; and b) perceptions and reactions to the disease differ from those of the biomedical-based governmental model.

The economic practices of Rotumans, Fijians and Indians are behaviors which set these cultures apart from one another. Although economic change becomes more apparent with urbanization, all three groups still adhere to traditional socio-economic practices. Cultures which are most affected by the disease do not themselves perceive their own behavior as contributing to ill health. This is not to say that by clearing land people cannot perceive their increased chances of coming into contact with mosquitoes, on the contrary, everyone recognizes the increase in mosquitoes as a result of such disturbance (Dunn 1976) but they do not recognize mosquitoes as contributing to disease. However, priorities are based on need, i.e. planting rootcrops or building a house are more important than avoiding mosquitoes. Priorities also
differ in terms of the division of labor among these traditional societies. Men and women have very specific roles to fulfill; responsibilities based on age and sex are an intrinsic part of the social structure of island cultures. Increased contact with mosquitoes does not detract from behavior which is necessary to survival. Indians, however, because of their culture-specific economic practices, have far less contact with mosquito vectors.

Since all three cultures do not perceive the health hazards which they create by their material culture and land use patterns, how readily will they accept behavioral changes which are introduced from outside sources? The governmental treatment and prevention of filarial disease is based on disease theories which are outside the islanders perceptions of health and disease. Scientific measures for disease control which seriously alter the social and economic practices of island cultures, will not easily replace traditional ethnomedical views of health and disease.

Traditional disease theories rarely explain filariasis as a mosquito transmitted disease. Instead, filariasis is most often attributed to social causes, and has little if any, relationship to the biomedical concept (except in areas where health education and DEC treatment have been fairly effective). Traditional healing methods provide social cures for the disease, quite unlike the treatment procedures of biomedicine. Disease does not occur in the hospital or clinic setting, it occurs in the cultural environment which is most familiar to the individual, family and group. Thus the interpretation of disease, from cause to cure to prevention, takes place in the context
in which it occurs. This is not to be labeled as irrational behavior but rather as behavior which is most rational in Fijian, Rotuman, and Indian societies. These societies differ significantly from western views of proper medical behavior and procedures. As previously mentioned, the fact that healing is a social and not a biological process in traditional cultures, has implications for a successful recovery. When healing involves the broader social network, it becomes more personalized and although biological symptoms may not altogether disappear, psychological health improves (Parsons 1951).

If control of filarial disease appears to be futile, the deceptive nature of the disease itself is partially to blame. This is an issue which not only questions the ethnomedical rationales for perceiving and treating disease, but also the scientific disease model as well. Unlike other mosquito transmitted diseases, the stages of filarial disease are not predictable, nor often visible. Filariasis is not a deadly disease like malaria, therefore it does not pose the immediate threat which accompanies malaria. Similarly, filariasis is not as threatening as yellow fever. And unlike the short incubation period of dengue haemorrhagic fever, filariasis develops slowly. Even the early stages of filariasis are difficult to detect; filarial fever may easily be mistaken for other fever-inducing illnesses. The duration of each disease stage, including vector contact, to the onset of filarial fever, is difficult to predict. It is equally difficult to predict if hydrocele or elephantiasis will occur. These are problems confronted by both lay and medical personnel.
Filariasis may be a disease which is easier to detect in the laboratory than in actual occurrence. After all, detection of the disease prior to observable symptomatology, is by the presence or absence of microfilaraemia. Not all carriers of microfilariae display symptoms of filariasis which is one reason why "positives" do not participate in DEC treatment. In other words, pathogenesis differs with each individual (genetic predisposition or resistance has been implicated but is an area in need of further research). The level of infectivity, the periodic appearance of the pathogen and the effectiveness of the particular vector in transmitting, in combination with individual biological and social reactions to the disease, can also contribute to the differential disease pattern. This is a disease with too many "unknowns", which raises the question of whose theory is more rational. Are ethnomedical interpretations of filariasis, which are based on historic encounters with the disease, less rational than theories based on biology? The answer is no. Prevailing ideas of good and ilī health will overcome, if not simply because they are more culturally familiar, then because biomedicine offers no other reasonable, equally perceptive alternative.

The methods employed to control filariasis in Fiji are not unlike those used in other tropical settings. Mass administration of DEC is carried out with the belief that the pathogen population can be reduced by the drug. Biological and environmental measures are carried out with the belief that the vector population will be reduced. Both of these measures do not apply directly to humans but involve human cooperation. Soliciting community participation for elimination of mosquito vectors
is not an unusual practice, since other diseases such as dengue and Ross River Fever also involve mosquito vectors. Participation in filarial drug therapy, however, is not a common practice.

