JAMES ROBERT RIACH
Health Patterns of the Secoya of the Northeastern Ecuadorian Amazon
(Under the Direction of TED GRAGSON)

Population growth and economic globalization have intensified the intrusion into tropical forest environments inhabited by indigenous cultures. Although such encroachments are key factors in disease emergence, health data from affected indigenous communities are scant. Furthermore, the identification of factors contributing to disease emergence has relied on the application of an ecological model of disease that does not consider the influence of macro-social forces or of the ethnomedical beliefs of the afflicted populations. The Secoya of the northeastern Ecuadorian Amazon live in a moist, tropical forest environment that has been ecologically degraded by entries of petroleum and agricultural industries, and of land-clearing colonists. It is hypothesized that emergent health conditions exist among the Secoya population. To test this hypothesis, I identify the patterns of the Secoya health problems, test for the presence of disease-emergence in the Secoya population, and identify potential emergence factors. I apply a biocultural approach to the collection and analysis of Secoya health data. I evaluate the health problems experienced by the Secoya with regards to their status as emergent conditions. The emergence factors I consider comprise biological and ecological elements in the environment, global and national political and economic social forces, and Secoya cultural beliefs, and behavioral patterns. My results include the identification of 261 health problems experienced by the Secoya during the period between 1998-1999. The most common health problems include grippe, diarrhea, a dizzy, weak or fainting syndrome, fever, febrile grippe, gastrointestinal parasitosis, skin fungal infections, leishmaniasis, malaria, and chicken pox. Definite emergent conditions include an unexplained fatal syndrome, dengue, hepatitis, tuberculosis, chicken pox, and chainsaw-related injuries. The agents associated with the emergent conditions have entered or re-entered the Secoya population as a result of recent intrusions into the environment. The intrusions have been driven by demographic, economic, and geopolitical macro-social

forces. They have also been influenced by the Ecuadorian government's view of the Amazon as a source of potential wealth and of indigenous cultures as in need of conversion to the national culture.

INDEX WORDS: Secoya, Ecuador, Amazon, indigenous populations, emerging diseases, globalization, environmental change, biocultural, health, epidemiology, medical anthropology, syndromic surveillance

HEALTH PATTERNS OF THE SECOYA OF THE NORTHEASTERN ECUADORIAN AMAZON

by

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DEDICATION

To my mother and father. For demonstrating throughout their lives the humanitarian essence, the respect for life, and the love for each other that are the source of my original inspiration.

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CHAPTER 1: INTRODUCTION

STATEMENT OF THE PROBLEM

A common concern within medical anthropology involves the impact on health associated with the entry of outside cultures into the territories of relatively isolated indigenous societies. Most of this concern has been with regard to how these types of intrusions cause local ecological and cultural changes that result in the emergence of outside diseases and nutritional disorders new to the indigenous populations (Hern 1991; Salzano 1985; Wirsing 1985). In the past, these impacts occurred in relative isolation and did not affect the health of distant populations. More recently, population growth and economic globalization have intensified the intrusion into tropical forest environments, which have been traditionally inhabited by indigenous cultures. Such encroachments have been identified as key factors in the local emergence of new diseases such as AIDS and several types of hemorrhagic fevers (Morse 1993), which increased human mobility now threatens to spread to the global population. The most culpable intrusions involve economic activities that cause deforestation and increased human population density (Morse 1993; Wolfe *et al.* 1998).

Despite the potentially serious implications of escalating intrusions into tropical forest environments on the health of local indigenous populations, and subsequently, to the global population, relevant health data from indigenous communities at risk remain notably missing. Moreover, as has been noted by Inhorn and Brown (1997) the manner in which the international health community has approached the task of detecting emerging diseases and identifying their causes has been deficient on several additional levels. Most noticeably, surveillance to detect emerging diseases has focused only on a short prioritized list of infectious diseases. Furthermore, the identification of emergence factors has relied on the application of an ecological model of disease that does not consider the influence of historical, macro-social, political or economic forces, or of

ethnomedical beliefs and practices. I address all of these problems in my dissertation through an anthropological study of the health patterns of an indigenous population in the the northeastern Ecuadorian Amazon. This population lives in a moist, tropical forest environment that has been ecologically degraded by entries of petroleum and agricultural industries, and land-clearing colonists. I use the term "Secoya" to refer to this population. This population comprises the membership of the political communal organization entitled *Organización Indígena Secoya del Ecuador* (OISE). Due to inter-cultural marriage practices, the population of OISE includes individuals of Secoya descent as well as of the Siona, Macaguaje, Kofán, Angotero, and lowland Quichua ancestry. I chose to refer to the population as "Secoya" given that the majority of OISE members have a Secoya ancestry and tend to refer to themselves as Secoya.

In this dissertation, I test for the presence of disease-emergence in the Secoya population and identify potential emergence factors. I apply a biocultural model of disease that synthesizes key aspects of the biological and cultural legacies of medical anthropology (Armelagos 1992; Hahn 1995). According to this approach, all health problems identified by Secoya ethnomedical and Western biomedical cultural standards are evaluated for emergence. The emergence factors are viewed as the result of the integration of biological and ecological factors, global and national political and economic social forces, and Secoya cultural beliefs, social organization and behavioral patterns.

Emergent Diseases and their Threats to Human Health

Emergent diseases are defined as any disease currently spreading or with the potential of spreading within affected populations (CDC 1994). Emergent diseases do not have to be new among humans or a particular population. They can include old diseases spreading within populations thought to have been rid of them, often in new more virulent or drug-resistant forms (Miller 1989). Emergent diseases can be

communicable or non-communicable. The communicable diseases are exclusively infectious while the non-communicable diseases tend to comprise nutritional disorders or systemic disorders caused by exposure to environmental contaminants.

New communicable emergent diseases and diseases re-emerging in new drug-resistant forms pose higher health threats to humans than other types of emergent diseases. This is because neither immunity nor cures exist for new diseases, and immunity and cures are of very limited use against the drug resistant forms of old diseases. Old diseases emerging for the first time in a new population can be devastating to that population, but pose less of a risk to outside populations in which immunity or cures might exist. Non-infectious diseases or disorders such as nutritional deficiencies and other systemic disorders pose a significant health risk to the affected population since they have the potential to compromise their immune system. Compromised immunity can lead to increased susceptibility to infectious diseases and to serious complications from otherwise benign infections (Scrimshaw *et al.* 1968; Scrimshaw 1970).

Factors Contributing to Emergence of New and Rare Infectious Disease

Indigenous cultures living in moist, tropical rainforest environments that have been ecologically disturbed by economically-driven intrusions are at risk for developing all types of emergent diseases. They are at particular risk for the emergence of infectious diseases new or rare among humans. The pathogenic sources of these types of emergent diseases evolved within wildlife populations with perhaps infrequent and isolated infections of humans (Schrag and Wiener 1995). The natural life cycle of each type of pathogen includes a limited set of wildlife species. Given that rain forests support the greatest species biodiversity of all terrestrial ecosystems, they are also likely to support the greatest diversity of rare and unknown pathogens of infectious disease with the potential of entering human populations (Wolfe *et al.* 1998).

The transmission of infectious pathogens from wildlife species to humans commonly occurs through contact with infected feces or body fluids, or via the bite of an infected arthropod vector such as a mosquito, tick, or fly. Ecological disruption of the tropical rain forests influences the distribution and abundance of potential wildlife hosts and vectors, and therefore of pathogens (Schrag and Wiener 1995). It does so by creating new environments that favor new or existing wildlife species or disease vectors over others, and by forcing out certain wildlife species into the surrounding intact forest. Accordingly, the pathogens associated with the wildlife or vector species will flourish in the areas where the population density of these species has increased (Morse 1991). Furthermore, the areas of the forest edge between the newly transformed forest and the intact forest provide ideal habitats for several arthropod species, which can be the natural hosts for certain pathogens, or vectors for the transmission of diseases between wildlife and humans across the boundaries of both types of environments (Roundy 1980).

Intrusion into traditional indigenous territories can also contribute to the development of new infectious diseases among the local residents by forcing them to expand into forest areas they had previously not ventured into. Intrusion into territories settled or used by indigenous populations for swidden horticulture, hunting, or fishing forces these populations to seek new means of providing their subsistence needs. One of the ways to do this involves expanding further into forest areas to find the needed resources. Such expansions increase the risk of indigenous cultures encountering wildlife infected with previously unknown infectious pathogens, which can then enter their populations.

Factors Contributing to Other Types of Emergent Conditions

In addition to being at risk for developing the emergence of new infectious diseases, indigenous societies in ecologically disturbed environments are also highly at risk of developing several other types of emergent conditions. They are particularly at

risk for the novel development among their population of old infectious diseases and nutritional and other systemic disorders. It should be noted, however, that these indigenous societies are not necessarily more at risk of developing these conditions than are other poor and crowded rural or urban societies throughout the world. Nonetheless, the mechanisms that enable the entry of these diseases into indigenous populations differ from those affecting other societies. These mechanisms involve interrelated cultural and ecological changes following the entry of the new cultures into traditional indigenous homelands.

The entry of the new cultures into the tropical forest homelands of indigenous populations and the subsequent changes in the local ecology and in cultural traditions of these indigenous populations have been well documented (Kroeger and Barbira-Freedman 1988; Salzano1985; Wirsing 1985). This typically involves a pattern of behavioral changes such as increased sedentism and population density, dietary changes, incorporation of western medicines, and increased contact with outsiders. In addition, national authorities tend to view the indigenous populations within their borders as subordinates, and national programs to provide access to basic water, sanitation, and health services for these indigenous cultures tend to be highly neglected. All of these factors increase the susceptibility of the indigenous cultures to all forms of infectious diseases and to nutritional deficiencies. The combined effect of all of these conditions can potentially tax the immune system of the members of the indigenous populations, thereby exacerbating all of their health problems.

Contemporary Responses to the Problem of Emerging Diseases

The current efforts to address the increase of emerging diseases derives from the manner in which international health programs have responded to health problems, and in particular, infectious diseases since the 1950's. These programs have characteristically consisted of the flow of advice, health professionals, and health technology from wealthy

nations to the poorer, developing nations. Although these programs have relied on the help of benevolent health professionals, their strategic approaches were not necessarily guided by altruism, but by the political and medical needs of the wealthy donor nations (Rubenstein and Lane 1990). This influence can be noted in several consistent patterns that have typified the manner in which emerging diseases have been approached in international health efforts.

The single most consistent pattern in the design of international health efforts is a selective focus on a short list of diseases prioritized by the wealthy donor nations (Inhorn and Brown 1997). Tropical diseases such as malaria, hookworm, and yellow fever were initially targeted for eradication on the rationale that they were obstacles to economic development (Brown 1976). Communicable infectious diseases currently comprise all of the prioritized emerging diseases (WHO 1992).

Another pattern in the current approach to addressing emerging diseases involves the application of an ecological model of disease, derived from epidemiology (Armelagos *et al.* 1990). This disease ecology model has guided the international health community in the identification of causal factors and the development of intervention programs to help control and prevent emerging diseases. According to this model, the causes of disease is understood as the interaction between sources of disease (i.e., pathogenic microbes and contaminants), human hosts, and the physical and biological environment (Mascie-Taylor 1993). The main approach of the resulting intervention programs has been the identification and modification of behavior believed to contribute to the transmission of the diseases (Inhorn and Brown 1997).

The 1998 CDC document entitled *Preventing Emerging Infectious Diseases, a Strategy for the 21st Century* exemplifies the current approach to responding to emerging infectious diseases. Initially developed in 1994 to address the concerns of emerging diseases in the United States, it was later adopted for application at the international level by the World Health Organization (WHO). The strategy calls for emphasis on four

activities: surveillance, applied research, prevention and control, and the strengthening of the public health infrastructure. Only the first two activities are directly involved with the detection of emerging diseases and the identification of their causes. The last two activities focus on the dissemination of information about emerging diseases for purposes of facilitating intervention programs, and on providing the support of personnel, laboratories and equipment to successfully carry out the objectives of all areas of activities. Only the first two components relate to the focus of my thesis. I elaborate on them next.

Surveillance includes efforts to detect, investigate and monitor emerging infectious pathogens, the diseases they cause, and the factors contributing to their emergence. One of the ways in which surveillance is carried out involves the collection of local-level health data and its vertical dissemination through regional, national, and eventually international health agencies such as the WHO. Local physicians and public health workers involved in routine medical activities and specialized "sentinel" surveillance teams working in areas considered particularly at risk for the development of an emergent disease are the main groups providing the local data. Physicians typically report laboratory-verified cases and outbreaks of the diseases prioritized as reportable by their own national policies usually in conformance to the guidelines established by the WHO. Sentinel surveillance teams may report on a broader set of conditions. Some of these reported conditions include the presence of suspect syndromes or patterned signs and symptoms indicative of a known or unknown emergent disease in what is called syndromic surveillance.

An increasing trend in surveillance approaches involves the collection of remotely sensed (RS) data on health risk factors. One of the ways this has been done includes the integration of local-level health and ecological data within geographical information systems (GIS) to identify spatial patterns indicative of disease transmission risks (Beck 1997; Dister *et al.* 1997; Glass *et al.* 1992). The idea behind this approach is that

ongoing RS surveillance can enable the detection of similar patterns in areas for which local-level data do not exist, and health agencies could be alerted to the distribution of new areas at risk for the introduction of an emergent disease.

The applied research component of the CDC strategy involves the integration of laboratory sciences, epidemiology and public health practice. The development of biotechnology useful in the laboratory and field identification of new sources of infectious diseases and syndromes provides one of the main foci of this component. Another focus includes research on the genetics, biology, and evolution of infectious pathogens. The main purposes are to identify and modify behavior that causes humans to enter the life cycle of infectious pathogens and to develop vaccines to innoculate humans.

Deficiencies in the Current Responses to Emerging Diseases

The responses to emerging diseases by the international health community in general, and as detailed in the 1998 CDC strategy in particular, suffer from various deficiencies. A particular deficiency is the explicit neglect of indigenous cultures in tropical forest environments. To date there exists no systematic surveillance of disease emergence among indigenous populations in tropical rain forests. This is a critical oversight since the populations live in the areas at highest risk of developing new and unknown infectious diseases.

Another significant deficiency is the total absence of consideration of macro-social political and economic forces. According to the current CDC strategy, human behavior represents one of the most significant factors contributing to disease emergence, and it must therefore be changed. Yet, there is no mention of efforts to identify or change the macro-social forces that cause the behavior in the first place. Failure to identify and address these forces ensures the perpetuation of activities that place humans at risk of developing new emerging diseases.

The lack of attention to non-infectious diseases is one of the most obvious, but least questioned deficiencies in the CDC strategy. Although non-infectious diseases are not likely to spread to distant populations, conditions such as nutritional deficiencies and systemic disorders can lead to immunocompromised disorders that enhance the susceptibility of affected individuals to the transmission of infectious diseases (Scrimshaw *et al.* 1968; Scrimshaw 1970). Given the high levels of pathogen diversity believed to exist in rain forests (Wolfe *et al.* 1998), this could include rare and unknown infectious diseases. Once introduced into a human population, new infectious diseases may then spread to distant populations. Therefore, monitoring emergent non-infectious diseases could provide valuable insights for preventing the emergence of infectious diseases.

Monitoring only infectious diseases prioritized by the wealthiest of nations ignores diseases that could be devastating to local populations. Such neglected diseases can evolve into more pathogenic and drug-resistant forms that could then threaten the global population. For example, the neglect of tuberculosis has led to its increasing re-emergence in drug resistant forms around the world.

The trend toward using satellite imagery to identify causal factors of disease emergence or to predict areas of future outbreaks tends to neglect not only the influence of macro-social forces, but also overlooks local-level ecological and cultural heterogeneity. Both can result in an underestimation of the actual and potential distribution of emerging diseases.

ANTHROPOLOGICAL APPROACHES AND CONTRIBUTIONS

Medical anthropology does not have a long record of studies of emerging diseases, or even of infectious diseases, particularly within the scheme of international health programs. In fact, the term “medical anthropology”did not enter general use until the 1960's (Wellin 1978). Nonetheless, I believe that medical anthropology is indeed

ideally suited to guide research on emerging disease. This is because the cultural and biological legacies of medical anthropology provide it with the basis for the synthesis of a biocultural model of disease that compensates for the deficiencies in the international health community response to emergent diseases. This is particularly true when such biocultural models are enlightened by more recent critiques of macro-social orientation.

All current orientations in medical anthropology owe their emergence to the works of anthropologists writing about medical phenomena since at least the 1920's. From the 1920's up until the 1960's cultural anthropologists were interested in explaining the sociocultural nature of medical beliefs and practices, particularly as manifested in small-scale traditional societies (Landy 1977; Wellin 1978). One of the earliest contributions of cultural anthropology to the development of theory in medical anthropology derives from the view that the medical beliefs and practices of a society are interrelated to each other and to the way that society conceptualizes the nature of the world (Rivers 1924; 1926). This view provided the foundation for the functional and cognitive approaches currently dominant in medical anthropology. The functional approach (Ackerknecht 1971) emphasizes the view of culture as comprising functionally integrated parts, including medical beliefs and practices (Ackerknecht 1971). The cognitive approach as represented in ethnomedical studies focuses on the conceptualization of medical beliefs within a society and the relationship of these beliefs to the cosmology of that society (Rubel and Hass1990).

By the 1960's medical anthropology became influenced by theoretical developments in evolutionary biology. This influence led to the development of the disease ecology orientation within the field of epidemiology, which was developed to define the relationship between host, pathogen, and environment (Armelagos 1992). This in turn led to the development of the ecological model of disease within medical anthropology (Wellin 1978). This ecological model is a biocultural evolutionary orientation. According to Lieban health and disease are “measures of the effectiveness

with which human groups, combining biological and cultural resources, adapt to their environments" (1973: 1031). In the model, the environment comprises biotic, abiotic and cultural elements, and also contains the social influence of other human groups (Wiley 1992).

The ecological model of disease has been used by anthropologists to document the influence of large-scale development projects (Hughes and Hunter 1970), acculturation (Hern 1991; Salzano 1985; Wirsing 1985), and ecological change (Nichter 1987) on the emergence of localized epidemics in different societies. However, by the 1980's various anthropologists had already begun to criticize the ecological model of disease for being too static and narrow in focus to properly explain the causality of disease. More specifically, critics argued that the explanations of disease have overlooked how important historical processes and social relations give rise to disease (Armelagos 1992). Of particular concern has been the neglect of macro-social political, and economic forces in favor of emphasizing physical, biological, and micro-social behavioral patterns as causes of disease (Baer 1986, 1990; Singer 1989; Turshen 1984). Medical anthropologists have tended not to conduct research on why environments have been disrupted, by whom, and for what purposes. Instead, the foci of medical anthropology research has been on how local populations behave in response to environmental changes and how this behavior contributes to disease among those local populations (Wiley 1992).

Another area of concern has been the tendency by medical anthropologists to use the ecological model of disease to only investigate health problems that are defined as diseases according to the Western medical system while ignoring what are defined as health problems according to other medical systems (Armelagos 1992; Scheper-Hughes 1990). The WHO-sponsored public health efforts of the 1950's to the 1970's revealed that for intervention programs to succeed in a given society, they need to identify and address the health problems as defined by that society. In addition, behavior that contributes to

the emergence of a health problem in a particular society may itself be the result of the way that society defines disease and explains its causation (Sommerfeld 1994).

Anthropologists have responded to the critiques of the ecological model in several ways. One of the responses has been to provide simultaneous attention to macro and micro social elements in identifying disease causation (Armelagos 1992; Inhorn and Brown 1990; Wiley 1992). This entails an analysis of how behavior ranging from population movements and agricultural practices to hygiene and dietary practices influences disease emergence, and of how historical social forces begot such behavior. Another change involves the addition of an ethnomedical dimension (Armelagos 1992) into the ecological model. This enables the consideration of how the way a society defines disease and its causation, and of how they respond to this threat, can influence patterns of disease emergence. For example, individuals with biomedically recognized infectious diseases that are not ethnomedically defined or recognized as diseases may not seek treatment and thus, help to spread the disease. It is believed that the incorporation of these changes would allow the synthesis of a biocultural model of disease truer to the holistic approach that is the hallmark of anthropological research.

RESEARCH GOALS AND OBJECTIVES

Indigenous cultures living in disturbed tropical forests have been hypothesized to be at highest risk for developing new and deadly communicable diseases that can threaten global health. The application of a holistic biocultural model to detect disease emergence among the Secoya would help test this hypothesis and would address precisely the very issues not dealt with by the current endeavors of the international health community. Accordingly, my goals for this dissertation are to identify the patterns in which the Secoya experienced health problems during the period from 1998-1999, to identify the possible emergent conditions represented by the health problems, and to explain how the biocultural context of the Secoya contributes to the patterns of these health problems.