A major problem with current methods of testing for microfilariae and establishing prevalence rates, is the time of day that testing is done. Bancroftian filariasis in Fiji is of a subperiodic type; the hours of its appearance vary throughout the day with the most heavy concentrations during early morning and evening hours. If these are the times when microfilariae are most likely to be detected, then this is also the time when blood samples should be collected. Lynch's studies from the turn of the century indicate that microfilariae density was significantly higher in evening (night) blood. Although recent studies collect blood samples from the more convenient hours of the day, vector activity (which is symbiotic with pathogen activity) is known to be high during early morning and evening hours. Based on this information, it is difficult to accept the current recurrence pattern suggested for filariasis in Rotuma and the Lau group. In other words high recurrence may reflect lack of detection of higher microfilariae rates and prevalence during previous campaigns, and not necessarily an actual increase in the pathogen population.

In addition to inadequate detection during earlier surveys, the rate of migration in and out of these smaller islands is fairly high, which may in turn influence the numbers of infected individuals in the area during the survey. Since blood samples are often collected on a volunteer basis, unwilling participants stay away from the testing center. Biological factors also need to be considered in the latent
development of the disease (children are believed to be infected at early ages but the disease does not manifest until 10-15 years later). If such biological factors are indeed involved, then the same children who may have shown absence or low levels of microfilariae earlier, are now the adults who are testing positive. All of these issues need be considered in future tests but meanwhile, samples can be done on smaller populations, i.e. a village, which can look at the periodicity factor and cultural and biological changes which may effect the development or delay in the disease. Dr. Mataika has initiated a pilot study for Kadavu in which a control and survey population have been identified and are being treated with DEC; this group will be followed for the next 5 years. Hopefully this study will shed new light on the development and control of filariasis in Fiji.

How can the effectiveness of control methods be measured if the disease model which calls for control differs from the ethnomedical model most adaptive to cultural needs? Changes in behavior do not automatically result from scientific knowledge about disease. No matter who delivers this knowledge or how effectively it is delivered, change depends on what is of immediate significance to the person, group or community. Hence, behavioral response, both positive and negative, depends largely on priorities and basic needs. Human behavior which increases contact with disease agents and influences the occurrence and persistence of disease, is the result of adaptive (and maladaptive) responses to the environment—both the cultural and the natural. Human behavior in such settings cannot be judged on the basis of what is rational or irrational. The meaning which such behavior holds is
expressed and specific to the cultural context in which it takes place. Even to the medical anthropologist, who offers an etic analyses of the situation, the disease is removed from the "self" experience. The analysis must interpret that which is experienced by the people who have the disease. Still, an anthropological assessment of the situation is a necessary link between what is culturally significant and the measures which are needed to control/reduce the disease.

Filariasis control in the tropics has been particularly difficult because of the variety and adaptability of mosquito vectors. However, the task of controlling the human reservoir of disease, is no less difficult. When incentives are given for behavioral change which has positive results in terms of disease reduction, control measures such as those which limit or eliminate breeding sites, can meet with more acceptance and effectiveness. An example of such incentive is the incorporation of change into a meaningful context, e.g. village clean-up schemes which are routine preparations for visits from distinguished leaders, classroom incentives encouraging elimination of vector breeding sites as an educational process, agricultural schemes which demonstrate equal or better productivity by lessening bush, burning empty coconut shells in the gardens and reusing the ashes for fallow, etc.

Other changes can be made in the control program itself. Group efforts by members from the Virus laboratory, Vector Control, Chemical Control and health educators, especially those who may share similar ethnic and linguistic backgrounds, would help a great deal in future control efforts. The discovery of a "better", more effective chemotherapeutic measure would also be helpful. If DEC had more
immediate effects, and if the treatment was less involved, then it would be more effective in terms of acceptance alone. However, the incentive to test and develop a better cure for filarial disease is lacking by the pharmaceutical industry which stands to profit little from such a "poor man’s disease".

In conclusion, filariasis may be difficult to eliminate from the tropics but there are means of reducing the disease and the human reservoir. But first an accurate assessment of the distribution of the disease needs to be made.
APPENDIX.

Correlation between microfilarial periodicity of W. bancrofti and the biting rhythm of Ae. polynesiensis

(Adapted from Mattingly 1969)

- - - - - - Microfilarial Density

----- Hourly biting rate

[Day and Night Indications]
BIBLIOGRAPHY

Ackerknecht, Erwin H.

Ali, Ahmed

Alland, Alexander

Alland, Alexander

Alland, Alexander

Anderson, A.G.

Armelagos, George J. and John R. Dewey

Armstrong, Jocelyn
1987 *Differentials on Maori Health*. Paper presented to the Association for Social Anthropology in Oceania Meetings, Savanna, Georgia.

Armstrong, R. W.

Audy, Ralph J.
Audy, Ralph J.

Austin, C. J.

Baer, Hans, Merrill Singer and John Johnsen

Baker, P. J. Hanna and T. Baker

Barash, David P.

Barrau, J.

Bates, Marston

Belkin, J.N.

Black, Francis

Boutilier, James
1984 METEI: a Canadian medical Expedition to Easter Island. Paper presented to the Association for Social Anthropology in Oceania Meetings, Savannah, Georgia.

Brenneis, Donald

Bryant, Jennifer J.

Burnett, Sir MacFarlane and White, David O.

281
Burnett, Sir MacFarlane  

Burnett, C.F.  

Buxton, L.  
1926 The Depopulation of the New Hebrides and other parts of Melanesia. Transactions of the Royal Society of Tropical Medicine and Hygiene 19:420-458.

Cardines, Richard J.  

Cheeson, F.W.  

Cliento, R.W.  

Cliff, Andrew D. and Peter Haggett  

Cockburn, Aiden  

Colson, Anthony and Karen Selby  

Coulter, J.W.  

Crosby, Alfred W. Jr.  

Crosby, Alfred W. Jr.  
Dasgupta, A.

Day, J.F. and J.D. Edman

Deo, Indra and Penelope Schoeffel

Derrick, R.A.

Derrick, R.A.

Desowitz, Robert S.

Desowitz, Robert S.

Desowitz, R.S. and E. Una

Desowitz, Robert S. and S.A. Southgate

Dobzhansky, Theodosius

Doumenge, Francois
Duke, Brian

Dunn, Frederick L. and Craig R. Janes.

Dunn, Frederick L.

Dunn, Frederick L.

Dunn, Frederick L.

Durkheim, Emile
1897 Le Suicide. Paris: F. Alcan.

Durrad, R.

Durrenberger, E. Paul

Eason, W.J.E.

Edman, John D.
Eggan, Fred  

Fabrega, Horatio Jr.  

Fabrega, Horatio Jr. and John E. Hunter  

Fabrega, Horatio Jr.  

Fabrega, Horatio Jr.  

Fatiaki, Anselmo  

Fenner, Frank  

Fenner, Frank  

Finucane, M.  
1901 *The Islands and People of Fiji*. Liverpool: Liverpool Geographical Society.

Forbes, Litton  
1875 *Two Years in Fiji*. London: Longmans, Green and Co.

Foster, George M. and Barbara G. Anderson  

Foster, George M.  

Frake, Charles  
Frankenberg, R.  

Frost, Everett L.  

Gardiner, J.S.  

Gillon, K.L.  

Green, Roger  
1981 Models of the Lapita Cultural Complex. *New Zealand Journal of Archaeology*

Harris, Marvin  

Herbst, Philip Henry  

Herskovits, Melville F.  

Hocart, A.M.  

Howard, Alan  

Howard, Alan  

Howard, Alan  
Howard, Alan  

Howard, Alan  

Howells, William  

Hudson, E.H.  

Hughes, Charles  

Hunt, Edward E. Jr.  

Iyengar, M.O.T., et al.  
1965 *Epidemiology of filariasis in the South Pacific*. WHO document.

Iyengar, M.O.T.  

Iyer, Ramamurthi  

Jachowski, L.A.  

Kershaw, W.E.  

Kessel, J.F. et. al.  

287
Kessel, J.F.  

Kessel, J.F.  
1957  Disabling effects and control of filariasis. WHO Document.

Kleinman, Arthur  

Lal, Brij  

Lal, Brij  

Lal, Brij  

Lambert, S.M.  

Landy, David  

Landy, David  

Laurence, B.R.  


Leslie, Charles  
Leslie, Charles

Lewis, Nancy

Lindenbaum, Shirley
1979  Kuru Sorcery: Disease and Danger in the New Guinea Highlands.

Livingstone, Frank

Livingstone, Frank B.