Dissertation Layout

In chapter 2, I provide a description of the biocultural context of the Secoya. In chapter 3, I explain my research methodology and specify the components and parameters of my biocultural model. In chapter 4, I present the results of my analysis of health patterns. In chapter 5, I offer explanations for the health patterns experienced by the Secoya. Chapter 6 contains my conclusions regarding the presence of new emerging diseases among the Secoya and of the factors that could contribute to these.

CHAPTER 2: SECOYA HISTORY AND ENVIRONMENTAL CONTEXT

INTRODUCTION

Since their contact with European society in the sixteenth century, the biocultural environment of the Secoya has undergone continuous change as the result of global or national political and economic forces. However, it was not until the latter third of the twentieth century that forces tied to the pursuit of industrial development led to largest-scale and most permanent changes in their environmental context. It is precisely such intrusions that are associated with the process of disease emergence. In this chapter I examine of the historical macro-social forces and behavior that shaped the contemporary context. I begin with a brief background of Secoya identity and ancestry, the tropical rain forest ecosystem they inhabit, and the ethnographic patterns of their traditional culture. I then review the macro-social forces and behavior that modified the traditional Secoya culture and environment during the period from their earliest contact with European society to just prior to the entry of industrial development in their territory in 1967.

SECOYA TERRITORY ECOSYSTEM CHARACTERISTICS

Throughout this dissertation I use the term "Secoya" to refer to the study population. This population comprises the membership of the political communal organization entitled *Organización Indígena Secoya del Ecuador* (OISE). Due to inter-cultural marriage practices, the population of OISE also includes members of the Siona, Macaguaje, Kofán, Angotero, and lowland Quichua cultures. In addition, some of the households identified included mestizo individuals. Nonetheless, the majority of OISE members share Secoya and Siona ancestry. The main distinguishing feature between the Secoya and Siona groups is that prior to the 20th century the Secoya lived below the mouth of the Aguarico River and the Siona above it. These two groups are descendants of an aboriginal population in the western Tukanoan linguistic family. This aboriginal

population was referred to as the *Encabellado* by the missionaries who first contacted them in 1599. However, both the Secoya and Siona have consistently self-identified themselves with a term in their own language that means "people." This term in the Secoya dialect is *Pai*, and *Bai* in the Siona dialect.

The population of the OISE is currently distributed in three communities within a legally-recognized territory of about 390 km^2 spread along a 40 km stretch of the Aguarico River and its tributaries, the Eno, and Shushufindi. These communities include San Pablo, Si'ekoya, which are comprised mostly of individuals of Secoya and Siona ancestery, and the Eno community which is comprised mostly of individuals with Quichua ancestry. The distribution of the Secoya communities within this territory is presented in figure 2.1. At the time they were encountered by Europeans, the territory of the Secoya ancestors, the Encabellado extended beyond their current boundaries to encompass an area of roughly 17,000 km^2 of the Napo and Aguarico (Vickers 1983). According to Steward's (1949: 508) map of the distribution of native groups at the time of contact, this territorial range comprised only a small part of the nearly 82,000 km^2 of land between longitude 1°N to 4°S and latitude 73°W to 77°W, which was occupied by the whole of the western Tuakanoan speakers. The Secoya use the term *airo* (forest, woods, jungle) in reference to all of this tropical rain forest environment. In the sections below I provide a description of the climate, vegetation and fauna, that characterize tropical rain forest systems in general and constitute the Secoya environment. This is followed by a brief discussion on the status of disease agents and human population density present in this environment prior to European entry.

Climate

According to the Köppen climatic system, the climate of the Secoya environment corresponds to that of Tropical Rain Forest (Af). The parameters of this classification include monthly temperature averages constantly above 18°C and a typical annual

average rainfall exceeding 1,500 mm. They also include constant levels of solar radiation year-round, the absence of a dry season, and near daily moist convective showers in the afternoon. Seasonal temperature variations are less than 3°C with diurnal temperature variations exceeding the seasonal variation. It should be noted that although there is no real "wet" or "dry" season, the period of less wetness occurs from December through February, and the period with highest rainfall occurs from March through July.

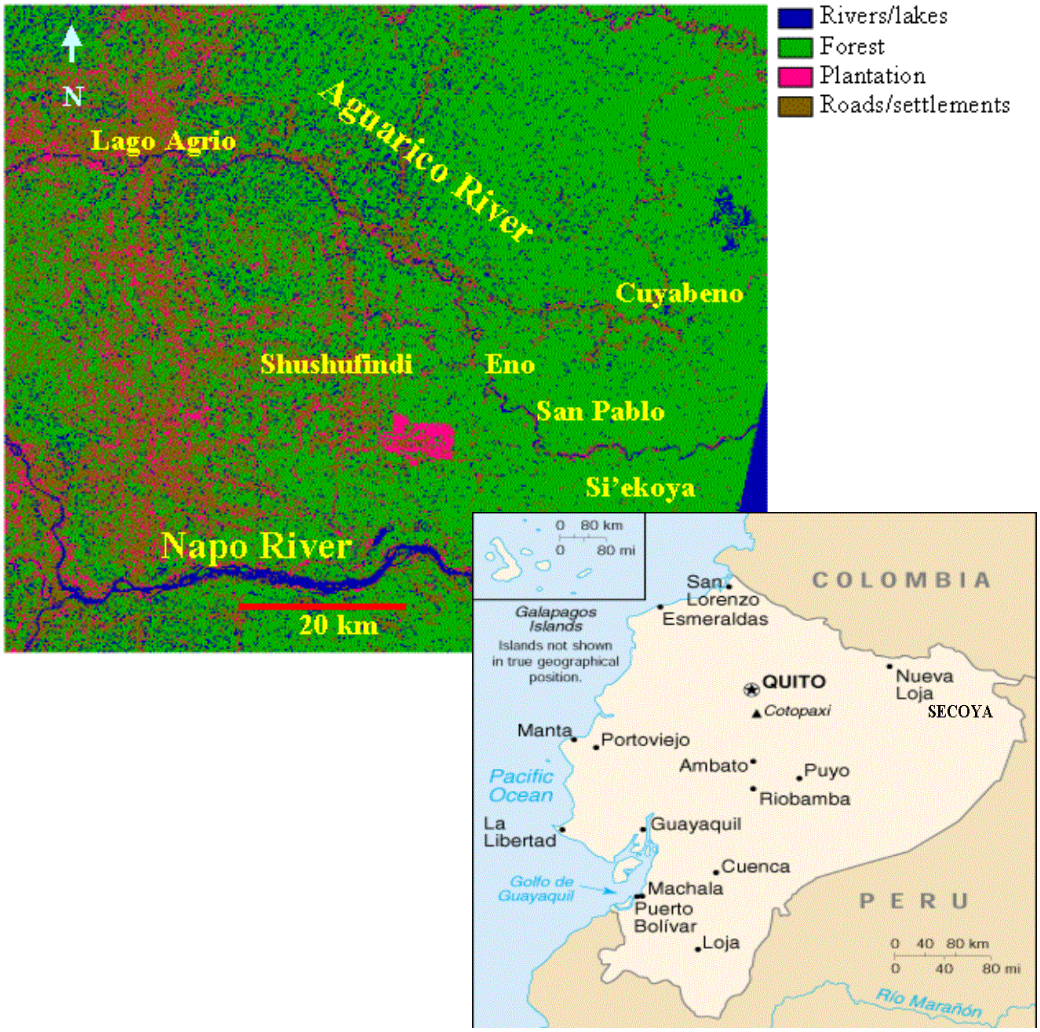

Figure 2.1: Distribution of Secoya communities within the study region.

Vegetation Characteristics

Within the tropical rain forest homeland of the Secoya there are two broad types of terrestrial ecosystems classified by Prance (1978) as forest on non-flooded land (terra firme) and forest on seasonally inundated lands (várzea). Each of these ecosystem types contains several vegetation types. The dominant vegetation type is classified as terra firme high forest with large biomass. This plant formation is characterized by a dominance of various species of broad-leaved evergreen trees with heights ranging from 25-45 m or more, which often support an abundance of epiphytes. Some of the largest trees have boles and girths several meters in diameter and buttressed trees and stilt roots are common. Palms, ferns, and mosses are numerous and diversity is highest near the canopy. Scattered within this forest type are formations classified as liana forest, where woody climbers are the dominant feature. The várzea forests consist mostly of the vegetation type classified as flood plain forest, which grows on periodically flooded islands and along the banks of the rivers. A second várzea vegetation type classified as swamp forest is found in the region, but limited to the water-logged soils in the Cuyabeno section of the territory.

Faunal Characteristics

The Amazon, in general is characterized by high faunal species diversity. The Aguarico and Napo region, however, may contain slightly higher species endemism than typically found in other parts of the Amazon, since it may have served as a rain forest refuge during the warm and dry periods of the Pleistocene (Haffer 1969; Meggers 1975; Prance 1978, 1982). Most Amazonian faunal biomass and biodiversity is comprised of invertebrates, particularly insects, many of which serve as vectors that carry infectious agents transmissible to humans. In the Amazon, fish are the most diverse of the vertebrate species. The remaining vertebrates are represented in order of decreasing diversity by birds, mammals, reptiles, and amphibians (Bourlière 1982). The majority of

the mammalian species are solitary nocturnal arboreal species and their abundance and biodiversity tends to decrease as the size of the animals increases. Smaller forms including primates, rodents, and bats are among the most diverse of mammals and are abundant in the forest. The least abundant mammalian forms include the felines such as the jaguar and several species of large ungulates such as tapirs, and collared and white-lipped peccaries. Snakes, including several pit vipers, constrictors, and coral snakes together with various species of lizards comprise a significant portion of the reptilian biomass. The amphibians are comprised mostly of frogs, toads, and a very few species of salamanders (Kricher 1989).

Infectious Disease Agents Present Prior to European Entry

It is commonly assumed that the number of pre-contact parasitic and infectious diseases among Amazonian Indians is relatively small compared to other populations (Coimbra 1988). Black (1990) considers the non-introduced endemic diseases to include Herpes Type 1, infectious mononucleosis, cytomegalo disease, hepatitis B, amoebiasis, trepanomal infection, syphilis, and helminthic infections including Ascaris, hookworm, and whipworm. According to Black, antibodies to these agents were so prevalent among all groups tested that they must have been common long before European contact. Coimbra (1988) summarized studies of other parasites common among Amazonian Indians. Both Coimbra and Black argue that the blood parasite *Mansonella ozzardi*,and the mycoses, black piedra, lobomycosis, and *Tinea imbricata* are so common they should be considered autochthonous to the Amazon. Black (1990) identified mayaro fever, oropuche fever, toxoplasmosis, leishmaniasis, trichinosis, yellow fever, and tetanus as non-introduced zoonotic diseases. These diseases are rare outside the indigenous populations, have a reservoir in forest animals, and do not cycle freely among human populations since they rely on vectors in the local forest ecosystem. In addition to these diseases various viruses found only in the South American tropics have recently been

identified and found to be transmitted to humans by several species of mosquitoes native to the region (Benenson 1995: 25-33). It is therefore likely that these viruses were also present in the Amazon prior to European contact. The viruses include several forms of alphaviruses, phleboviruses, flaviruses, bunyaviruses, and rhabdoviruses (White 1996). The histoplasmosis fungal infection is likely to also represent an infectious disease present in the Amazon prior to European contact. This is because the *Histoplasma* fungi grows on highly organic soil that has accumulated several years worth of feces from bats (Benenson 1995), which are known to be common to the region (Kricher 1989).

Human Population Density Prior to European Entry

Steward (1949: 663, 1959: 51-54) and Denevan (1974) estimate pre-contact indigenous population density for South America. Steward's estimates correspond to the cultural types that he identified for the pre-contact indigenous groups so the aboriginal Encabellado were classified with the marginal tropical forest tribes. Denevan provides population density estimates for regions differentiated by habitats. The Encabellado were assigned a population to residents of lowland forest habitats. Despite the different approaches, both Steward's and Denevan's classifications place the aboriginal Encabellado population density at approximately 0.2 persons per km^2.

ETHNOGRAPHIC PATTERNS OF SECOYA TRADITIONAL CULTURE

I draw for my description of the traditional cultural context on descriptions of the traditional practices, knowledge, and beliefs of the Secoya and of their close relatives the Siona of the Putumayo (Cipolletti 1988; Moya 1992; Payaguaje 1994; Piaguaje 1994). I also rely on anthropological studies by Langdon (1974) and Vickers (1976). The traditional Secoya culture is broadly characterized as people relying on swidden horticulture, hunting, fishing, and collecting, who lived in small and shifting settlements,

and who participate in symbolic ritualistic activities involving the use of psychotropically active plants.

The Secoya traditionally lived in large elliptical palm-thatched houses with dirt floors distributed throughout several scattered communities or local groups. Houses were large enough to accommodate several nuclear family units that together comprised a kin group. Kin group membership was organized according to a patrilineal kinship system and a patrilocal marital residence pattern. Although largely an egalitarian culture, each household was headed by the oldest male. This unofficial leader (headman-shaman) was perceived to have amassed over his lifetime great knowledge and wisdom about Secoya cosmology. He was expected to use his cognitive powers to manipulate or communicate with the spirits and ensure the well-being of his kin by helping them attain food and avoid harm, and by healing them when they were sick or injured.

Each multi-household community recognized one household leader as having more knowledge and power than all others. This leader exerted his influence across all households in the community. The households that comprised the communities had friendlier relations with each other than with households of other communities. In fact, sickness and death in were commonly attributed to malevolent acts of sorcery by the leaders of other communities, thereby contributing to inter-community tensions.

The Secoya settle along streams and small tributaries of the major rivers of the region. Each community is surrounded by an area of land where they practice swidden horticulture, and most of their hunting, fishing, and collecting of wild plant products and animals takes place. The sites of households, communities, and of the territories exploited change on a periodic basis as resource availability in those sites is perceived to decrease. Such relocations tend to occur within the limits of the territorial range that has been historically occupied either by themselves, their relatives, or their ancestors.

The traditional subsistence strategy of the Secoya involves the combination of swidden gardening, hunting, fishing, and collecting. Manioc (*Manihot esculenta*) and

plantains (*Musa x paradisiaca*) are the dominant crop and caloric staples. Additional cultigens such as *Bactris gasipaes* and *Carica papaya* produce fruits rich in vitamin A and C (Lescure *et al.* 1987). Hunting and fishing are the main source of protein, and also provide iron, thiamin, niacin, and retinol (Benefice and Barral 1994). Wild plants, seasonal fruits, insects, eggs, or other subsistence items provide smaller amounts of calories to the diet. However, they provide valuable fat, vitamins, and minerals to their diet. Some of the many wild plant products collected for medicinal or ritual purposes contain compounds that serve to meliorate or prevent health problems. For example, *Diplopterys cabrerana*, which is used in the yajé ritual, contains antihelminthic properties (Sollman 1948).

Secoya cosmology entails an ordered multi-layered universe comprised of humans and hundreds of named spirits or supernatural forces that control all aspects of the universe including health, sickness, death, food supply, weather, and natural catastrophes. The Secoya generically refer to these spirits and forces as *watí*. To ensure one's well being and prosperity an individual must learn how to deal with these supernatural forces. This task is achieved by men called "drinkers of yajé" or shamans who have the responsibility to diagnose and treat the ailments of members of his household and local community.

The Secoya conceptualize "health" using the term *wahɨ́,* which implies life and well-being. It is contrasted with the polar opposite concept of *dawu*, which refers to sickness or disease (Vickers 1981: 711). The manner in which the Secoya conceptualize health is revealed in the various ways in which they apply the term *wahɨ́* in their language. They use this term to describe green color, green as a stage of ripeness, fresh, fat, young, tender, and well. They also use it as a verb that means "to be alive." It is a concept that implies growing life at a stage of youth, strength, and health (Langdon 1974: 210). By contrast, the Secoya associate sickness or *dawu* with rottenness and skinniness.

For them, the description of the severity of one's state of health are made with regard to their fatness or skinniness.

According to the traditional Secoya ethnomedical beliefs, the ultimate cause of most ailments is related to the supernatural. However, some ailments such as injuries related to accidents or minor ailments that go away by themselves or with some type of family herbal treatment, are believed to be the result of a "natural" factors. The longer an ailment persists despite treatment, the more likely it is to be perceived as caused by supernatural causes.

Langdon (1974: 212-213) identified three major forms of supernatural causation of sickness as perceived among the Putumayo Siona. These include simple spirit attacks, motivated spirit attacks, and sorcery. Generally, spirits or *watí* are perceived as neutral spirits which may be called upon by the shaman to help heal or cause sickness. However, some spirits are perceived as inherently malicious and encounters with them are believed produce harmful effects. The simple spirit attack usually involves an encounter with a malevolent spirit or *watí* or the breaking of a taboo. Simple spirit attacks are most commonly attributed to sickness among children. Motivated spirit attacks are usually attributed to deceased shamans or elders. It is believed that when shamans die they become *watí* and any grudges they held against members of the family or community are acted upon by the *watí*. These types of sickness are believed to most commonly affect the adults of the community but children may also be affected.

Serious sickness or death is usually perceived as the result of an attack from a sorcerer of another community. These sorcerers are shamans believed to have enlisted the help of a *watí* to cause harm to members of a distant community. In cases where sorcery is suspected retribution is expected and the sorcerer may be targeted for murder by family members of the deceased. Typically, it is believed that only sorcerers will cause harm and shamans will only heal. In actuality, both shaman and sorcerer are products of an initiation process into the *yajé* realm. This initiation is akin to an

educational program where student apprentices learn to identify supernatural events and how to deal with them from a master shaman (Vickers 1976). It may take several years to successfully graduate, something which not all initiates accomplish. Along the way, the initiates attain different levels of mastery. According to Fernando Payaguaje, a now deceased master Secoya shaman, those who can not attain the highest levels of shamanic wisdom may fall to the temptation of anger and feelings of power brought on by *yajé* and become sorcerers. Once one has done this they can never become a shaman (Payaguaje 1994).

The Secoya recognize various syndromes of bad health, which are expressed as various forms of *dawu.* An adjective describing the ailment is usually added to the *dawu* term to refer to the type of sickness being experienced. Some forms of *dawu* are referred to in terms of the signs or symptoms associated with a perceived state of bad health. Some of the examples of these as provided by Langdon (1974: 209) include *pã?po dawu* (tiredness); *gone dawu* (fungi causing feet infections); and *hayó dawu* (fever). Other syndromes are referred to in terms of the cosmologically-recognized cause of a particular condition. Vickers (1981: 711) provides some examples of the many categories of these types of syndromes including *ma oma dawu* (red frog illness) and *?aíro baĩ dawu* (forest people illness). In each of these examples, objectively recognized signs and symptoms such as chest pain, coma, vomit, and nausea are explained in terms consistent with the Secoya's belief in the supernatural causation of sickness. For example, *ma oma dawu* is characterized by a prolonged coma which is believed to have been caused by when a sorcerer enlists the aid of a *watí* to carry a supernatural red frog "dart" to his victim where it causes the coma. Likewise, *?aíro baĩ dawu* is caused when individuals cross invisible nausea and vomit-causing vapors placed on a forest trail by small spirit beings called *?aíro baĩ.* upon the request of a sorcerer.

The Secoya use the term *ɨ́kó* to refer to the concept of "remedy." The term is used to refer to a large variety of plants and animals used to insure that an event or person will

develop normally, to insure health, to prevent danger or disruption of normality, and to return the situation or person to its normal state. The Secoya regard *yajé* as *ʼ̃kó* while all other forms of remedies are considered as types or subclasses of *ʼ̃kó*. *Yajé* has the widest applicability of all the remedies and also sets the meaning, power, and pattern of use for all other remedies used by the Secoya. Its serves as the principal medium that allows the shaman to diagnose the ultimate supernatural causation of events and is also symbolically perceived as imparting curative powers to other remedies (Langdon 1974 157-158).

PRE-INDUSTRIAL PERIOD (1599-1966)

The major driving forces behind the intrusions into the Amazon region of Ecuador and into traditional Secoya territories have involved the pursuit of wealth from the land and the assimilation of the indigenous peoples into the European-based national culture. By 1599 Jesuits began entering the traditional Secoya territory (Vickers 1976). The missionaries attempted to evangelize the Indians they encountered and to convert them from hunters and gatherers into a European-style peasantry (Muratorio 1987: 98). All contacts between the missionaries and the Indians involved the presence of armed soldiers whose function was to protect the missionaries and to instill fear (of God) among the Indians (Cipolletti 1988: 16). This atmosphere of tension and conflict coupled with the tragedy of deadly epidemic diseases (Castellví 1944; 42; Figueroa 1904: 206; Palacios 1989) characterized the conditions in these missions.

Following the departure of the missionaries by the end of the 18th century and until the beginning of the 20th century, there was virtually no contact between the Encabellados and outsiders other than that with river traders and the occasional explorer (Vickers 1976). The activities of these traders do no appear to correspond to any macro level social, political, or economic forces. Rather, it was based on a self interest of individuals in search of adventure and their own personal economic gain.

From the end of the 19th century and throughout the 20th century there is a marked increase in penetration of economic activities into the Amazonian region with little regard of the consequences to the indigenous population living there. It was during this time that the Ecuadorian Amazonian region were exploited by neighboring Peruvians and Colombians for the purpose of collecting rubber and other forest products. The living conditions of the Indians involved in the rubber collection activities in particular were among the most brutal in Amazonian history from which tens of thousands of Indians died from sickness, hunger or murder at the hands of their *patrónes.* The Boran and Witotoan people of the Putumayo regions of Colombia and Perú were the most affected (Langdon 1974: 35-37). The Secoya were also recruited by Peruvian and Colombian patrons who traveled into the Napo and Aguarico to recruit labor (Vickers 1976: 46-48).

Further impetus for the economic penetration into the Amazon was provided towards the end of the 19th century as the region was increasingly viewed to be in need of economic and social transformation. Conservatives viewed the Amazon as a "conjoint of savages" in need of modernization (Muratorio 1987: 130). Liberal leaders like President Eloy Alfaro took a more favorable view of the Indian position and referred to plans for the "liberation" of the Indian rather than their transformation. However, according to him, these plans still required economic development and social and political changes, which would in turn require the integration of the Amazonian region with the rest of the nation and the protection of the Ecuadorian borders against the advances of the Peruvian military. Acting on this belief, in 1921 a legislative decree authorized the government to offer colonization contracts in the Amazonian region to international private firms (Moya 1988: 48-49).

Amidst the growing political and economic desires to exploit the land and the people of the Amazon, the Secoya became involved in an abusive patronage system of rubber collection that lasted from the 1900's through the 1940's. Many Indians died as the result of diseases incurred by the poor living conditions in the *haciendas* of the patron or

directly as the result of murder by the same. In addition, by the 1920's various Ecuadorian "colonists" acting as figureheads for British and North American firms mined gold exploitation along the Napo. This was followed in the 1930's with the beginning of concessions of vast areas of the Amazon to international oil companies (Muratorio 1987). One of these was a 10 million hectare concession to Anglo Saxon Petroleum, a subsidiary of Royal Dutch Shell (Muratorio 1987: 204-205). According to Galarza (1988) this eventually led to the 1941 Perú-Ecuador War in which Ecuador lost nearly one third of its territory to Perú as was dictated by the 1942 Protocol of Río de Janeiro. As a result of Ecuador's dissatisfaction with the terms of this treaty, the Napo and Aguarico rivers were until recently, closed to commerce and travel between the two countries. This action served to inhibit the Secoya living in Ecuador from visiting their families residing in Perú.

By the1940's several Secoya families that had been involved in the rubber collection patronage system fled their patrons and migrated to the Cuyabeno River in Ecuador. In 1955 the Secoya and Siona that were living in the Cuyabeno region were visited by the Summer Institute of Linguistics (SIL), which had been contracted by the *Ministerio de Educacíon y Cultura* to provide schooling to the Siona and Secoya (Vickers 1984). The entry of the SIL coincided with a political climate in which public policy toward Indians was becoming more favorable than it had been in the 19th century and legislative efforts to redress the abusive patron system were enacted. Nonetheless, public policy was still greatly influenced by the opinion of Indians as primitive, unlearned savages in need of assimilation to the national culture. The activities of the SIL among the Siona-Secoya reflect those national attitudes. For example, the SIL developed a school curriculum that emphasized European history, introduced the Secoya to a market economy by contracting them for various paying jobs, and emphasized biomedical health and Christian values while vilifying and banning their cosmological beliefs, yajé rituals, and traditional healing practices. In addition, the SIL also convinced the Secoya to

practice a more centralized and sedentary form of settlement in order to facilitate access to their households.

The macro-social activities that emerged throughout the Post-Contact Pre-Industrial Period brought about several changes to the bioecological context. The one that has had the greatest impact on their health and well-being include the introduction of various infectious disease agents. Throughout the Post-Contact Pre-Industrial period Amazonian Indians suffered from a number of epidemics of newly introduced diseases. There are reports of epidemics in 1589, 1669, 1749, 1756, 1762, and 1860 of various types of infectious diseases including influenza, measles, tuberculosis, chicken pox, and whooping cough (Castellví 1944: 42). Smallpox epidemics were reported to have occurred in 1642, 1647, 1680, and 1750 (Figueroa 1904: 206; Palacios 1989). The smallpox epidemic of 1750 is particularly significant since it occurred in the Secoya homeland area on the Santa María (Wahoya) River in Peru. The common cold and influenza were among the most frequent and serious diseases suffered by the Secoya ancestors (Simson 1886: 193-195). Black (1990) identifies various diseases that were likely to have been introduced into the Amazon by Europeans. These include rubella, mumps, poliomyelitis, malaria, hepatitis A, dengue, parainfluenza, respiratory syncytial disease, the common cold, rotovirus diarrhea, diphtheria, and scarlet fever. It is also possible that European activities during this time period also introduced the *Aedes aegypti* mosquito, which is the principal vector of yellow fever.

Various aspects of the aboriginal cultural tradition were influenced by the macro-social context in the environment throughout this period. Arguably, the changes that had the greatest impact on the health of the Secoya were those that affected the traditional cosmological beliefs, and associated practices, particularly the yajé ceremonies. The subsistence activities remained very similar in form throughout the period, but shifted from being communal practices to being household activities and incorporated the use of new technologies and new cultivars over time. The settlement and migratory patterns

also remained quite similar throughout the period, but were influenced during their involvement in the patronage system and the missionary activity of the SIL.

INDUSTRIAL PERIOD (1967-PRESENT)

In 1967, a consortium of the Union Texas Petroleum Company (Texaco) and the Gulf Oil Corporation drilled its first successful oil well in an area that was to become the frontier town known as Lago Agrio. This even thrust the region and its inhabitants into the Industrial Period. By 1970 the Texaco-Gulf consortium had erected a pipeline connecting the Lago Agrio wells to the northern port of Esmeraldas. It had also built a road paralleling the pipeline in the section from Lago Agrio to Quito (Vickers 1997). In the years that followed, the Ecuadorian government became increasingly dependant on the oil revenues generated in this region, and oil companies were allowed to operate free of restrictions and regulations controlling their impact on the ecology and indigenous inhabitants of the region. In addition, colonists quickly swarmed the region, attracted by the opening of the Quito-Lago Agrio road and further enticed by government policies encouraging agricultural homesteading.

These events resulted in a rapid and drastic ecological and social transformation of the region. This is precisely the type of context associated with the emergence of disease. In the sections below I provide a review of how macro-social forces have influenced these processes and the consequences of the same on the Secoya environment.

Expansion of the Oil Industry and Colonization

The Ecuadorian government depended on the oil industry to help foster its industrial economy and to relieve demographic and geopolitical pressures. Their plan was to develop an oil industry in the region and to reinvest subsequent oil revenues to support the development of other industries. It also involved having oil companies active in the region build the infrastructure necessary to colonize the region while

simultaneously developing national level programs to encourage its settlement. The idea was that colonization would help relieve the demographic pressures from the crowded cities while also establishing the presence of Ecuadorian nationals in the region.

The Ecuadorian government facilitated their plan by passing of the Law of Hydrocarbons. This law established the national oil company, and dictated that the international oil companies pay royalties, land taxes, and contribute to the building of a local infrastructure. Originally enacted in 1971, the specifics of this law have been revised several times since then to maximize revenues and to continually increase the role of the national oil company (Kimerling *et al.* 1991: 43-44).

The other action taken by the government was to publicly encourage the settlement of the Amazonian region. In September of 1972 General Rodríguez Lara, presidential leader of the military government, described in a public speech his vision for the development of the Amazon. President Lara spoke against the practice of swidden horticulture and the production of the indigenous subsistence staples such as manioc. He urged potential colonists to work together with the *Instituto Ecuatoriano de Reforma Agraria y Colonización* (IERAC) to obtain legal title to lands and bank loans so that they could cut down the forest and plant commercial crops like rice, cocoa, maize, and wheat, and raise cattle and pigs. He promised the development of government aid and educational programs through which modern insecticides and herbicides would be provided to the colonists on their path toward the conquest of the jungle (Whitten 1984: 165-166).

By 1982 the oil industry had generated around $7.4 billion in revenues for the Ecuadorian government and population growth due to colonization was booming. However, later in the 1980's oil prices and oil revenues dropped. Ecuador compounded the problem by extensive borrowing and by 1991 had a $12.4 billion foreign debt (Kimerling *et al.* 1991: 46). The Ecuadorian government response was to intensify petroleum production. The majority of the oil revenues were used to pay the foreign debt

and to fund the military rather than to alleviate poverty or to build the infrastructure of the region. In addition, the intensified dependence on oil revenues created little incentive among government leaders to make many requests of the foreign oil companies. The government did not request the international companies to observe environmental protection regulations nor did it place demands on the type of infrastructure that should be built in the region. Consequently, the oil companies have operated largely devoid of environmental restrictions and have built an infrastructure suited to their own needs rather than those of the local population.

The first national agency charged with developing and enforcing environmental protection regulations was not created until 1984. It was then that the *Direccíon General de Medio Ambiente* (DIGEMA) was created under the Ministry of Energy and Mines. However, lack of political support from the ministry and a paucity of resources made DIGEMA essentially powerless. The ministry responded by creating a new environmental department, the *Subsecretario de Medio Ambiente* (SMA) in 1990. DIGEMA was reorganized and renamed *Direccíon Nacional de Medio Ambiente* (DINAMA) and placed under control of SMA in hopes of enhancing its power, but it still did not make much impact. One of the actions taken by DINAMA was to require environmental impact statements for approval prior to any exploratory or production activities. However, they also withheld a draft of the first comprehensive environmental regulations for Ecuador's oil industry developed by DIGEMA prior to its reorganization and replaced them with a set of voluntary guidelines (Kimerling *et al.* 1991: 48-53).

The lack of an infrastructure suitable to accommodate the colonists in the Amazon and national policies governing settlement procedures have significantly influenced the way colonization affected the indigenous population of the region, including the Secoya. According to IERAC policy, each colonist family is entitled to 50 hectares of land which the owner has to clear and put into production to receive its legal title (Southgate 1991). Unfortunately, lack of resources slow the bureaucratic process of title adjudication,

thereby creating insecurity among landowners who anxiously await legal title to their property. In order to ensure that they will receive title to these lands the owners maintain the property cleared, thus contributing to the forest fragmentation of the region (Rudel 1983). The agriculturalists tend to select plots of land based on the accessability of nearby roads. Since there has been virtually no investment in the infrastructure of the region, the only roads are those built by the oil companies. Since there are no restrictions on where oil activities may be carried out roads often enter environmentally sensitive areas. Such areas are commonly parts of traditional indigenous territories.

CONSEQUENCES OF INTRUSIONS DURING THE INDUSTRIAL PERIOD

The industrial development, colonization, and subsequent circumscription and reduction of traditional indigenous lands that characterized the Industrial Period caused the most drastic and rapid bioecological changes experienced by the indigenous inhabitants of the northeastern Ecuadorian Amazon. All of these changes have the potential of causing significant impacts on the health and well-being of the Secoya. The changes that have been the most severe and present the greatest concern include increases in the non-indigenous population size and population density of the region, increases in endemic infectious disease agents, the fragmentation of the forest, and the introduction of large quantities of toxic chemicals and heavy metals into the environment.

The current Secoya territory lies within the province of Sucumbíos, which covers an area of approximately 18,150 km^2. In 1967 the non-indigenous population of Sucumbíos was virtually non-existent and the population density was very close to the 0.2 persons per km^2 that existed since prior to European contact. However, the non-indigenous population grew to nearly 77,000 by 1990 (INEC 1990), causing the population density to rise by 2,000% to approximately 4.2 persons per km^2. Currently, the population of Sucumbíos continues to grow at a rate of about eight percent, nearly four times the national average (ECORAE 1998). Nearly two thirds of this new

population is involved in small-scale agriculture while the other third live in “frontier” towns, primarily *Lago Agrio* and *Shushufindi Central*. The population density of the Secoya has also increased and in 1999 a total of 347 Secoya were living within their legally recognized 395 km^2 parcel of land, leading to an average population density of about 0.9 persons per km^2.

The rapid increases in population size and density occurred without the development of a sanitary infrastructure to provide potable water and the adequate disposal of sewage and solid wastes created by the population. These neglects led to the creation of habitats ideal for the development of various forms of infectious diseases including various gastrointestinal diseases, tuberculosis, influenza and other respiratory ailments, and various forms of hepatitis. The lack of a sanitary infrastructure also contributes to the spread of these and other infectious conditions. This is because without a sanitary infrastructure, clean water for the use of personal hygiene or for cooking becomes difficult to obtain. Consequently, infectious diseases can be spread by either a direct fecal-oral transmission route, or through the ingestion of contaminated water, soil, or food. Various other agents are spread as the result of contact with secretions of an infected individual, or contact with material contaminated by infected secretions.

The crowding and lack of sanitary conditions created also provide ideal breeding grounds for insects and rodents known to carry a number of viral diseases including malaria, leishmaniasis, and Chagas disease. In addition, the government failed to institute an adequate vaccination program for common infectious diseases such as measles, tetanus, whooping cough, diphtheria, and poliomyelitis, thereby enabling the reproduction of the agents associated with these infectious diseases within the region. Throughout the region newly introduced behavior such as prostitution has contributed to a high presence of venereal diseases in the region, particularly gonorrhea (Ruiz *et al.* 1993).

Although many of the infectious diseases found in the region do not represent new introductions, increased population size and density enables many of them to become

endemic by ensuring a continuous supply of susceptible hosts for the disease agents. The risk for developing and maintaining the infectious agents in the population of the region is greatest in the crowded frontier towns. These are the same towns that the Secoya increasingly frequent in order to purchase market goods, medicines and to receive biomedical health care.

The population influx experienced during the Industrial Period was also accompanied by large-scale clearing of the land, which contributed to the fragmentation of the forest. The majority of the deforestation was carried out by the agricultural colonists who, lacking any other infrastructure, relied on the building of roads by the oil companies to guide their colonization pattern. My own analysis of a 1986 landsat image of the Aguarico River basin region revealed that a total of about 32% of that region of the Ecuadorian Amazon had been deforested. Within the landsat image I identified an area of about 1,150 km^2 surrounding the community of San Pablo to approximate the territorial range of the Secoya. By 1986 about 18.5 % of this area of the landsat image had been transformed from its original state. Analysis of a 1995 landsat image reveals that over 36% of the same area has been transformed. A comparison of these two images is presented in figure 2.2.

The majority of the deforested areas have been transformed into agricultural settlements, but roads and frontier towns also comprise large portions of the transformed areas. In addition, in 1979 the Ecuadorian government granted a 98.5 km^2 concession to the *Palmeras de Los Andes* company for the development of an African oil palm plantation in an area located west of San Pablo on the south bank of the Shushufindi River. Another oil palm concession was granted a few years later to the *ACEIPA* company on the southern banks of the Shushufindi (Vickers 1997).

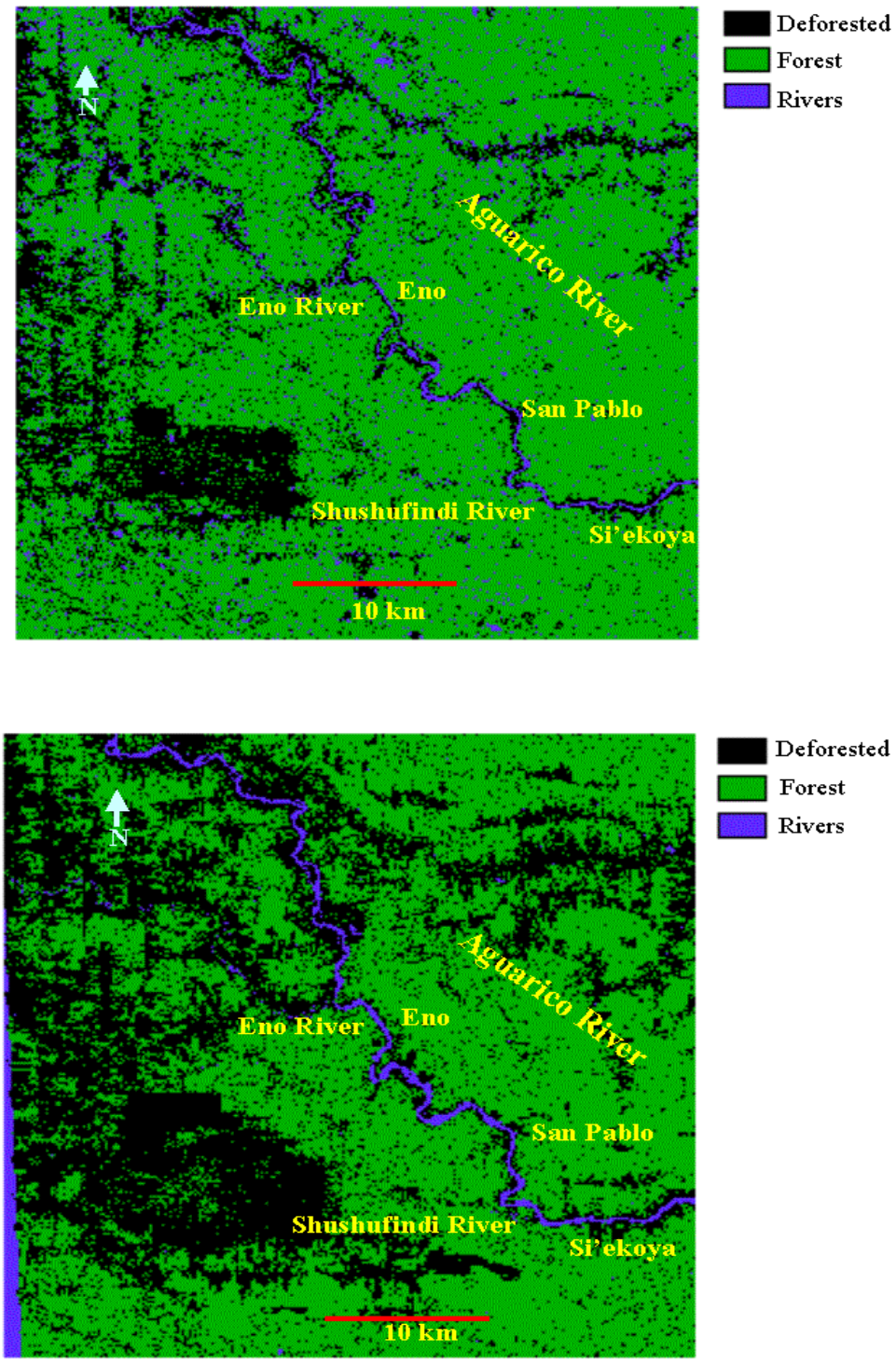

Figure 2.2: Landsat 1986 (top) and 1995 (bottom) images of the Secoya territorial range.

The process of deforestation in the region is of concern given that it eliminates the habitats for various faunal and floral subsistence resources used by local residents. Tropical deforestation in the Amazon region has also been linked to epidemic outbreaks of malaria in the Amazon region (Moran 1988; Smith 1982), including the Ecuadorian Amazon (Amunárriz 1984). Deforestation in other tropical regions has also been linked to the emergence and resurgence of several other vector-borne infectious diseases (Coimbra 1988; Forattini 1989; Lainson 1989; Matola *et al.* 1987; Nichter 1987).

The development of the African oil palm plantations is also of concern because they are situated in what was one of the preferred traditional hunting areas for the Secoya. These agribusinesses bulldozed the forest on their concessions and replanted it with monocrop stands of African oil palms, which they maintain through the use of large amounts of chemical fertilizers, herbicides, and pesticides. Several Secoya stated they believe contaminants from the plantations spill into the Shushufindi and cause the fish to behave "crazy" and to have such a disgusting smell that they can not eat them.

One of the changes in the bioecological context of the region recently having received considerable national and international attention is the introduction of toxic chemical and heavy metals into the environment by the oil companies (Kimerling *et al.* 1991). Toxic wastes produced during the exploratory drilling, extraction, and processing stages were routinely released into the environment at a rate of over 4.3 million gallons per day, contaminating the groundwater, streams, and rivers of the region (ibid: 31). The toxic oil wastes come in the form of drilling mud, waste gas, toxic brine, and crude oil, each of which is dumped or released into the environment at different stages of the oil operations. Although Ecuador has never made public data concerning the chemical composition of its wastes, data from oil companies in the United States indicate that wastes typically contain toxic levels of aluminum, antimony, arsenic, barium, cadmium, chromium, copper, lead, magnesium, mercury, nickel, benzene, naphthalene, phenanthrene, sodium and chlorides (ibid: 59). In Ecuador, the geological composition of

the region causes toxic levels of salt to be produced during the drilling of oil wells. In addition, oil itself is contains toxic levels of sulfates, bicarbonates, hydrogen sulfide, cyanide, and heavy metals including arsenic, cadmium, chromium, lead, mercury, vanadium, and zinc (ibid: 65).