Lock, Margaret and Nancy Scheper-Hughes
1986a  Speaking Truth to Illness: Metaphors, Reification, and a Pedagogy for Patients. Social Science and Medicine 23(2).

Lynch, G.W.A.

MacDonald, Hugh
1902  Annual Medical Report for 1902. Legislative Council Paper No. 11.

Maguire, T. et. al.

Mahoney, L.E. and J.F. Kessel
Mak, F.W. and D.T. Dennis  

Manning, Grant B.  

Manson-Bahr, P.E.C.  

Mataika, J.U. et al.  

Mataika, J.U., B.C. Dando, G.S. Spears and F.N. Macnamara  

Mataika, J.U., M.V. Mataitoga and E. Kimura  

Mattingly, P.F.  

May, Jacques  

May, Jacques  

McArthur, Norma  

McCracken, Robert D.  

Mishra, Vijay

Morse, Janice M.

Naidu, Vijay

Naipaul, V.S.

Nations, Marilyn K.

Nayacakalou, Rusiate

Nelson, G.S.

Nelson, S. and J.M. Cruikshank

Ottesen, Eric A.

Papao, Johnny

Parsons, Talcott

Pawley, Andrew
Pillai, J.S. and J. Urdang
1979 The Discovery of the Mosquito *Aedes Aegypti* on Tokelau group. *New Zealand Medicine* 90:212-213.

Prasad, Shiu

Press, Irwin

Press, Irwin

Prior, Ian and Janet Davidson

Prior, Ian

Rajotte, Freda and John Bigay

Rao, C.K.

Ribeiro, Jose M.

Riley, I.D.

Rivers, W.H.R.
Roberts, S.H.  

Robertson, Robert T. and Akosita Tamanisau  
1988 Fiji: Shattered Coups. New South Wales, Australia: Pluto Press.

Rogers, Garth  

Romanucci-Ross, Lola  

Rosenfield, P.L. and C. Widstrand  

Rossignol, P.A.  

Roundy, Robert  

Roundy, Robert  

Rubel, Arthur  

Rubenstein, Donald  
Rubenstein, Donald and Geoffrey White  

Russell, W.E.  

Sahlins, Marshall  

Sahlins, Marshall  

Sasa, Manabu  

Seemann, Berthold  

Service, M.W.  

Seymour-Smith, C.  

Shweder, Richard A.  

Shweder, Richard A.  
1985 Anthropology's romantic rebellion against the enlightenment, or there's more to thinking than reason and evidence. *Culture Theory: Essays on Mind, self and emotion*. Edited by R. Schweder and R. Levine.

Singer, Merrill  
Siwatibau, Suliana  
Unpublished paper submitted to the Institute of  
Natural Resources, University of the South Pacific.

Social Indicators of Fiji for 1986. Government Publication. Suva, Fiji:  
Government Printers.

Sontag, Susan  
1978 Illness as Metaphor. Canada: Collins Publishers,  
Toronto.

Spencer, Dorothy M.  
1941 Disease, Religion and Society in the Fiji Islands.  
Washington: Seattle University Press.

Spielman, A. and P. Rossignol  
Hill.

Subramani  
1979 Editor. The Indo-Fijian Experience. Australia:  
University of Queensland Press.

Symes, C.B.  
1960 Observations on the epidemiology of filariasis in  
Fiji. Suva, Fiji: Government Printers

Symes, C.B.  
1956 Observations on the Natural History of Human  

Taylor, R., N. Lewis and S. Levy  
Caledonia: South Pacific Commission.

Thaman, Randy  
1984 Food and National Development in the South Pacific.  
Editors R. Thaman and W. Clarke. Suva, Fiji:  
University of the South Pacific Press.

Thomson, Basil  
1908 The Fijians: A study of the Decay of Custom. London:  
William Heinemann.

Tippett, A.R.  
1974 The ethnopsychology of depopulation in the Pacific  
with special reference to Fiji. Unpublished paper, St.  
Mark’s Library, Canberra, Australia.
Toohey, M.R., M.S. Goettel and J.S. Pillai

Trostle, James

Turner, Victor

Waqanovonovo, Makereta

Ward, Martha C.

Weiner, Michael

Weisenfeld, S. L.

Wilcocks, Charles and P.E.C. Manson-Bahr

Wellin, Edward

Wilson, Jim


Young, Alan 1978 Rethinking the Western Health Enterprise. *Medical Anthropology* 2:1-10.