The national oil companies dispute the claims that oil activities in the region have led to toxic contamination and health problems among local residents. Following a series of oil spills in the Cuyabeno in 1990 and 1991, *Petroecuador* developed a program in conjunction with the World Bank to integrate a health component into environmental impact studies and environmental management plans by oil companies. The result was the creation of the *Estudio de Impacto Ambiental en Salud* (EIAS) and the *Plan de Manejo Médico Sanitario Ambiental* (PMMSA). The study of the EIAS-PMMSA in Cuyabeno (Mena 1993) found what they considered to be acceptable levels of contaminants in the water. In addition, the rapid medical survey, designed to identify acute health problems, found no evidence suggesting oil spills had caused any health problems among the indigenous population.

The findings of the EIAS-PMMSA study contradict those presented by the *Centro para Derechos Ecónomicos y Sociales* (CDES). In the report (CDES 1994) they indicate extremely high levels of toxic contaminants in all water sources throughout the Cuyabeno and Aguarico regions. In addition, a comparative clinical study was conducted in several communities in the Ecuadorian Amazon. The study compared the health status of individuals living in areas of high levels of oil contamination with that of individuals living in areas with little or no contamination. The study found that individuals living in contaminated areas showed an unusually high incidence of miscarriages, skin fungal infections, and headaches and nausea (CDES 1994: 39; Kimerling *et al.* 1991; UPSAE 1993). Furthermore, both colonist and indigenous groups have reported perceived increases in the number of deformed births and of livestock with their stomachs rotted out.

Secoya Responses to Environmental Changes

The Secoya experienced various changes in their cultural tradition in response to the new bioecological and social conditions in their environment. These changes include the development of a pluralistic health system, but the most pronounced changes are those of the economic and social dimensions of their culture. In the sections below I describe various aspects of the contemporary Secoya culture in context of some of the most significant changes it has recently experienced.

The Secoya now practice what must be considered a pluralistic health care system. They still hold fast to many of their traditional beliefs and practices regarding sickness and healing, but have also incorporated many Western biomedical practices. Most of the Secoya I interviewed informed me of having been prescribed or actually using some form of biomedical remedy to treat particular ailments. Antibiotics and common cold remedies remedies were often purchased in open markets where the quality of the products could not be verified. These remedies were self prescribed widely by the Secoya for a number of different ailments including diarrhea, fever. Several Secoya also reported having taken cold tablets to successfully treat what they thought were cases of malaria. In addition to incorporating biomedical remedies the Secoya now also use the services of traditional healers from other cultures including the Kofán, Quichua, and mestizo colonists. This is largely due to the weakening of the *yajé* cult and the lack of new shaman apprentices among their own culture.

At the economic level, the Secoya responded to changes in their environment by intensifying their participation in the market economy, incorporating new technologies in their traditional subsistence strategies, and altering their traditional settlement patterns. The Secoya participated in the market economy as workers for the oil companies. They were most commonly hired to clear sites for the camps, build offices, or to clear seismic trails through the forest (Vickers 1976: 51). Their work conditions were often harsher than those of other workers and they often did not receive the same benefits. According

to César Piaguaje (in Moya 1992: 170-171), the indigenous workers would be taken to a site in the jungle, which nobody was familiar with and then forced to return to the base by foot across dangerous snake-filled swamps. He tells of how he did not receive medical check ups as a company employee because he was told that as a native of the jungle he would not get sick.

The Secoya eventually also became employed by various ecotourism agencies to help build cabins for the tourists, and work as motorists and guides. As the Secoya learned more about the ecotourism industry some of the men decided to form their own agency named *Wï' Wï* (River Dolphin). By the time I did my fieldwork, several Secoya women were disappointed with the men's handling of the agency and were making plans to take over and become the first all-female, all indigenous ecotourism tour agency in the region. Most of the men, however, refused to take them seriously. Several Secoya have also pursued careers as teachers or *promotores de salud* (local health promoters and practitioners). Individuals interested in these careers must first apply to the appropriate governmental agencies for funding to receive the necessary training, which usually involves extended travel to Quito or other highland cities. Other Secoya families have become involved with small-scale cash cropping and livestock raising.

The Secoya still practice hunting, fishing, swidden horticulture, and collection of wild plant and animal products for their subsistence. However, since their entry into the market economy they now incorporate into these practices new technologies such as shotguns, chainsaws, picks and shovels, flashlights, nets, iron hooks, monofilament line and other manufactured items. The use of these new technologies has not led to an intensification of resource consumption by the Secoya (Vickers 1994). They still hunt, fish or collect only as much as is immediately needed to feed the family. However, the cost of these items does limit access to them. For example, some Secoya are strained to afford shotgun shells and have lost their skills in the use of more traditional hunting tools.

The pattern of periodic resettlement has traditionally been driven by the perception of decreasing game and horticultural land availability in a given area (Vickers 1976). During my fieldwork, many of the Secoya living in San Pablo stated they felt certain game animals were no longer available and that others were getting harder to find. Yet, despite the general consensus among the Secoya that game is scarce in San Pablo, I have observed during my visits to the Secoya in 1996, 1997, and 1999 a tendency towards greater sedentism rather than a return to the more traditional nomadic settlement pattern of the past. When I first arrived in San Pablo in 1996 there were only a few buildings made of concrete. This included a small school and a group of non-working toilet stalls. In 1997 there were more concrete buildings including a series of classrooms and a library. By 1999 there were more concrete buildings including a radio office were built in San Pablo and concrete classrooms were built in Si'ekoya. The small and open thatch-roofed houses I had seen in 1996 and 1997 were largely replaced by bigger and fully enclosed two to three story houses with zinc roofing. In one of the community meetings that the Secoya held with members of the catholic church-based *Fondo Ecuatoriano Populorum Progressio* (FEPP) the plan for building concrete houses for the Secoya was discussed.

Deforestation and the tendency towards increasing sedentism may thus be contributing to a decrease in game availability in the Secoya territory. In addition, sedentism can increase the fecal contamination of soil and water, favoring the reproduction of the *Trichuris trichuria* nematode, which is endemic to the region. Conversely, the historical semi-nomadic tradition of the Secoya served to reduce their chances of exposure to this organism.

The perceived reduction in the availability of game in San Pablo coincides with documented decreases in the nutritional contribution of hunting and fishing to the Secoya diet and increases in the contribution of purchased food items from 1974 to1990. In 1974, hunting and fishing contributed to 20.7% of the Siona-Secoya caloric intake and 81.7% of their protein intake. Store bought foods contributed to 2.4% of the caloric

intake (Vickers 1976, 1994). By 1986 hunting and fishing contributions decreased to 16% of the caloric intake and 73.3% of the protein intake; the contribution of purchased items had increased to 4.5% of their caloric intake (Benefice and Barral 1991). By 1990 the caloric contribution of hunting and fishing had decreased to 10.4%, and the contribution of purchased foods had increased to 18% (Vickers 1993, 1994).

During my fieldwork in 1999 many of the Secoya regularly purchased food items from the local weekly market located up river at Poza Honda, near the junction of the Eno and Aguarico rivers. Some of the most commonly purchased food items included noodles, rice, sugar, cooking oil, canned sardines, and salty crackers. They also purchased a number of different candies, soda pop, and alcoholic beverages. During my fieldwork, the Secoya were also involved in a fish farming project initiated by the New Hampshire-based Institute for Science and Interdisciplinary Studies (ISIS). The project involved damming small streams and raising fish in the resulting ponds. Many of these fish ponds did not survive the dry season or the floods of the rainy season, and by the time I finished my fieldwork, only a few of the ponds had produced edible fish.

The influence of market-purchased foods on the diet of the Secoya is significant since the incidence and pathological manifestation of many diseases can be exacerbated by the lack of adequate nutrition. Of particular concern is the change in the role of game and store-purchased food in the Secoya diet. This is because fish and game were the main sources of protein and of iron, thiamin, niacin, and retinol (Benefice and Barral 1991) while the store-purchased foods that replaced fish and game provide mostly calories and are largely devoid of protein, vitamins, or minerals.

The increasing involvement of the Secoya in the market economy has also contributed to an increased role of biomedical health care among the Secoya. The Secoya commonly travel to the nearby frontier towns to purchase antibiotics from vendors to treat a wide variety of syndromes. The type and amount of antibiotics that they purchase is based on the kinds of antibiotics available and on how much they can afford to buy rather

than any biomedical considerations. This type of practice is associated with the re-emergence of infectious agents in more drug resistant forms. Tuberculosis, in particular, has been shown to be susceptible to evolving into drug resistant forms as the result of improper antibiotic treatment.

Another form of response by the Secoya to increased pressures on their environment has been to organize themselves politically. The Secoya formed the *Organizacíon Indígena de los Sionas y Secoyas del Ecuador* (OISSE) political organization in the late 1970's. It has since been renamed as the *Organización Indígena Secoya del Ecuador* (OISE). Since developing their first political organization, the secoya has froged alliances with other individuals and organizations concerned about the impacts of the Industrial Period on the ecology and indigenous populations of the region. Together they have fought for legal title to portions of their traditional territory, staved-off colonist incursion into their territories. They have also negotiated with the government and international oil companies to receive compensation for the impacts of their activities in Secoya territory.

The first mission of the Secoya political organization was to lobby for the legal title to an expanded territory. The demarcation of legally recognized indigenous territories and the development of "protected areas" are tasks carried out by distinct agencies housed under the *Ministerio de Agricultura y Ganadería* (MAG). Although both efforts are essentially based on good intentions, their results have often been unfavorable to the indigenous inhabitants. For example, the initial efforts to demarcate the legally-recognized Secoya territory did not consider the land requirements of the traditional Secoya subsistence strategies. As a result, in 1978 the Secoya were granted title to 7,043 hectares of land (Vickers 1994), an area that represents approximately 41% of their ancestral territorial range. Another example occurred in 1978 when the entire Cuyabeno River Basin was designated a protected area, and the Secoya on the Aguarico were denied access to the areas even though it comprised part of their traditional hunting

and fishing grounds (Vickers 1984). Continuing negotiations between the government and the Secoya political organization eventually led to greater consideration of the Secoya subsistence strategies in land titling negotiations and in 1989 the Secoya were granted an additional 31,414 hectares (Vickers 1994).

The second set of issues of great importance dealt with by the OISE have been those related to government's 1995 decision to permit the entry of into their territory. Occidental Exploration and Production Company (OEPC, commonly referred to as OXY). One of the issues negotiated by OISE has been the terms of compensation OXY should be required to provide the Secoya in exchange for permission to conduct activities in their territory. Since my initial visit among the Secoya in 1996, I have noticed a growing number of items that OXY has provided the Secoya in partial satisfaction of the negotiated agreements. Many of these items, such as the concrete housing, and centrally located communal stoves and water pumps, help to induce a more centralized and sedentary lifestyle. However, virtually none of these items is useful in helping the Secoya deal with long-term increased stresses on resources or with exacerbated sanitary and hygienic problems associated with increased sedentism.

The Secoya are aware of the need to examine potential long-term environmental impacts associated with oil activities in their region and use their political organization to attempt to make OXY comply with environmental regulations. However, the Secoya are not always as successful at doing this as they would like to be. In 1998, OXY sought permission from the Secoya to conduct topographic studies in part of their traditional and legally recognized territory. The Secoya requested that OXY provide the results of the environmental impact study in order to receive permission for the topographic study. OXY repeatedly failed to produce the document while still requesting the Secoya to grant their permission. The document was eventually provided, but OXY did not allow the Secoya the time they requested to review it and establish their negotiation position before beginning with their next stage of negotiations (Vickers 1998).

SUMMATION

The intrusions into the Secoya territory during the Industrial Period have altered the ecological social environment of the region. Many among the Secoya believe that these changes threaten their health. The biomedically-trained Secoya *promotor de salud* reported that the number of cases of health problems that he could not recognize and did not know how to treat were increasing among his patients. Various elders indicated that they could not recall a time when so many Secoya suffered as many health problems as they do now. Some Secoya pointed to the possibility of contaminants from the oil activities as the source of most of the new health problems. However, to at least one Secoya elder the problem was due not to ecological or physical changes in the environment, but to changes in the cultural knowledge of the Secoya. According to him, the Secoya are losing their language, thus losing the ability to know and understand their cosmology and of how to practice the shamanic rituals. He believes that the Secoya are now suffering more than ever from disease because they do not know of or understand the forces that affect the environment and their lives or how to control them.

The Secoya may differ with regard to how they explain the causes of what is perceived to be an increase in the number and variety of health problems. However, they tend to agree that their health problems are an issue of major concern. I approach this issue in the following chapters by identifying the patterns of health problems experienced by the Secoya and providing my explanation of their causes.

CHAPTER 3: METHODOLOGY

INTRODUCTION

In this chapter I discuss the methods of data collection and analysis that I followed to achieve the goals of my dissertation. The first section includes the identification of the types of data I collected, my reasons for seeking to collect these data and the methods I used to collect the data. The second section includes the explanation and justification of the strategies I applied to organize and analyze the data to identify various measures of health patterns among the Secoya and to analyze the epidemiology of disease emergence among the Secoya.

DATA COLLECTION

I conducted my field work during the period from August through October of 1999. This corresponds to the period following the "wet season," but prior to the beginning of the "dry season" in the region. It is important to note that although this time of the year is normally a period with daily rainfall, the region experienced an unusually dry spell during the time of my field work. The bulk of my field work consisted of collecting health data useful for measuring the incidence of health problems during 1998-1999 and for developing biomedical diagnoses of these health problems. It also entailed the accumulation of cultural and bioecological data about the local, regional, and national context to help identify risk factors associated with the diagnosed health problems. Health data derive predominantly from household-level interviews. To a lesser degree, health data also derive from interviews with experts on traditional and biomedical health systems and from ethnographic observations made during my stay with the Secoya. Data about the existing cultural and bioecological context were derived from ethnographic observations made while conducting household interviews, attending community

meetings, and participating in daily life. Data about the historical cultural and bioecological context were collected from secondary sources and from landsat images.

Conceptualization and Guidelines for Measurement of Health Problems

The concept of health refers to the condition or status of the body or mind. It exists along a continuum extending from "good" health to "bad" health. Measures of "bad" health have predominantly been used as indicators of the health of populations. However, what constitutes "good" or "bad" health is culturally determined. Individuals are considered to be experiencing "good" health if they fall within the limits of what is conceived culturally to be "normal" mental, emotional, physical, or social functioning. Conversely, individuals are considered to be experiencing "bad" health if they fall outside these culturally defined limits (Mascie-Taylor 1993:1; Murray and Chen 1992). Whether an individual is deemed to fall within or outside of these limits depends on whose cultural norms are applied in the evaluation. For example, applying Secoya norms, an individual may perceive himself to fall within the limits of "good" health. Following biomedical norms, however, this same individual may be considered to be in "bad" health. To be as culturally sensitive as possible, I define the Secoya health problems as the sum of what the Secoya and biomedical health experts consider to be experiences for "bad" health. I term these experiences as "health problems."

How Measures of Incidence of Health Problems are Collected

The two fundamental means to measuring health problems are through self-perception and observation (Murray and Chen 1992). Self-perception measurements are based on the reporting of experiences perceived as "health problems" by the individuals who experience them. Observation measurements are based on the presence of what an observer conceives to be apparent abnormalities of the body or mind of an individual. Accordingly, for the purposes of this dissertation, I define the incidence of health

problems as the sum of the reports of self-perceived and of observed cases of health problems over a specified period of time.

According to *Taber's Cyclopedic Medical Dictionary* (Thomas 1979), changes in the body or its functions, which are subjectively perceived as abnormal by the individual experiencing the changes are considered "symptoms." For example, abdominal pain is a symptom commonly associated with diarrhea. Changes that may be objectively identified, such as liquid stools, lumps, rashes, or fevers are referred to as "signs" of a disease. Diseases recognized by biomedicine are known to be associated with specific combinations of signs and symptoms. These aggregates are commonly referred to as "syndromes." By collecting data concerning the signs and symptoms of health problems I was able to differentiate various categories of syndromes from which a diagnosis of biomedically recognized conditions was possible. The approach I followed was to collect reports of signs and symptoms perceived by the Secoya to indicate health problems. I also documented signs that I or an accompanying medical doctor observed and perceived as indicators of existing health problems.

How Health Problems are Biomedically Diagnosed and Differentiated

The typical approach to identifying biomedically defined health conditions entails matching various measures of the signs and symptoms of a reported health problem to those of a biomedically defined condition. This process is normally referred to as a differential diagnosis. Some of the measures necessary for developing a diagnosis include information about the timing of the onset, the location in the body, and the intensity of the symptoms perceived as indicative of a health problem. Other valuable measures include perceptible qualities of physical, physiological, and behavioral manifestations associated with the reported health problems. Additionally, information about the progression of the health problem, either with or without a specified treatment,

is also a key diagnostic feature of health problems. These key measures of symptoms and signs comprise a significant portion of what Kleinman and Mendelsohn (1978) consider to be criteria for the development of "explanatory models" of sickness episodes. These models are used by victims of health problems, as well as by traditional and biomedical health experts, to diagnose health problems in order to determine the appropriate healing strategy. In my household interviews I collected data on the same key measures of signs and symptoms that typically comprise explanatory models in order to develop a differential diagnosis of these health problems.

How Data About Health Problems Were Collected

The most significant data I collected are derived from 29 household-level interviews. The interviews were conducted between August 27, 1999 and September 28, 1999 in the communities of San Pablo, Eno, and Si'ekoya. During these interviews I collected retrospective health surveys of self-perceived health problems for all members of the household. I also documented my observation of signs of possible health problems among the present household members.

Additional health data were collected during separate interviews with three Secoya individuals regarded by other Secoya to be experts in the traditional health systems, and with two non-Secoya medical doctors who are experts in the biomedical health system. During these interviews I collected data from the Secoya health experts on perceptions of changes in health patterns among the Secoya over the last 20-30 years and their explanations for those changes. I discussed with the biomedical experts, information about the health profile they were developing for the Secoya in 1999 and their tentative explanations for such a profile. I obtained other biomedical data from Eugenio Espejo Hospital in Quito, including medical histories and lab reports for the recently deceased Secoya.

How Households Were Selected for Interviews

My goal was to interview as many households as possible within each of the Secoya communities. In order to get an idea of the approximate location of all the Secoya households I provided the president of the Si'ekoya community with a 1:50,000 topographic chart of San Pedro de Kantesiya (Instituto Geográfico Militar 1978) and asked him to plot the location of the Secoya households. He marked the locations of all households excluding those within the Eno community and those within the center of the San Pablo community, which were too clustered to be marked individually within the topographic chart. I obtained the number and location of these additional households from observations gathered while walking around the San Pablo and Eno communities. The data in table 3.1 compare the total and sampled number of households and individuals residing in each of the three Secoya communities.

Table 3.1: Number of total and sampled households and residents in Secoya communities (September 1999).

Villages	**Households**		**Population**	
	Total	**Sampled**	**Total**	**Sampled**
San Pablo	39	15	211	87
Si'ekoya	16	12	85	67
Eno	4	2	51	12
TOTAL	**59**	**29**	**347**	**166**

I was able to sample a greater percentage of the total Si'ekoya population than I was able to sample in the San Pablo or Eno communities. This is because I was able to attain canoe transportation during my field work in the Si'ekoya community, thereby enabling me to canvass the majority of the households in that community. I was restricted to travel by foot in the San Pablo community and therefore, focused my interviews to the households that were clustered in the center of the community. I was

able to travel to the Eno community on two occasions during the period of my field work. During those visits, the heads of the households were present in only two of the households. The average household size in Eno was considerably larger than in the other communities. This community was comprised exclusively of residents of Quichua descent, who typically have a larger number of children per household than do families of Secoya descent.

How Retrospective Health Surveys Were Conducted

All the interviews were conducted in a similar manner. I conducted the majority of the interviews in Spanish and by myself. However, in some of the interviews I needed a translator. Additionally, given that the medical doctor provided me with transportation within Si'ekoya and to Eno, he was also present in some of the interviews within these communities. During these interviews he acted mostly as an observer, but sometimes would interject his own questions designed to help develop a diagnosis of a reported health problem.

I conducted interviews with as many of the household members present as possible. All of the interviews began with one of the heads of household that was present at the time. If any member of the household was not present, one of the heads of the household would provide me with information about that individual. I asked the heads of the household to provide me with the names, ages, and sex of all the members of the household. I continued my interviews by asking all members to tell me about the history of their health problems as best as they could recollect. After being given a chance to recollect the history of their health problems, I asked questions designed to prompt their recall about any problems they may have experienced. I then elicited detailed qualitative descriptions of the reported signs and symptoms of the problems. For example, I asked them to describe the intensity and radiation of any pain, cough, or fever. I asked them to describe in detail the color, texture, and where relevant, the smell of liquid stools,

phlegm, and urine. I also inquired about the date and place of the onset of the signs and symptoms, the frequency with which each health problem occurred, how they were treated and why, and finally the progression of the health problems. In addition to the information provided by the interviewee, I also observed certain signs of health problems presented by members of the household even though they did not report them. For example, I made note of dental conditions, lividness of lips, eyelids, and tongue, of skin blemishes and of general physical appearances that could indicate health problems.

I obtained data about the age and sex structure of the whole Secoya population during several community meetings held in Si'ekoya and San Pablo. During these meetings, individuals from different households listed the age and sex of all the members of their household. For households where a representative was not available, a relative or close friend of the family provided the information. These data sets were collected to calculate the incidence rates of the health problems.

Conceptualization and Measurement of Health-Risk Factors

Health problems are caused by excessive or relative lack of contact with specific organisms, substances, or forces that are referred to as the "agents" of health problems (Mascie-Taylor 1993). For the purposes of this dissertation, I define any factor that contributes to the excess or lack of contact with these agents as a "health-risk factor." My approach was to collect an inventory of factors that are readily apparent and generally shared by all members of the Secoya population, emphasizing those that are known to contribute to the development of health problems. For example, lack of clean drinking water in a community is known to place members of the community at risk of developing diarrhea. I also gathered ethnographic information regarding sex-specific differences in behavior. These data are used to explain differences in the distribution of health problems between the male and female Secoya. For example, the male-dominated

practice of hunting may expose males to infected insect vectors found in the forest preferentially over females who remain at home during the day.

Health-risk factors are defined as factors present in the environment that contribute to the development of health problems. I conceptualize the environment as comprising bioecological and cultural dimensions. The bioecological dimension includes all the biotic and abiotic components that are interacting with each other in the moist rain forest ecosystem of the region. The cultural dimension comprises all aspects of human culture including social behavior. The environment is further divided into three distinct levels including the local, regional, and national levels of the environment. The local environment refers exclusively to the Secoya territory that is inhabited by the Secoya. It does not consider the Secoya territory that is inhabited by colonists. The regional environment refers to the spatial area directly surrounding the Secoya territory. Although spatial parameters are not specified, they approximate the boundaries of the politically defined region of the Sucumbios province. The national level of environment does not have a spatial dimension. It refers instead to the social dimension of the environment comprised of the centralized political unit that creates and enforces policies whose influence can extend to all regions of the country.

Cultural health-risk factors

I define cultural health-risk factors simply as those factors present in the environment whose origin lies within the realm of human culture. The concept of culture has defied singular definition by anthropologists. Given my interest in approaching a comprehensive understanding of the factors contributing to health problems, I rely on one of the broadest and oldest definitions of culture as offered by Edward B. Tylor:

> Culture or civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, arts, morals, law,

> custom, and any other capabilities and habits acquired by man as a member of society (Smith 1970: 1 Tylor 1871 original).

In his definition, Tylor considers not only the mental aspects of culture, but material objects and human behavior themselves as part of human culture. Using Tylor's definition as a foundation, I conceptualize culture as being divided into the material and non-material dimensions. I define the material dimension as all the things made or used by people. I conceive non-material culture as divided into social and cognitive dimensions. I consider the social dimension as being comprised of micro-social and macro-social phenomena. The micro-social phenomena include the patterns of behaviors and activities and macro-social phenomena are the rules and social forces that help shape these patterns. The cognitive dimension includes knowledge, beliefs, attitudes, and values.

The collection of data on all the elements of culture existing in all three levels of environment is beyond the scope of this research. Instead, my collection of cultural data focuses on documenting the elements of culture within each level of environment that are most likely to be contributing to the development of health problems among the Secoya. I gave greatest emphasis to local factors followed by regional and national factors. This is due to the fact that I lived among the Secoya and was, therefore, able to get more data about their cultural environment.

At the local level, I emphasized data regarding behavioral patterns and about the conditions of the material culture. The behavioral data I collected includes descriptions of activities associated with subsistence strategies, personal hygiene, diet, living arrangements, and travel patterns. For material culture, I collected information on house structures and various assorted material possessions, and the types of energy, food, health, and sanitary resources available. These were complemented with data regarding the cultural knowledge and or beliefs regarding sickness and health. Local level cultural data

were obtained largely through ethnographic observations made during my household interviews, during my presence in community meetings and during general day-to-day living experiences.

At the regional level, I emphasized the collection of data regarding cumulative patterns of activities such as industrial development, colonization, ecotourism, crime, and conflict. Much of these data were collected from secondary sources (Kimerling *et al.* 1991; Rudel and Horowitz 1993; Vickers 1993, 1994), but complemented with ethnographic observations made during my visits to the towns surrounding the Secoya territory including Lago Agrio and Shushufindi. At the national level, I focused on collecting data only on the elements of the macro-social dimension. For example, I obtained copies of various secondary sources of data detailing the history of official national economic, development, and colonization policies. I also spoke with the national director for the health of indigenous peoples (*Directoria Nacional de Salud de Los Pueblos Indígenas)* and with the provincial epidemiologist of Sucumbíos regarding national health policies affecting the Secoya.

Bioecological factors

Elements within the bioecological environment include physical or biological agents whose excess and paucity can contribute directly to health problems. They also include a number of other factors that influence the abundance and distribution of other agents that cause health problems. Some of the bioecological agents directly associated with health problems include climate, parasites, anthropogenic chemicals, and plant and animal food resources.

I did not collect climatological data per se, but I was able to experience the effect of the relatively high temperature and humidity typical for this region on my own well-being. To measure the potential risk of parasites, I relied primarily on the observation of local and regional landscape features that provided ideal habitats for the reproduction and

maintenance of known parasites. To a lesser degree I also collected data based on my own observation of parasites and from Secoya reports of parasite distribution. The measurement of the potential risk of the presence of chemical contaminants and of the potential distribution of habitats for various pathogens and vectors was based largely on remotely collected regional-scale data obtained from Landsat images and topographic charts. I complemented these data with ground-truthed observations of local-level landscapes and with Secoya reports on the distribution of plants and animals.

DATA ANALYSIS

The analysis of the data is divided into four main stages. First, all the data describing the health problems experienced by the Secoya were analyzed to create a classificatory typology for the different signs and symptoms. Secondly, the rates for health problems reported or observed in the Secoya population were calculated. Thirdly, data about the signs and symptoms of the reported or observed health problems were analyzed to compile a diagnostic inventory of the possible biomedically recognized health problems experienced by the Secoya. These conditions were then classified as having either an emergent or non-emergent status among the Secoya population. The fourth and final stage involved the analysis of the data about biocultural elements in the environment in order to identify and explain the causal mechanisms associated with the conditions differentially diagnosed as emergent among the Secoya.

Classification of Signs and Symptoms

I separated the data about the Secoya experiences of health problems into one set of data dealing with health problems experienced by the Secoya prior to1998 and a second set of data dealing with health problems experienced since 1998. I differentiated the data in both these sets as being either “syndromes” or “diagnosed” health problems. The “syndrome” typology is comprised of classifications of clusters of signs and

symptoms that collectively characterize biomedically-recognized health conditions. For example, a sudden appearance of cough without fever with rapid remission indicates a viral infection. On the other hand, a prolonged case of cough with fever indicates a pulmonary bacterial infection. The "diagnosed" health problems were those for which signs or symptoms were not elaborated, but for which either an event that affected their health was described or a health condition they were diagnosed with was identified. For example, a bite from a bot fly was a health-affecting event whereas "chickenpox" was a medically diagnosed condition. Given the collaboration of the medical doctor in some of the interviews within Si'ekoya and Eno, I have a disproportionately larger amount of data on medically diagnosed conditions for these communities than I do for San Pablo. Data regarding medically diagnosed conditions for the residents of San Pablo are comprised instead of conditions that the Secoya reported having had diagnosed either by the local health practitioner or at one of the local clinics or hospitals.

I organized all the "syndrome" and "diagnosed" typologies into a general level of classification I define as "symptom classes." It is comprised of classifications that refer to the principally noted abnormality in function, appearance, or sensation of the body or mind. For example, any complaints of abnormal bowel movements, appearance of stools or sensations around the stomach area were classified into the "gastrointestinal (GI)" symptom class.

Measures of the Health Patterns

I provide several measures of the patterns in which the Secoya experienced health problems during the period from 1998-1999. These include measures of morbidity, and of incidence, concurrence, and recurrence of individual health problems. All of these measures are provided at both the population and sex-specific level of analysis for health problems classified into symptom classes, syndromes, and diagnosed conditions. Morbidity refers to the number of health problems experienced per Secoya. Incidence

refers to the rate at which each health problem was experienced by the Secoya. I define concurrence as the rate at which health problems were experienced concurrently with other health problems by the same individual. Lastly, I define recurrence as the rate at which health problems were reported to have been experienced repeatedly at least once by the same individual. In addition to all of these rates, I also identify health problems that were experienced concurrently with each other and measure the number of times they were experienced concurrently.

I did not calculate the rates for health problems experienced prior to this date due to the unreliability of such data. Most of these data were in the form of Secoya self-reports of signs and symptoms perceived as health problems. However, the difficulty in recalling historical events is likely to contribute to an unacceptable level of under-reporting of health problems and to inaccuracy of details about the signs and symptoms. Additionally, some of these data correspond to events that occurred under a different and unknown population size and structure. The measurement of all rates requires calculating the number of events having occurred over a specified period of time within a population of specified size. Without accurate information about the number of events or the population structure prior to 1998, I did not believe it possible to calculate the incidence rates of any health problems with reasonable accuracy. Therefore, those historical data were excluded from the study.

Significance of Morbidity, Incidence, Concurrence, and Recurrence

The rates of health problems are particularly useful measures for assessing the degree of spread of specific health problems among the population. The measure of the variability of these rates between health problems can be used to help differentiate the extent to which different risk factors are present within the environment. The assumption is that the risk factors associated with the conditions of highest incidence are likely to be among the most widespread in the environment. The measure of the variability of the

rates between males and females helps assess whether the risk factors associated with particular health problems are commonly shared by both sexes or whether they are associated with behavior patterns of either males or females. In general, the lack of variability in the rates between males and females indicates that the risk factors are commonly shared between the sexes. If variability exists between males and females, then the factors most significantly contributing to the health problems are likely to be the result of properties associated with the group with the highest rates.

In addition to assessing the abundance and distribution of risk factors, the measures of concurrence and recurrence can also be useful in assessing the status of the Secoya immune system. If concurrent and recurrent health problems represent infectious conditions, then high rates on both of these measures could be indicators of deficiencies in the immune system of the population. This is because concurrence and recurrence of infectious conditions are both causes and results of a compromised immune system (Scrimshaw *et al.* 1968).

Measuring the Rates of Morbidity, Incidence, Concurrence, and Recurrence

The rate of morbidity was measured by calculating the sum of all health problems experienced per individual. I then calculated the mean and modal frequency of morbidity across the Secoya. All other rates measured were calculated by counting the number of events as experienced per the population at risk and then multiplying this ratio by 1,000. The population at risk represents all the people to whom the health problem events could have happened to. When calculating the rates among the whole Secoya population I use the size of the sample population (166) as the population at risk. To calculate the sex-specific incidence rates I use the number of Secoya males (94) or females (72) sampled to represent the populations at risk. The final result provides a measure of the number of cases that would be present if the size of the population at risk was 1,000. This procedure standardizes the rates and allows for easy comparison between the populations at risk. I

measured the variability in the rates between the health problems by calculating the mean absolute deviation from the mean of the rates across all health problems. I measured the variability in the rates between males and females by calculating the difference in the sex-specific rates for each health problem category and then measuring the mean absolute deviation from the mean of these differences. These measures of variability allowed me to determine which symptom classes, syndromes, or diagnosed conditions were experienced by the population at rates of incidence, concurrence, and recurrence significantly higher than the others. They also allowed me to determine which of these types of health problems were experienced at significantly different rates between males and females.

I applied the bootstrap procedure (Efron 1979) using the "Resampling Stats 2.1" software package to perform all statistical calculations needed to identify patterns in the health problems experienced by the Secoya. The bootstrap procedure is one form of a larger class of methods that involve drawing samples with replacement from the original data called resampling procedures. Replacement refers to the idea that whenever a datum is drawn from the original sample, it is immediately replaced and available for resampling again. This ensures that each datum has an equal opportunity for being selected each time a sample is drawn form the original data.

The bootstrap is a particularly strong procedure for estimating parameters, or the standard error for the confidence interval for the parameter when parametric assumptions cannot be made about the population. The bootstrap procedure treats the sampled data themselves as an empirical frequency distribution and as the best available proxy of the frequency distribution of the population from which they were drawn. This procedure replaces the unknown population distribution with the empirical distribution. Properties about the population such as the mean absolute deviation are then determined based on the empirical distribution (Chernick 1999: 1-14). The properties are not determined from only one sample, but from many samples that are repeatedly drawn with replacement

from the original data. The "Resampling Stats" software allows the computer to draw several thousand samples from the original data, calculating the desired statistics from each resample and showing how the statistics changed in the resamples. All the bootstrapped statistical analyses reported in this dissertation are based on running 1,000 simulations with replacement.

To identify whether any health problems occurred among the Secoya at a rate significantly higher than most health problems, I measured the variability in all the incidence, concurrence, and recurrence rates for syndromes, diagnosed conditions, and symptom classes experienced by the Secoya. To do this, I first calculated the bootstrapped 95% confidence interval for the mean of all rates at the population level. I then calculated the bootstrapped 95% confidence interval for the mean absolute deviation of these rates. Any rates that exceeded the sum of the 95th percentile limits of the bootstrapped mean and the maximum mean absolute deviation are considered to be significantly higher than all others and are classified as the highest rates. All the rates that did not qualify as statistically significant are further classified as upper mean, moderate, and low rates. All non-statistically significant rates above the 95th percentile limit of the bootstrapped mean represent the upper mean rates. Rates within the mean interval indicate moderate rates and those below the mean interval represent low rates.

To determine whether any health problems occurred at rates significantly different between males and females, I measured the variability of the sex-specific rates of incidence, concurrence, and recurrence of the syndromes, diagnosed conditions, and symptom classes experienced by the Secoya. To do this, I first calculated the difference in the sex-specific rates for each health problem category. I then calculated the bootstrapped 95% confidence interval for the mean of this variability. I also calculated the bootstrapped 95% confidence interval for the mean absolute deviation of the variability. Any differences that exceeded the sum of the 95th percentile limits of the

bootstrapped mean and the mean absolute deviation of the variability are considered significant.

Other Measures of Concurrence

Health problems that are frequently concurrent with each other may indicate an initial condition and a secondary, opportunistic condition that emerged as the result of the detrimental effects of the initial condition. Such health problems are commonly referred to as "sequelae." For example, tuberculosis is commonly a sequela of AIDS. Such opportunistic developments often occur as the result of compromised immune systems. Therefore, the measure of possible sequela among the Secoya health problems can provide an indication of the status of the immune system of the population. In order to test whether any of the patterns of concurrence could represent the process of sequela I measured the frequency with which different health problems are concurrent with each other. I do this by counting the number of times any two types of symptom classes, syndromes, or diagnosed conditions were experienced concurrently by a single individual during the period from 1998-1999. This identifies which types of concurrence were the most frequent and enables me to determine whether such concurrence is interrelated and indicative of sequelae.

Differential Diagnosis

I used several differential diagnosis databases (Benenson 1995; Blacklow 1983; Eddlerton and Pierni 1999; Manson 1996; Strickland 2000) including the MedSwift 2.1 software package to identify possible biomedically recognized health conditions represented by the syndromes experienced by the Secoya during the period from 1998-1999. To arrive at a diagnosis of possible conditions represented by the syndromes, I compared the data I collected about each syndrome to the information in the databases. Some of the most relevant data included the locus of the affected area, whether the

syndrome represented an acute or chronic condition, the intensity of the symptoms, and the presence of physical, physiological or behavioral manifestations. I also considered the geographical location where the syndromes occurred and patient histories.

Ranking the Confidence of the Diagnosis

The databases generally provided a list of various conditions that could possibly be represented by each of the indicated syndromes. Generally speaking, the number of possible conditions decreases as stricter criteria are imposed to arrive at a diagnosis. None of the databases that I used imposed a set of criteria adequate to determine which of the diagnoses of the syndromes experienced by the Secoya was the most probable. To do this I developed a set of criteria to differentiate the diagnoses according to the likelihood of their accuracy. These criteria consider whether the diagnoses were attained by a medical doctor. A diagnosis by a medical doctor could be based on the interpretation of a reported syndrome, a physical examination, laboratory results or a combination of these. The confidence in a medical diagnosis increases proportionately with the amount of evidence upon which a medical diagnosis was made.

My criteria also consider whether the diagnosed condition is known to be distributed in the area. I rate the knowledge about the distribution of a diagnosed condition as being of high, moderate, or low confidence. I consider confidence in the distribution of the condition to be high if there exists any official documentation of recent cases within the Secoya population. The confidence in the distribution is rated as moderate if recent cases had been documented only at the regional level, or if cases of the medical condition had recently been suspected within the Secoya, but not medically diagnosed or documented. The confidence in the distribution of the condition is rated as low if there exists some evidence indicating that the condition is not, or could not, be present within the region. For example, several fevers experienced by the Secoya are typical of the syndromes associated with arboviruses known to be distributed in various

parts of the Amazon rain forest, but whose distribution within Ecuador has been undocumented. Therefore, the confidence in the diagnosis that these fevers are caused by these arboviruses tends to be low.

My final criteria in assessing the accuracy of a diagnosis considered whether the risk factors associated with these conditions are known to exist in the area. Knowledge about the presence of risk factors associated with the medical condition varied from high to low confidence. High confidence was ascertained if a risk factor was observed to exist. Low confidence was ascertained if the risk factor was not observed to exist and there are reasons to believe it could not exist. For example, although several conditions could be attributed to toxic chemical contamination, the activities that contribute to chemical contamination in the region have not been documented for a number of years, making this diagnosis an unlikely possibility.

Using these criteria, I differentiated the levels of diagnosis into first, second, and third level diagnoses. A first level diagnosis is the one considered to be of the highest confidence. In order to be a first-level diagnosis the condition has to have been medically diagnosed with moderate to high confidence. It can also attain this ranking if there was a high degree of confidence that the condition was distributed among the Secoya and risk factors associated with the condition were observed to be present. The ranking of second-level diagnosis was assigned if there was only a moderate confidence that the condition was distributed among the Secoya, but risk factors associated with the condition were observed. The third level-diagnosis rank was assigned if confidence that the condition was distributed among the Secoya was low, but risk factors associated with the condition were observed. The designation of a third-level diagnosis was also made if the confidence that the condition was distributed among the Secoya was low and risk factors were not observed or believed to exist in the study area.

Differentiating Non-emergent and Emergent conditions

I differentiated the list of conditions diagnosed as possibly representing the syndromes experienced by the Secoya as being either emergent or non-emergent conditions among the Secoya. The criteria I used to make this differentiation are derived largely from the definition of what comprises an "emerging disease." Emerging diseases are comprised of: diseases newly recognized by biomedical science; old diseases previously unrecognized by biomedical science; new forms of old diseases; the appearance of an old disease in a new geographical region; and re-emergences of old diseases in areas thought to have been rid of them (Miller 1989). I considered a condition to be emergent if it could satisfy any of these criteria for the Secoya and non-emergent if it did not.

Patterns in the Diagnoses of Conditions

I provide measures of two types of patterns in the distribution of differentially diagnosed conditions. The first pattern refers to the distribution of differentially diagnosed conditions across different levels of incidence, concurrence, and recurrence of the medically diagnosed conditions and syndromes with which they are associated. The second pattern refers to the distribution of differentially diagnosed conditions in relation to the number of medically diagnosed conditions and syndromes with which they are identified. High rates of incidence, concurrence, and recurrence are indicators of possible disease emergence. Conditions that are associated with a diverse set of syndromes are significant because of the large number of disabilities and dysfunctions they can cause. The threat to the well-being of the population is even greater if these conditions are emergent. Often the source of these conditions can be traced to a set of factors. Targeting these factors in an intervention program provides an efficient way of reducing the number of different health problems experienced by the population.

For the reasons cited above, I identify the conditions associated with the highest rates of incidence, concurrence, and recurrence. I also measure the number of syndromes associated with each differentially diagnosed condition represented in all three levels of diagnosis for both non-emergent and emergent conditions. In this measurement I calculate the bootstrapped 95% confidence interval for the mean and mean absolute deviation of the number of syndromes associated per diagnosed condition. Any condition associated with a number of syndromes that exceeds the sum of the 95th percentile limits of the bootstrapped mean and mean absolute deviation of the number of syndromes associated per diagnosed condition is considered significant.

Explanation of Health Patterns

I provide an explanation for the health patterns that combines the results of the various measures of health problems and the differential diagnosis of these problems. I identify the factors that contribute to the similarity or dissimilarity evident in the distributed pattern of medically diagnosed conditions and syndromes across the different levels of incidence, concurrence, and recurrence at the population and sex-specific levels. I also demonstrate how various factors could influence the incidence, concurrence, and recurrence of the diagnosed conditions and syndromes. I provide this analysis based on existing knowledge regarding the differentially diagnosed conditions associated with the medically diagnosed conditions and syndromes. This includes information about the geographic distribution, ecology, and where applicable, the biology of the agents implicated in the differentially diagnosed conditions.

SUMMARY TABLES AND CHARTS

Throughout this chapter I have identified and defined various health concepts and the criteria for their measurement, which for purposes of convenience to the reader, I summarize in this section. The first stage of my analysis involves classifying all health

problems into various categories including symptom class, unidentified syndrome, and diagnosed conditions. My definitions for each of these classifications are provided in table 3.2.

Table 3.2: Definitions of health problem classifications.

Health Problem Classification	Definition of Classification
Symptom class	Organ or event-based health problem
Undiagnosed syndrome	Cluster of signs and symptoms associated with a health problem
Diagnosed condition	Medically diagnosed health problem

Following the initial classification of all reported and observed health problems, I calculate the total and sex-specific rates of morbidity, incidence, concurrence, and recurrence of each of the different health problems. The definition used in this thesis for each of these measures of health is provided in table 3.3.

Table 3.3: Definitions of health measures.

Measures of Health	Definitions of Measures of Health
Morbidity	Number of health problems experienced during 1998-1999
Incidence	Number of cases of a health problems experienced during 1998-1999
Concurrence	Number of times a health problem was experienced concurrently with other health problems by same individual during 1998-1999
Recurrence	Number of times a health problem was experienced repeatedly by same individual during 1998-1999

The total and sex-specific rates calculated for each health measure are differentiated into various levels including significant, upper median, moderate, and low. The criteria I use to determine each of the different levels are described in table 3.4.

Table 3.4: Criteria for determining levels for total and sex-specific rates of health measures.

Level of Rates	Criteria for assessing level of rates
Significant	Rate exceeds sum of 95th percentile limit of the mean and the maximum mean standard deviation
Upper mean	Rate is less than significant but exceeds upper limits of 95th percentile confidence interval of mean
Moderate	Rate is within 95th percentile confidence interval of the mean
Low	Rate is below 95th percentile confidence interval of the mean

All reported and observed problems are differentially diagnosed and each diagnosis is ranked according to the level of confidence for each. The criteria I use to rank the levels of confidence of the differential diagnoses are described in table 3.5.

Table 3.5: Criteria for ranking of differential diagnosis.

Rank	Criteria for ranking the level of confidence in the differential diagnosis
First level	Biomedically diagnosed with moderate to high level of confidence, or high confidence that condition is present among the Secoya and risk factors contributing to the condition are known to be present in the environment
Second level	Moderate confidence that condition is present among the Secoya, but risk factors contributing to the condition are known to be present in the environment
Third level	Confidence that condition is present among the Secoya is low, but risk factors contributing to the condition can be known to be present or believed to be missing in the environment

The criteria upon which the different levels of confidence for the diagnoses are based depend on the confidence that a particular condition is present among the Secoya.

The criteria upon which the confidence that these conditions are present among the Secoya are described in table 3.6.

Table 3.6: Criteria for assessing the confidence that a particular condition is present among the Secoya.

Rank	Criteria for ranking the confidence that condition is present among the Secoya
High	Official documentation exists of recent cases among the Secoya
Moderate	Official documentation of recent cases among regional population exists, or cases among the Secoya suspected, but not officially diagnosed
Low	Evidence exists that condition is not or could not be present among the Secoya

CHAPTER 4: RESULTS

INTRODUCTION

In this chapter I present the results of my data analysis. I begin by presenting the age and sex structures of the Secoya population and of my sample population. I follow this with a review of the various classifications of health problems that I developed based on the health data I collected. I then present the calculated incidence of these health problems, and the degree to which they occurred concurrently and recurrently. I proceed with the results of my differential diagnosis of both non-emergent and emergent conditions. I conclude by explaining how these patterns could be influenced by various characteristics of agents, risk factors, and pathological presentations known to be associated with the conditions diagnosed for those health problems.

SECOYA AND SAMPLE POPULATION STRUCTURE

The Secoya population size was measured at 347, including 190 (54.8%) males and 157 (45.2%) females. Individuals under 18 years of age comprised the majority (50.7%) of the total population. They were followed in decreasing order by the 18-60 (43.2%) and the over 60 (6.1%) age groups. Males under 18 represented nearly 30% of the total population. My sample consists of 166 individuals, including 94 (56.6%) males and 72 (43.4%) females. The under 18 age group (53%) was the largest group sampled. It was followed in decreasing order by the 18-60 (41.6%) and over 60 (5.4%) age groups. Males under 18 comprised 31.3% of the total sample population. A comparison of these two population structures is presented in figure 4.1. I believe the similarity between these population structures reveals the sample population to be an accurate representation of the actual population.

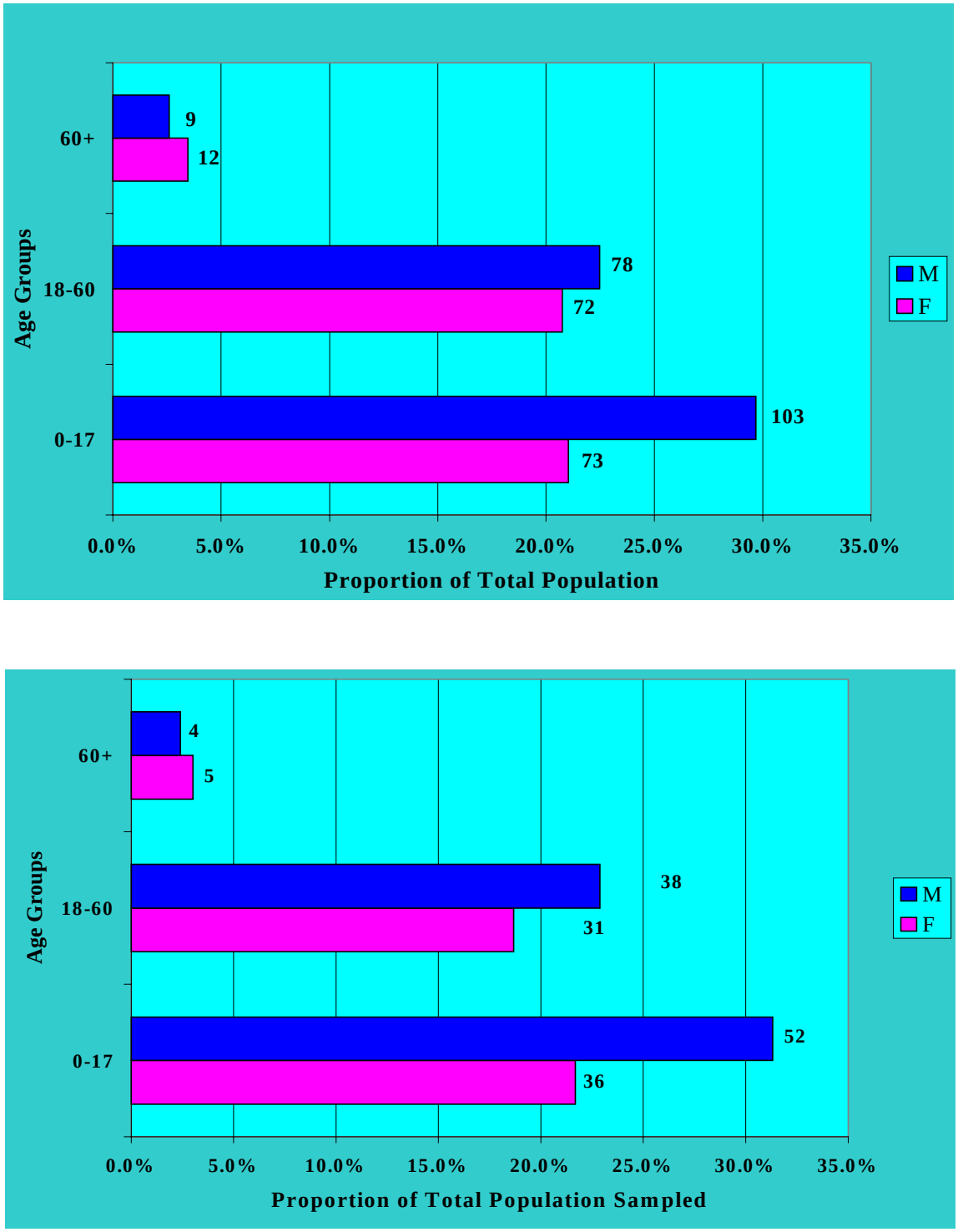

Figure 4.1: Comparison of age-sex structure for September 1999 Secoya population (top) and sample population (bottom).

CLASSIFICATION OF HEALTH PROBLEMS

I collected information on 261 events of health problems experienced by the Secoya from 1998-1999. These health problems were classified into a total of 21 symptom classes that were subdivided into 27 undiagnosed syndromes and 21 diagnosed health conditions. All the symptom classes, syndromes, and diagnosed conditions are presented in table 4.1. Most of the symptom classes identify the particular organ-system that presented abnormal signs or symptoms. These include auditory, dermatological, gastrointestinal, gynecological, head, optic, respiratory tract, breast, cardiac, hepatic, skeletomuscular, and urinary tract symptom classes. The GI/gynecological symptom class refers to health problems reported only by females. This includes pain in the abdominal region. It was not possible to decipher whether the pain affected the gastrointestinal or the gynecological organ system. Therefore, it received the dual classification. Other symptom classes refer to the type of sign, symptom, or health-influencing event that was experienced. These include break/sprain, cut, sting/bite, fever, neoplastic (tumor growth), syncopal (fainting), and fatal symptom classes.

Some symptom classes are comprised of mutually exclusive undiagnosed syndromes and diagnosed conditions while others include only one or the other. The only exception to this is represented by the fatal symptom class, which refers to a series of deaths that occurred among the Secoya over a nine month period in 1999. A description of the pathology associated with the deaths is detailed in the Appendix. The pattern of signs and symptoms associated with the deaths were similar enough among the deceased to consider the deaths to be have been caused by one condition. However, various medical doctors from distinct hospitals, clinics, and laboratories were unsuccessful in agreeing on a single diagnosis for this condition. Instead, four medical conditions were identified as the ones most likely to be the cause of deaths. Therefore, the deaths are attributed to the UFS, which I consider to be possibly attributed to any or all of the four diagnosed conditions listed in table 4.1.

Table 4.1: Classification of health problems experienced by the Secoya (1998-1999).

SYMPTOM CLASSES	UNDIAGNOSED SYNDROMES	DIAGNOSED CONDITIONS
GASTROINTESTINAL	diarrhea diarrhea with fever and/or vomit stomach ache bloody diarrhea intestinal worms	parasitic infection poisoned
RESPIRATORY TRACT	grippe febrile grippe cough shortness of breath	tuberculosis
FEVER	fever fever and chills	malaria dengue
DERMATOLOGICAL		fungal infection chicken pox leishmaniasis head lice allergic reaction
SYNCOPAL	dizzy, weak, or fainting	
HEAD	headache headache w/ fever	infected injury
SKELETOMUSCULAR	generalized bone pain joint pain back pain limb numbness	
GI/GYNECOLOGICAL	abdominal pain	
FATAL	Unidentified Fatal Syndrome (UFS)	*tuberculous meningitis* *acute leukemia* *disseminated histoplasmosis* *Evan's syndrome* (tentative diagnoses)
GYNECOLOGICAL	uterine	miscarriage menopause
OPTIC	eyes hurt	far sighted
URINARY TRACT	urination and/or kidney pain	
BREAST	breast pain dry breast	
CUT		cut
STING/BITE		bites/stings
BREAK/SPRAIN		break/sprain
HEPATIC	liver pain	hepatitis
CARDIAC	irregular heartbeat	
NEOPLASTIC		benign cyst
AUDITORY		deafness
EMOTIONAL		emotional grief

According to the data presented in table 4.1 the symptom classes with the most syndromes associated with it is the gastrointestinal symptom class, which has five different syndromes associated with it. The respiratory tract and skeletomuscular symptom classes, each have four different syndromes associated with them. Fevers and head symptoms are comprised of two syndromes each. All the other symptom classes are comprised of only one syndromic pattern or of only diagnosed conditions. The symptom class with the most diagnosed conditions associated with it is the dermatological symptom class, which is comprised of five diagnosed conditions. The fatal symptom class is associated with four diagnosed conditions. Fever, gastrointestinal, and gynecological symptom classes each include two different forms of diagnosed health conditions. All other symptom classes that include a diagnosed condition have only one diagnosed condition associated with them.

HEALTH PATTERNS

In this section I present the results of the measures of the various rates in which health problems were experienced by the Secoya during the period from 1998-1999. Unless otherwise indicated, all rates refer to the number of events being measured per 1,000 individuals at risk and all statistical measures reported in this section were derived using the bootstrapping procedure elaborated in the methodology chapter. To simplify the reporting of the statistical measures, the term “mean interval” is used to refer to the bootstrapped 95% confidence interval of the mean. The term “maximum variability from the mean” refers to the bootstrapped 95^{th} percentile limit of the confidence interval for the mean absolute deviation from the actual mean. As per the guidelines established in the methodology chapter, any rates that exceed the sum of maximum limits of the mean interval and maximum variability from the mean are statistically significant and represent the highest rates. All non-significant rates above the maximum limits of the mean

interval represent the upper mean rates, those within the mean interval indicate moderate rates, and those below the mean interval represent low rates.

Morbidity

The mean morbidity rate is 1.7 health problems per individual during the period from 1998-1999 with a mean interval from 1.7-2.1; the modal frequency is 1 and the maximum variability is 1.2 from the mean. Therefore, I consider a rate of more than 3.3 health problems per individual during the period from 1998-1999 to be significantly higher than the morbidity rate experienced by the majority of the population. According to this criteria significant morbidity was experienced by the Secoya at a rate of 120.5/1,000. The sex-specific rates were 152.8/1,000 for females and 95.7/1,000 for males.

Incidence of syndromes

The data presented in table 4.2 compare the cumulative and sex-specific incidence rates of the syndromes experienced by the Secoya. The mean incidence rate was 45.7, with a mean interval from 29.0-65.2 and the maximum variability is 58.7 from the mean. Given these figures, I consider any syndrome with a incidence rate exceeding 123.8 to have been experienced at a rate significantly higher than the majority of all other syndromes.

Grippe and diarrhea have the highest incidence rates. The dizzy, weak, or fainting, fever, and febrile grippe syndromes have upper mean rates of incidence. The syndromes including diarrhea with fever and vomit, stomach ache, headache, fever and chills, bloody diarrhea, abdominal pain, and cough have moderate rates of incidence. The remaining fifteen syndromes all had low incidence rates.

Table 4.2: Syndrome incidence rates (per 1,000).

SYNDROMES	TOTAL	F	M	VAR
grippe	241.0	208.3	266.0	57.6
diarrhea	192.8	180.6	202.1	21.6
dizzy, weak, or fainting	114.5	166.7	74.5	92.2
fever	102.4	69.4	127.7	58.2
febrile grippe	78.3	55.6	95.7	40.2
diarrhea with fever and/or vomit	54.2	55.6	53.2	2.4
stomach ache	54.2	69.4	42.6	26.9
headache	54.2	55.6	53.2	2.4
fever and chills	42.2	27.8	53.2	25.4
bloody diarrhea	30.1	13.9	42.6	28.7
abdominal pain	30.1	69.4	0.0	69.4
cough	30.1	41.7	21.3	20.4
headache with fever	24.1	0.0	42.6	42.6
generalized bone pain	24.1	13.9	31.9	18.0
joint pain	24.1	55.6	0.0	55.6
UFS	24.1	13.9	42.6	28.7
eyes hurt	18.1	13.9	21.3	7.4
urination and/or kidney pain	18.1	13.9	21.3	7.4
breast pain	12.0	27.8	0.0	27.8
shortness of breath	12.0	13.9	10.6	3.3
back pain	12.0	13.9	10.6	3.3
limb numbness	12.0	13.9	10.6	3.3
dry breast	6.0	13.9	0.0	13.9
irregular heartbeat	6.0	0.0	10.6	10.6
worm in feces	6.0	13.9	0.0	13.9
uterine pain	6.0	13.9	0.0	13.9
liver pain	6.0	0.0	10.6	10.6

The mean of the difference in the sex-specific incidence of syndromes is 24.8 with a mean interval from 18.7-33.1 and the maximum variability is 23.7 from the mean. Accordingly, I consider any difference in the sex-specific syndrome incidence rate exceeding 56.8 to be statistically significant. With the exception of gynecological-type and breast syndromes, the only statistically significant difference in sex-specific incidence rates was represented by the dizziness, weakness and fainting and fever, and grippe syndromes. The dizzy, weak, or fainting syndrome was most represented in females and the fever and grippe among males. Joint pain, headache with fever, febrile grippe, the unidentified fatal syndrome, bloody diarrhea, stomach ache, and fever with chills all exhibited upper mean level differences in sex-specific rates of incidence. Of these

syndromes, joint pain and stomach ache were most common among females, and the remainder most common among males.

Incidence of diagnosed conditions

The data presented in table 4.3 compare the cumulative and sex-specific incidence rates of the diagnosed conditions experienced by the Secoya. The mean incidence of diagnosed conditions is 15.2 with a mean interval from 10.5-20.4 and the maximum variability is 16.0 from the mean. Therefore, I consider the incidence of any diagnosed condition with a incidence rate exceeding 36.4 to be significantly higher than the majority of all other rates.

Table 4.3: Diagnosed condition incidence rates (per 1,000).

CONDITIONS	TOTAL	F	M	VAR
fungal infection	54.2	55.6	42.6	13.0
parasitic infection	54.2	55.6	53.2	2.4
chicken pox	36.1	41.7	31.9	9.8
malaria	30.1	41.7	21.3	20.4
leishmaniasis	24.1	13.9	31.9	18.0
bites/stings	18.1	0.0	31.9	31.9
fall	12.0	13.9	10.6	3.3
chainsaw cut	12.0	0.0	10.6	10.6
head lice	12.0	27.8	0.0	27.8
dengue	12.0	0.0	21.3	21.3
miscarriage	12.0	27.8	0.0	27.8
hit by debris in river	6.0	13.9	0.0	13.9
machete cut	6.0	13.9	0.0	13.9
deafness	6.0	0.0	14.9	14.9
allergic reaction	6.0	0.0	10.6	10.6
emotional grief	6.0	13.9	0.0	13.9
poisoned	6.0	13.9	0.0	13.9
menopause	6.0	13.9	0.0	13.9
infected injury	6.0	13.9	0.0	13.9
hepatitis	6.0	0.0	10.6	10.6
benign cyst	6.0	13.9	0.0	13.9
far sighted	6.0	0.0	10.6	10.6
tuberculosis	6.0	0.0	10.6	10.6

The conditions diagnosed as fungal and as parasitic infections have the highest rates of incidence. Chicken pox, malaria, and leishmaniasis represent have upper mean rates of incidence. The diagnosed conditions including bites/stings, fall, chainsaw cut, head lice, dengue, and miscarriage have moderate rates of incidence. The remaining twelve diagnosed conditions have low rates of incidence.

The mean difference between the sex-specific incidence rates of the diagnosed conditions is 15.9 with a mean interval from 12.5-17.3 and the maximum variability is 6.9 from the mean. According to these figures, I consider any differences in the sex-specific incidence of diagnosed conditions exceeding 24.2 to be statistically significant. With the exception of miscarriages, statistically significant variability in the sex-specific incidence of diagnosed conditions was only represented by bites and stings, and by head lice. Males tended to be more frequently diagnosed with bites and stings, while head lice was diagnosed more frequently among females. Dengue, malaria, and leishmaniasis exhibited upper mean level differences in the sex-specific incidence rates. Malaria was more common among females while dengue and leishmaniasis were more common among males.

Incidence of symptom classes

The data presented in table 4.4 compare the cumulative and sex-specific incidence rates of the symptom classes suffered by the Secoya. The mean incidence rate of symptom classes is 74.9 with a mean interval from 37.6-117.0 and the maximum variability is 120.2 from the mean. Accordingly, any symptom classes with a incidence rate exceeding 237.2 are considered to have been experienced by the Secoya at a rate significantly higher than other symptom classes.

The gastrointestinal and respiratory symptom classes have the highest rates of incidence. The fever and dermatological symptom classes have upper mean rates of

incidence. The syncopal, head, and skeletomuscular symptom classes have moderate rates of incidence. The remaining fourteen symptom classes have low rates of incidence.

Table 4.4: Symptom class incidence rates (per 1,000).

SYMPTOM CLASS	TOTAL	F	M	VAR
gastrointestinal	397.6	402.8	393.6	9.2
respiratory	361.4	319.4	393.6	74.2
fever	186.7	138.9	223.4	84.5
dermatological	132.5	138.9	127.7	11.2
syncopal	114.5	166.7	74.5	92.2
head	78.3	55.6	95.7	40.2
skeletomuscular	72.3	97.2	53.2	44.0
GI/gynecological	30.1	69.4	0.0	69.4
gynecological	24.1	55.6	0.0	55.6
optic	24.1	13.9	31.9	18.0
fatal	24.1	13.9	42.6	28.7
break/sprain	18.1	27.8	10.6	17.1
breast	18.1	41.7	0.0	41.7
cut	18.1	13.9	21.3	7.4
sting/bite	18.1	0.0	31.9	31.9
urinary	18.1	13.9	21.3	7.4
hepatic	12.0	0.0	21.3	21.3
auditory	6.0	0.0	10.6	10.6
cardiac	6.0	0.0	10.6	10.6
emotional	6.0	13.9	0.0	13.9
neoplastic	6.0	13.9	0.0	13.9

The mean difference in the sex-specific incidence of symptom classes is 30.7 with a mean interval from 25.2-43.1 and the maximum variability is 27.8 from the mean. Based on these measures, I consider any difference in the sex-specific incidence of symptom classes exceeding 70.9 to be statistically significant. The only symptom classes to show statistically significant variability in the sex-specific incidence rates included the syncopal, fever, and respiratory symptom classes. The syncopal symptom class was most prevalent among females and the latter two among males. Skeletomuscular symptom classes exhibited an upper mean level difference in the sex-specific incidence rates. This symptom class was most commonly experienced by females than males.

Concurrence of Health Problems

A total of 43.9% of the population sampled experienced multiple health problems during the period from 1998-1999. The individuals who experienced multiple health problems during this time period included 43.6% of the males sampled and 44.4% of the females sampled. The mean number of health problems experienced concurrently by individuals who experienced multiple health problems is 3.1, with a modal frequency of 2, a mean interval from 2.9-3.4 and the maximum variability is 1.2 from the mean. Therefore, I consider any concurrence rate in excess of 4.6 to be statistically significant. The rate of significant concurrence among the Secoya was 60.2/1,000. The sex-specific rates of significant concurrence were 83.3/1,000 for females and 42.6/1,000 for males.

Concurrence of syndromes

The data in table 4.5 present the population-level and sex-specific rates of concurrence of the syndromes experienced by the Secoya during the period from 1998-1999. The mean syndrome concurrence rate is 35.5 with a mean interval from 23.3-54.9 and the maximum variability is 53.1 from the mean. Accordingly, I consider any syndrome concurrence rate exceeding 108.0 to be statistically significant.

The syndromes including grippe, diarrhea, and fever had the highest concurrence rates. The dizzy, weak, or fainting and febrile grippe syndromes have upper mean rates of concurrence. The syndromes including headache, fever and chills, stomach ache, bloody diarrhea, cough, generalized bone pain, headache with fever, joint pain, and frequent urination and/or kidney pain have moderate rates of concurrence. All the remaining fourteen syndromes have low rates of concurrence.

Table 4.5: Syndrome concurrence rates (per 1,000).

SYNDROME	TOTAL	F	M	VAR
grippe	222.9	166.7	266.0	99.3
diarrhea	174.7	180.6	170.2	10.3
fever	108.4	69.4	138.3	68.9
dizzy/weak	72.3	111.1	42.6	68.6
febrile grippe	72.3	55.6	85.1	29.6
headache	48.2	55.6	42.6	13.0
fever and chills	36.1	27.8	42.6	14.8
stomach ache	36.1	69.4	10.6	58.8
bloody diarrhea	30.1	13.9	42.6	28.7
cough	30.1	41.7	21.3	20.4
generalized bone pain	24.1	13.9	31.9	18.0
headache w/ fever	24.1	0.0	42.6	42.6
joint pain	24.1	55.6	0.0	55.6
urination and/or kidney pain	24.1	13.9	31.9	18.0
abdominal pain	12.0	27.8	0.0	27.8
back pain	12.0	13.9	10.6	3.3
breast pain	12.0	27.8	0.0	27.8
diarrhea and fever	12.0	13.9	10.6	3.3
diarrhea and vomit	12.0	13.9	10.6	3.3
limb numbness	12.0	13.9	10.6	3.3
shortness of breath	12.0	13.9	10.6	3.3
vomit	12.0	13.9	10.6	3.3
dry breast	6.0	13.9	0.0	13.9
eyes hurt	6.0	0.0	10.6	10.6
fever and vomit	6.0	0.0	10.6	10.6
irregular heartbeat	6.0	0.0	10.6	10.6
uterine	6.0	13.9	0.0	13.9
worm	6.0	13.9	0.0	13.9

The mean difference in the sex-specific concurrence of syndromes is 20.9 with a mean interval from 17.9-32.6 and the maximum variability is 20.0 from the mean. Based on these measures, I consider any difference in the sex-specific concurrence of syndromes exceeding 52.6 to be statistically significant. According to this criterion, grippe, fever, dizzy, weak or fainting, stomach ache, and joint pain all had significant differences in sex-specific rates of concurrence. Headache with fever had upper mean level differences in sex-specific rates of concurrence. Of these conditions, males had higher rates of concurrence for grippe and fever and females had higher rates of concurrence for the remaining conditions.

Concurrence of diagnosed conditions

The data in table 4.6 present the population-level and sex-specific rates of concurrence for the diagnosed conditions experienced by the Secoya during the period from 1998-1999. The mean rate of concurrence among diagnosed conditions is 12.0 with a mean interval from10.4-20.3 and the maximum variability is 15.5 from the mean. Therefore, I consider any rate of concurrence of diagnosed conditions exceeding 35.8 to represent a statistically significant rate of concurrence of diagnosed conditions.

The conditions diagnosed as fungal and parasitic infections have the highest rates of concurrence. Chicken pox and leishmaniasis have upper mean rates of concurrence. The conditions including deafness, malaria, bites/stings, fall, head lice, and miscarriage represent have moderate rates of concurrence. The remaining nine diagnosed conditions have low rates of concurrence.

Table 4.6: Diagnosed condition concurrence rates (per 1,000).

CONDITIONS	TOTAL	F	M	VAR
fungal infection	54.2	55.6	42.6	13.0
parasitic infection	54.2	55.6	53.2	2.4
chicken pox	36.1	41.7	31.9	9.8
malaria	30.1	41.7	21.3	20.4
leishmaniasis	24.1	13.9	31.9	18.0
bites/stings	18.1	0.0	31.9	31.9
fall	12.0	13.9	10.6	3.3
chainsaw cut	12.0	0.0	10.6	10.6
head lice	12.0	27.8	0.0	27.8
dengue	12.0	0.0	21.3	21.3
miscarriage	12.0	27.8	0.0	27.8
hit by debris in river	6.0	13.9	0.0	13.9
machete cut	6.0	13.9	0.0	13.9
deafness	6.0	0.0	14.9	14.9
allergic reaction	6.0	0.0	10.6	10.6
emotional grief	6.0	13.9	0.0	13.9
poisoned	6.0	13.9	0.0	13.9
menopause	6.0	13.9	0.0	13.9
infected injury	6.0	13.9	0.0	13.9
hepatitis	6.0	0.0	10.6	10.6
benign cyst	6.0	13.9	0.0	13.9
far sighted	6.0	0.0	10.6	10.6
tuberculosis	6.0	0.0	10.6	10.6

The mean difference in the sex-specific concurrence of diagnosed conditions is 13.9 with a mean interval from 13.5-18.8 and the maximum variability is 7.3 from the mean. Based on these measures, I consider any difference in the sex-specific concurrence of diagnosed conditions exceeding 26.1 to be statistically significant. According to this criterion, only chainsaw-related problems, head lice, and miscarriage had statistically significant differences in the sex-specific rates. Bites/stings and chicken pox had upper mean level differences in the sex-specific rates of concurrence.

Concurrence of symptom classes

The data in table 4.7 present the population-level and sex-specific rates of concurrence for the symptom classes. The mean rate of symptom class recurrence is 46.9 with a mean interval from 35.4-111.1 and the maximum variability is 113.0 from the mean. Based on these values, I consider any rates of concurrence of symptom classes exceeding 224.1 to be statistically significant. According to this criterion, gastrointestinal and respiratory symptom classes were the only ones with significant rates of concurrence.

The mean difference between sex-specific rates of symptom class concurrence is 29.1 with a mean interval from 25.0-45.2 and the maximum variability is 28.6 from the mean. I therefore, consider any differences in the sex-specific rates of symptom class concurrence exceeding 73.8 to be statistically significant. According to this criterion, the respiratory tract symptom class was the only one to exhibit a statistically significant difference in the sex-specific rate of concurrence. The syncopal and gastrointestinal symptom classes had upper mean level differences in the rates of concurrence. Of all these symptom classes, the syncopal one was the only one most experienced concurrently with other symptom classes by females.

Table 4.7: Symptom class concurrence rates (per 1,000).

SYMPTOM CLASS	TOTAL	F	M	VAR
gastrointestinal	343.4	375.0	319.1	55.9
respiratory	337.3	277.8	383.0	105.2
fever	162.7	125.0	191.5	66.5
dermatological	120.5	125.0	117.0	8.0
head	78.3	55.6	95.7	40.2
skeletomuscular	72.3	97.2	53.2	44.0
syncopal	72.3	111.1	42.6	68.6
gi/gynecological	24.1	55.6	0.0	55.6
gynecological	24.1	55.6	0.0	55.6
breal/sprain	18.1	27.8	10.6	17.1
breast	18.1	41.7	0.0	41.7
cut	18.1	13.9	21.3	7.4
urinary	18.1	13.9	21.3	7.4
optic	12.0	0.0	21.3	21.3
sting/bite	12.0	0.0	21.3	21.3
auditory	6.0	0.0	10.6	10.6
cardiac	6.0	0.0	10.6	10.6
hepatic	6.0	0.0	10.6	10.6
neoplastic	6.0	13.9	0.0	13.9

Types of health problems that were concurrent with each other

The data presented in table A.1 in the appendix represent the total number of times different syndromes were experienced concurrently with other syndromes. Of a total of 303 possible combinations of syndrome concurrence only 55 combinations were documented. Considering only the cases of actual syndrome concurrence, the mean frequency of concurrence is 1.4 with a mean interval from 1.4-2.5 and the maximum variability is 2.1 from the mean. Therefore, all cases of syndrome concurrence exceeding the frequency of 4.6 are considered significant. The concurrence of diarrhea with grippe and of diarrhea with febrile grippe have the highest frequency rates. A total of 8 other pairs of syndromes were experienced concurrently at an upper mean frequency rate. These included: diarrhea with dizzy, weak, or fainting; fever; fever and chills; headache; and joint pain. The others included grippe with fever and with bloody diarrhea, and fever with headache.

The data presented in table A.2 in the appendix represent the total number of times different syndromes were experienced concurrently with diagnosed conditions. In addition it also includes the only two diagnosed conditions that were experienced concurrently with each other. Of a total of 318 possible combinations of concurrence only 40 cases were documented. The mean frequency of actual cases of concurrence is 1.3 with a mean interval from 1.1-1.4 and the maximum variability is 0.6 from the mean. Accordingly, all cases of concurrence exceeding a frequency of 2.0 are considered significant. Diarrhea with skin fungal infection or with chicken pox, and fever with GI parasitic infection are the pairs with the highest rates of concurrence. The concurrence of dizzy, weak, or fainting with chainsaw cut and with malaria have upper mean frequency rates.

The data presented in table A.3 in the appendix represent the total number of times different symptom classes were experienced concurrently with each other. Of a total of 191 possible combinations of concurrence only 53 cases were documented. The mean frequency of actual cases of concurrence is 2.6 with a mean interval from 1.2-3.1 and the maximum variability is 3.5 from the mean. Accordingly, all cases of concurrence exceeding a frequency of 6.6 are considered significant. The frequency of concurrence of the gastrointestinal symptom class with respiratory, fever, and dermatological symptom classes, and of the combination of respiratory symptom class with dermatological and fever symptom classes satisfied this criterion. The concurrence of gastrointestinal with the syncopal and with the head symptom classes has an upper mean frequency rate.

Recurrence of Health Problems

A total of 25.9% of the population sampled experienced recurrent health problems during the period from 1998-1999. This included 29.8% of the males sampled and 20.8% of the females sampled. The mean number of health problems that were experienced recurrently by the Secoya during the period from 1998-1999 is 0.5 with a

mean interval from .4-.6 and the maximum variability is 0.0 from the mean. Accordingly, I consider all cases of recurrence to be significant.

Recurrence of syndromes

The data in table 4.8 present the population-level and sex-specific rates of syndrome recurrence. The mean rate of syndrome recurrence is 14.7 with a mean interval from 12.0-33.1 and the maximum variability is 31.1 from the mean. Therefore, I consider all syndrome recurrence rates exceeding 64.2 to be significantly higher than the majority of all the other rates.

Table 4.8: Syndrome recurrence rates (per 1,000).

SYNDROME	TOTAL	F	M	VAR
grippe	102.4	97.2	106.4	9.2
fever	66.3	41.7	85.1	43.4
diarrhea	60.2	41.7	74.5	32.8
dizzy, weak, or fainting	42.2	83.3	10.6	72.7
headache	18.1	13.9	21.3	7.4
abdominal pain	12.0	27.8	0.0	27.8
cough	12.0	0.0	21.3	21.3
headache w/ fever	12.0	0.0	21.3	21.3
limb numbness	12.0	13.9	10.6	3.3
bloody diarrhea	6.0	0.0	10.6	10.6
febrile grippe	6.0	0.0	10.6	10.6
fever and chills	6.0	0.0	10.6	10.6
generalized bone pain	6.0	0.0	10.6	10.6
joint pain	6.0	13.9	0.0	13.9
liver pain	6.0	0.0	10.6	10.6
shortness of breath	6.0	0.0	10.6	10.6
stomach ache	6.0	13.9	0.0	13.9
uterine	6.0	13.9	0.0	13.9

The only syndromes found to have a statistically significant recurrence rate included grippe and fever. These two syndromes together with diarrhea and dizzy, weak, or fainting represent the syndromes with the highest concurrence rate. The syndromes including headache, abdominal pain, cough, headache with fever, and limb numbness

represent the moderately recurrent syndromes. The nine remaining syndromes are considered the least recurrent of the syndromes.

The mean difference in the sex-specific rates of syndrome recurrence is 20.7 with a mean interval from 10.6-24.2 and the maximum variability is 19.2 from the mean. Accordingly, all differences in the sex-specific rates of syndrome recurrence exceeding 43.4 are considered to be statistically significant. The only syndromes to have a statistically significant difference in sex-specific rates of recurrence includes dizzy, weak, or fainting, and fever. The former is more frequently recurrent among females and the latter among males. Diarrhea and abdominal pain exhibit upper mean level differences in sex-specific rates of recurrence. The former is more frequently recurrent among males and the latter among females.

Recurrence of diagnosed conditions

The data in table 4.9 compare the population-level and sex-specific rates of recurrence of diagnosed conditions. The mean rate of recurrence of diagnosed conditions is 6.0 with a mean interval from 6.0-18.9 and the maximum variability is 14.7 from the mean. As such, I consider any rates of recurrence of diagnosed conditions exceeding 33.6 to be statistically significant. The only diagnosed condition to be statistically significant is that of parasites. All other diagnosed conditions have recurrence rates that fall within the mean interval.

Table 4.9: Diagnosed condition recurrence rates (per 1,000).

DIAGNOSED	TOTAL	F	M	VAR
parasitic infection	36.1	27.8	42.6	14.8
bites/stings	6.0	0.0	10.6	10.6
chainsaw cut	6.0	0.0	10.6	10.6
far sighted	6.0	0.0	10.6	10.6
head lice	6.0	13.9	0.0	13.9
malaria	6.0	13.9	0.0	13.9
tuberculosis	6.0	0.0	10.6	10.6

The mean difference in the sex-specific rates of recurrence of diagnosed conditions is 12.6 with a mean interval from 11.1-13.3 and the maximum variability is 1.9 from the mean. Based on these figures, I consider any differences in the sex-specific rates of recurrence of diagnosed conditions exceeding 15.2 to be statistically significant. According to this criterion, there are no statistically significant differences in the sex-specific rate of recurrence of diagnosed conditions. The condition of parasites has upper mean level differences in the sex-specific rates of recurrence. Males tended to experience parasites recurrently more frequently than females.

Recurrence of symptom classes

The data in table 4.10 compare the population-level and sex-specific rates of recurrence of symptom classes. The mean rate of recurrence of symptom classes is 48.2 with a mean interval from 18.1-54.4 and the maximum variability is 48.2 from the mean. Therefore, I consider any rates of recurrence of symptom classes exceeding 102.6 to be statistically significant.

Table 4.10: Symptom class recurrence rates (per 1,000).

SYMPTOM CLASS	TOTAL	F	M	VAR
respiratory	132.5	97.2	159.6	62.4
gastrointestinal	108.4	83.3	127.7	44.3
fever	78.3	55.6	95.7	40.2
syncopal	42.2	83.3	10.6	72.7
head	30.1	13.9	42.6	28.7
skeletomuscular	30.1	27.8	31.9	4.1
gi/gynecological	12.0	27.8	0.0	27.8
cut	6.0	0.0	10.6	10.6
dermatological	6.0	13.9	0.0	13.9
fynecological	6.0	13.9	0.0	13.9
hepatic	6.0	0.0	10.6	10.6
optic	6.0	0.0	10.6	10.6
sting/bite	6.0	0.0	10.6	10.6

The respiratory and gastrointestinal symptom classes were both experienced recurrently at a rate significantly higher than the majority of other symptom classes. In addition to these two symptom classes, fever was also one of the most frequently recurrent symptom classes. The symptom classes including syncopal, head, and skeletomuscular all had moderate rates of recurrence. The remaining seven symptom classes were the least frequently recurrent.

The mean difference in the sex-specific rates of recurrence of symptom classes is 29.1 with a mean interval from 25.0-45.2 and the maximum variability is 28.6 from the mean. Accordingly, I consider all differences in the sex-specific rates of recurrence of symptom classes exceeding 73.8 to be statistically significant. According to this criterion, no differences in the sex-specific rates of recurrence of symptom classes were statistically significant. However, both syncopal and respiratory symptom classes had upper mean level differences in the sex-specific rates of recurrence. The former symptom class was more frequently recurrent among females and the latter among males.

DIFFERENTIAL DIAGNOSIS

I collected data on a total of 264 health problems experienced by 171 Secoya during the period from January 1998 to September 1999. Five of these cases involved unexplained fatalities. My differential diagnosis of the data identifies a total of 164 health conditions associated with distinct agents. These are differentiated into 78 (47.6%) emergent and 86 (52.4%) non-emergent conditions based on the criteria specified in the methodology chapter. The detailed diagnosis of non-emergent and emergent conditions are presented respectively in tables A.4 and A.5 in the appendix.

Primary level diagnosis of non-emergent conditions

The data in table 4.11 compare the 16 health problems differentially diagnosed at the primary level for non-emergent conditions. All of these diagnoses were originally

determined by a medical expert. For each of these, only the name of the diagnosed condition was provided by the medical expert. I identify the particular agents that medical databases indicate can be responsible for those conditions.

Table 4.11: Primary level diagnosis for non-emergent conditions.

DIAGNOSIS	CONDITION	AGENTS
malaria	malaria	*Plasmodium* spp.
leishmaniasis	leishmaniasis	*Leishmania* spp.
bites/stings	insect bite snake bite stingray sting	*Dermatobia hominis* *Bothrops* spp. *Potamotrygon hystrix*
break/sprain	break/sprain	accident
head lice	pediculosis	*Pediculus humanus capitis*
miscarriage	miscarriage	accident due to malaria
allergic reaction	allergic reaction	Unknown
emotional grief	emotional grief	Unknown
poisoned	poisoned	cyanide
menopause	menopause	natural aging
infected wound	infected wound	*Staphylococcus* spp.
benign cyst	benign cyst	Unknown
far sighted	far sighted	Unknown

None of the conditions identified at this level were experienced at the highest rates of incidence, concurrence, or recurrence. However, malaria and leishmaniasis had upper mean rates of incidence. Leishmaniasis was also had an upper mean rate of concurrence. In addition, malaria was the only condition that was associated with more than one type of health problem, being implicated in causing one case of miscarriage.

Both malaria and leishmaniasis are attributed to exposure to infected insect vectors whose habitat is known to be widely distributed in the region. The remaining non-emergent conditions are attributed to encounters with local fauna, and a number of other conditions that could occur by chance in virtually any society.

Second level diagnosis of non-emergent conditions

The data in table 4.12 compare the 22 health problems differentially diagnosed at the second level for non-emergent conditions. All of the diagnoses of the second level are known to be common in the region and the syndromes are known to be the primary complaints associated with each differentially diagnosed condition.

Grippe, diarrhea, fungal and parasitic infections, and fever were all experienced at the highest rates of either incidence, concurrence, or recurrence. The main conditions implicated in these health problems included various non-influenza respiratory viruses, GI parasites, and skin fungi. Food poisoning resulting from the consumption of unclean or rotted food was also implicated in diarrhea, and stress from the hot climate was related to fever. Health problems listed in table 4.12 experienced at upper mean rates of incidence and concurrence included dizzy, weak, or fainting and febrile grippe. Both heat stress and non-influenza respiratory viruses were also implicated as causes of these health problems. At this level of diagnosis, the mean number of health problems associated per differentially diagnosed condition is 2.6 with a mean interval from 1.5-2.6 and the maximum variability is 2.0 from the mean. According to these figures, any differentially diagnosed condition with more than 4.6 associated health problems is considered to be associated with a significantly larger number of health problems than the majority of the differentially diagnosed conditions. Both parasitosis and heat stress or dehydration satisfy this criterion. The differentially diagnosed conditions including menstruation, febrile respiratory disease, and rheumatism or arthritis are associated with an upper mean range number of syndromes.

Table 4.12: Second level diagnosis for non-emergent conditions.

SYNDROMES	CONDITION	AGENTS
grippe	common cold	various non-influenza viruses
diarrhea	food poisoning	several bacteria
	parasitosis	various GI parasites
dizzy, weak, or fainting	heat stress/dehydration	heat
	physical or emotional stress	Unknown
fever	febrile respiratory disease	various non-influenza viruses
	heat stress/dehydration	heat
febrile grippe	febrile respiratory disease	various non-influenza viruses
fungal infection	ringworm	several fungi
parasites	parasitosis	various GI parasites
diarrhea with fever and/or vomit	parasitosis	various GI parasites
	food poisoning	several bacteria
stomach ache	parasitosis	various GI parasites
headache	heat stress/dehydration	heat
	menstruation syndrome	Unknown
	physical or emotional stress	Unknown
fever and chills	febrile respiratory disease	various non-influenza viruses
	heat stress/dehydration	heat
	malaria	*Plasmodium* spp.
bloody diarrhea	parasitosis	*Escherichia coli*
lower abdominal pain	parasitosis	various GI parasites
	menstruation syndrome	Unknown
eyes hurt	Iritis	Unknown
cough	common cold	various non-influenza viruses
headache w/ fever	febrile respiratory disease	various non-influenza viruses
	heat stress/dehydration	heat
generalized bone pain	rheumatism/arthritis	Unknown
joint pain	rheumatism/arthritis	Unknown
eyes hurt	glaucoma	Unknown
urination and/or kidney pain	urinary tract infection	sevral bacteria and fungi
	Inflamated ureter	Unknown
breast pain	mastitis	several bacteria
	menopause	natural aging
	menstruation syndrome	Unknown
shortness of breath	asthma	allergens
	hyperventilation	Unknown
back pain	menstruation syndrome	Unknown
	physical injury	Unknown
	rheumatism/arthritis	Unknown
breast pain	breast engorgement	Unknown
dry breast	dry breast	Unknown
worm	parasitosis	several macro-helminths
uterine	inflamated uterus	Unknown
liver pain	parasitosis	*Giardia lambli*

Third level diagnosis of non-emergent conditions

The data in table 4.13 compare the 15 health problems differentially diagnosed at the third level for non-emergent conditions. Many of the conditions identified at this level are associated with the same infectious agents found in the second level diagnoses. However, these agents are likely to cause the health problems listed in the third level of diagnosis only when the infections are of an unusually high virulence. Other diagnosed conditions included in this table are common in the human population at large, but are likely to be associated with signs and symptoms not reported by the Secoya. For example, although *E. histolyca* parasitosis can cause generalized bone pain, it is more likely to be associated with gastrointestinal distress. Therefore, although these conditions represent a possible diagnosis, there is a low probability that they are the source of the reported syndromes.

None of the syndromes diagnosed at the third level of diagnosis for non-emergent conditions had incidence or recurrence rates significantly higher than other syndromes. However, included in this level of diagnosis is fever, which was found to have a concurrence rate significantly higher than other syndromes and was also among the most recurrent of the syndromes. In addition, the dizzy, weak, or fainting, and febrile grippe syndromes, which were also included at this level of diagnosis, were found to be among the most prevalent and concurrent. Unusual presentations of strep throat or of various types of pneumonia are implicated as causes of fever and febrile grippe at this level. In addition, severe *E. histolyca* infections could also be associated with fever. Severe infections of *G. lambli* and certain types of tumors could be associated with the dizzy, weak, or fainting syndrome at this level of diagnosis. This syndrome could also be the result of uncommon disorders such as hypertension and hypoglycemia.

Table 4.13: Third level diagnosis for non-emergent conditions.

SYNDROMES	CONDITION	AGENTS
dizzy, weak, or fainting	anemia	*Giardia lambli*
	hypertension	Unknown
	hypoglycemia	Unknown
	tumor	Unknown
fever	parasitosis	*Entamoeba histolyca*
	pneumonia	several viral, fungal, bacterial
	strep throat	*Streptococcus pyogenes*
febrile grippe	pneumonia	several viral, fungal, bacterial
	strep throat	*Streptococcus pyogenes*
diarrhea with fever and/or vomit	anemia	*Giardia lambli*
stomach ache	anemia	*Giardia lambli*
	malaria	*Plasmodium* spp.
	irritable colon	Unknown
	psychosomatic pain	Unknown
headache	hypertension	Unknown
	hypoglycemia	Unknown
	tumor	Unknown
fever and chills	parasitosis	*Entamoeba histolyca*
	pneumonia	several viral, fungal, bacterial
	strep throat	*Streptococcus pyogenes*
lower abdominal pain	ovarian cyst	Unknown
	psychosomatic pain	Unknown
bloody diarrhea	parasitosis	several protozoa
headache w/ fever	parasitosis	*Entamoeba histolyca*
	pneumonia	several viral, fungal, bacterial
	strep throat	*Streptococcus pyogenes*
generalized bone pain	parasitosis	*Entamoeba histolyca*
	malaria	*Plasmodium spp.*
	osteomyelitis	several bacteria
joint pain	malaria	*Plasmodium spp.*
	osteomyelitis	several bacteria
limb numbness	nerve disorder	Unknown
irregular heartbeat	pericarditis	following bacterial infection
	rheumatic heart disease	following strep throat

At this level of diagnosis, the mean number of health problems associated per differentially diagnosed condition is 2.2 with a mean interval from 1.7-2.8 and the maximum variability is 1.3 from the mean. According to these figures, any differentially diagnosed conditions with more than 4.1 number of health problems associated with it is considered to be associated with a significantly larger number of health problems than the majority of the differentially diagnosed conditions. The only differentially diagnosed

condition to satisfy this criterion was parasitosis. However, pneumonia, strep throat, anemia, and malaria all were associated with an upper mean number of health problems.

Primary level diagnosis of emergent conditions

The data in table 4.14 compare the 10 conditions differentially diagnosed at the primary level for emergent conditions. All of these conditions except those associated with hemolytic anemia and death were verified conclusively. However, given the extensive clinical and laboratory analyses involved in developing the list of possible conditions associated with the fatal syndrome, I consider them to be the most likely of the known conditions that could cause the syndrome.

Table 4.14: Primary level diagnosis for emergent conditions.

DIAGNOSIS	CONDITION	AGENTS
chicken pox	chicken pox	varicella-zoster virus
tuberculous meningitis	tuberculous meningitis	*Mycobacterium tuberculosis*
acute leukemia	acute leukemia	Unknown
disseminated histoplasmosis	disseminated histoplasmosis	*Histoplasma* spp.
Evan's syndrome	Evan's syndrome	Unknown
chainsaw cut	chainsaw cut	chainsaw
dengue	dengue	dengue virus (1-4)
deafness	chainsaw noise injury	chainsaw
hepatitis	hepatitis (A-E)	hepatitis virus (A-E)
tuberculosis	tuberculosis	*Mycobacterium tuberculosis*

None of the health problems diagnosed at the primary level for emergent conditions were experienced at the highest rates of either incidence, concurrence, or recurrence. However, chicken pox, had upper mean rates of incidence and concurrence. Additionally, tuberculosis is the only condition diagnosed at this level that is associated with more than one type of health problem. Furthermore, it is highly likely that all of the conditions associated with the fatal syndrome are opportunistic conditions related to immunodeficiency.

Second level diagnosis of emergent conditions

The data in table 4.15 compare the 9 conditions differentially diagnosed at the second level for emergent conditions. None of the health problems included at this level of diagnosis represent medically diagnosed conditions. These diagnoses are considered to be highly probable because in most cases, these syndromes represent the primary or principal complaints associated with over- or under-exposure to the listed agents.

Table 4.15: Second level diagnosis for emergent conditions.

SYNDROMES	CONDITION	AGENTS
grippe	influenza	influenza viruses
diarrhea	parasitosis	*Trichuris trichuria*
dizzy, weak, or fainting	nutritional deficiency	nutrients
fever	influenza hepatitis (A-E)	influenza viruses hepatitis virus (A-E)
febrile grippe	influenza	influenza viruses
diarrhea with fever and/or vomit	parasitosis	Norwalk virus
stomach ache	peptic ulcer	*Helicobacter pylori*
headache	nutritional deficiency	nutrients
fever and chills	influenza	influenza viruses
bloody diarrhea	parasitosis	*Trichuris trichuria*
abdominal pain	endometritis	several bacteria
cough	influenza	influenza viruses
headache with fever	influenza nutritional deficiency hepatitis (A-E)	influenza viruses nutrients hepatitis virus (A-E)
eyes hurt	nutritional deficiency	vitamin A
urination and/or kidney pain	urinary tract infection	*Neisseria gonorrhea*
limb numbness	nutritional deficiency	B2
irregular heartbeat	dilated cardiomyopathy	alcohol B1 deficiency following unknown virus
liver pain	liver cirrhosis hepatitis (A-E)	alcohol hepatitis virus (A-E)

The health problems diagnosed at this level and with the highest rates of either incidence, concurrence, or recurrence include grippe, diarrhea, and fever. The dizzy, weak, or fainting and febrile grippe syndromes all had upper men rates of incidence and concurrence. Influenza viruses are implicated in all but the dizzy, weak, or fainting and

diarrhea syndromes. Severe *T. trichuria* parasitosis and nutritional deficiencies could lead to these two syndromes. In addition, various strains of hepatitis could also be implicated as a cause of fever.

At this level of diagnosis for emergent conditions, the mean number of health problems associated per differentially diagnosed condition is 2.4 with a mean interval from 1.6-3.6 and the maximum variability is 2.1 from the mean. According to these figures, any differentially diagnosed condition with more than 5.6 health problems associated with it is considered to be associated with a significantly larger number of health problems than the majority of the differentially diagnosed conditions. The only differentially diagnosed condition to satisfy this criterion was influenza. However, nutritional deficiency was associated with a larger number of health problems than the maximum limit of the mean interval.

Third level diagnosis of emergent conditions

The data in table 4.16 compare the 13 health problems differentially diagnosed at the third level for emergent conditions. None of the health problems included at this level represent medically diagnosed conditions. Several of the syndromes listed in this table would only be associated with the given condition or agents under conditions of advanced or highly virulent infections. For example, diarrhea caused by nutritional deficiency would be likely only in severe cases. In other cases, the diagnosed condition presumes the presence of agents for which evidence of distribution in the environment is weak or missing, such as various toxic chemicals and heavy metals and a wide number of arboviruses. In yet other cases, the syndromes listed would not likely be the primary or principal complaints associated with the diagnosed condition. For example, joint pain may be associated with histoplasmosis, but the primary complaint would most typically involve respiratory distress.

Table 4.16: Third level diagnosis for emergent conditions.

SYNDROMES	CONDITION	AGENTS
diarrhea	nutritional deficiency- infection synergism chemical contamination	nutrients repeated infections cadmium, lead
dizzy, weak, or fainting	immunodeficiency chemical contamination	repeated infections various
fever	arbovirus	several viruses
	nutritional deficiency- infection synergism	nutrients repeated infections
	chemical contamination cirrhosis of liver drug reaction histoplasmosis Hodgkin's disease acute leukemia mononucleosis pneumonia	cadmium, lead alcohol antibiotics *Histoplasma* spp. Epstein-Barr virus Unknown Epstein-Barr virus *Chlamydia pneumoniae*
febrile grippe	mononucleosis pneumonia	Epstein-Barr virus *Chlamydia pneumoniae*
diarrhea with fever and/or vomit	nutritional deficiency- infection synergism chemical contamination	nutrients repeated infections various
stomach ache	nutritional deficiency- infection synergism chemical contamination	nutrients repeated infections cadmium, lead, vanadium
headache	immunodeficiency chemical contamination	repeated infections cadmium, lead
fever and chills	drug reaction pneumonia	antibiotics *Chlamydia pneumoniae*
abdominal pain	chemical contamination irritable colon	Unknown Unknown
cough	chemical contamination histoplasmosis	various *Histoplasma* spp.
headache with fever	immunodeficiency chemical contamination cirrhosis of liver drug reaction histoplasmosis Hodgkin's disease arbovirus acute leukemia mononucleosis pneumonia	repeated infections cadmium, lead alcohol antibiotics *Histoplasma* spp. Epstein-Barr virus several viruses Unknown Epstein-Barr virus *Chlamydia pneumoniae*
generalized bone pain	arbovirus hepatitis B histoplasmosis	several viruses hepatitis B virus *Histoplasma* spp.
joint pain	arbovirus hepatitis B histoplasmosis	several viruses hepatitis B virus *Histoplasma* spp.
hemolytic anemia, death	immunodeficiency	cadmium, chromium, mercury
eyes hurt	chemical contamination	various
limb numbness	chemical contamination	various
irregular heartbeat	chemical contamination	arsenic

Diarrhea and fever are the only health problems diagnosed at this level found to have a statistically significant rate of incidence or concurrence. No health problems with significant rates of recurrence were included in this level of diagnosis for emergent conditions. However, the fever, dizzy, weak, or fainting, and febrile grippe syndromes, all of which were found to have upper mean rates of either incidence, concurrence, or recurrence are included at this level of diagnosis. Chemical contamination associated with petroleum activities in the region was implicated as a possible cause in all these health problems with the exception of febrile grippe, which could be due to mononucleosis or a chlamydial form of pneumonia. Severe cases of the nutritional deficiency-infection synergism could also be implicated in diarrhea and fever while immunodeficiency resulting from repeated or multiple infectious diseases could also be the cause of the dizzy, weak, or fainting syndrome. Of all of the most prevalent, concurrent, or recurrent health problems diagnosed at this level for emergent conditions, fever was the one associated with the largest number of possible conditions. This is because in addition to the conditions already noted, it could also be caused by various types of viruses including a multitude of arboviral conditions. These arboviruses are identified in the table A.5 in the appendix.

At this level of diagnosis for emergent conditions, the mean number of health problems associated per differentially diagnosed condition is 3.0 with a mean interval from 2.6-5.1, and the maximum variability is 3.1 from the mean. According to these figures, any differentially diagnosed condition with more than 8.2 health problems associated with it is considered to be associated with a significantly larger number of health problems than the majority of the differentially diagnosed conditions. The only differentially diagnosed condition to satisfy this criterion was chemical contamination. However, histoplasmosis, immunodeficiency, arboviruses, pneumonia, and the nutritional deficiency-infection synergism all were associated with an upper mean number of health problems.

CHAPTER 5: EXPLANATIONS FOR THE HEALTH PATTERNS

INTRODUCTION

In this section I explain the health patterns uncovered in this study. I do this by demonstrating how various factors could influence the rates of the health problems experienced by the Secoya in terms of existing knowledge regarding the differentially diagnosed conditions associated with these.

Health Problems with the Highest Rates of Incidence, Concurrence, and Recurrence

The data in table 5.1 compare the health problems with the highest rates of incidence, concurrence and recurrence. All of these health problems implicate infectious conditions as the most likely cause. With exception of fever, all of the health problems with the highest rates of concurrence and recurrence also have the highest rates of incidence. This indicates that concurrence and recurrence tend to be functions of incidence. Therefore, the factors that influence the incidence of health problems are also responsible for influencing their concurrence and recurrence. However, recurrence is also influenced by the extent to which infections produce future immunity. For example, most of the infectious agents associated with grippe or parasites do not produce long term immunity in their hosts, thus making them susceptible to re-infection.

Table 5.1: Health problems with highest rates of incidence, concurrence, and recurrence.

Incidence	Concurrence	Recurrence
grippe	grippe	grippe
diarrhea	diarrhea	parasitic infection
fungal infection	fever	
parasites	fungal infection	
	parasitic infection	

The incidence rates of grippe and diarrhea were significantly higher that those of all other syndromes. This is partly because both of these health problems are associated with a wide variety of non-emergent conditions that are caused by very common agents all of which are typically spread by poor hygienic practices. For grippe this includes various forms of non-influenza respiratory viruses. For diarrhea these include a wide variety of gastrointestinal parasites. Another significant contribution to the high incidence of both of these syndromes is that they represent the most typical pathological presentation of the conditions. In addition, the high incidence of grippe could also be related to the presence of emergent conditions such as influenza viruses, given the high rate of population influx into the region and the relatively abundant distribution of influenza viruses in the region. Emergent conditions are likely not a significant factor in the high incidence of diarrhea. Although emergent conditions such as *T. trichuria* infection and an immunocompromised condition can cause diarrhea, the mechanisms associated with the spread of these conditions are complex and require a long period of time. Thus, it is unlikely that they significantly affect the incidence of diarrhea. The high incidence of the medically diagnosed conditions of fungal and parasitic infections can be attributed primarily to a widespread abundance of infective agents and behavioral risk factors present in the environment. It may also be explained as the result of the relative ease with which these health problems can be diagnosed. Skin fungal infections are easily observable, but parasite infestation requires laboratory analysis. For a laboratory analysis to be performed an individual has to experience symptoms, submit to an examination, and have access to laboratory facilities. Therefore, it is likely that the actual incidence of gastrointestinal parasitosis is higher than that which could be diagnosed.

Health Problems with Upper Mean Rates of Incidence, Concurrence, and Recurrence

The data in table 5.2 compare the various health problems upper mean rates of incidence, concurrence, and recurrence. All of these health problems still implicate

infectious conditions as their most likely cause, and incidence remains the primary factor contributing to concurrence and recurrence. However, none of the concurrent health problems listed in the table are associated with health problems with the moderate or lowest incidence rates. Diarrhea and fever have high rates of recurrence because most of the infectious agents that cause the differentially diagnosed conditions associated with them do not produce long-term immunity.

Table 5.2: Health problems with upper mean rates of incidence, concurrence, and recurrence.

Incidence	Concurrence	Recurrence
chicken pox	chicken pox	diarrhea
dizzy, weak, fainting	dizzy, weak, fainting	fever
febrile grippe	febrile grippe	
fever	leishmaniasis	
leishmaniasis		
malaria		

The syncopal syndrome identified as dizzy, weak, or fainting had the third highest incidence rate of all syndromes. It was also found to occur among women at a rate significantly higher than that for males. I do not believe that this syndrome is the direct result of excessive or under exposure to any given agent. Rather it is likely due to continuous exposure to a wide number of factors including heat and physical stress combined with the synergistic effects of nutritional deficiency and concurrent or recurrent infection. In addition, the possible exposure to toxic chemicals cannot be ruled out as a factor. The dizzy, weak, or fainting syndrome may have affected females more than males because of the metabolic and physiological changes associated with menstruation and also because females tend to eat less than males.

The high incidence of fever is partly explained by the fact that it is associated with most of the same agents and risk factors associated with grippe. The high incidence of

fever is also attributed to its added association with several non-emergent and emergent conditions not associated with grippe. A reason why fever is less prevalent than grippe may be because fever is a more severe, and therefore, less frequent pathological presentation of the infection with the agents that cause grippe. Additionally, the conditions not linked with grippe, but associated with fever, may be relatively scarce. The non-emergent of these conditions include parasitosis, pneumonia, and strep throat. The emergent of these conditions include hepatitis (A-E), various arboviral infections, chlamydial pneumonia, mononucleosis, Hodgkin's disease, histoplasmosis, drug reactions, and cirrhosis of the liver. The most significant risk factor contributing to the spread of these conditions is poor hygienic practices, but promiscuous sexual relations, and widespread ideal mosquito, sand-fly, and bat habitats are also significant factors. The fact that all of these risk factors are widely distributed and established in the environment helps to increase the incidence of these conditions and of the fever syndrome. Fever was found to be significantly more prevalent among males than females. It is likely that hunting at night, which is primarily a male activity, increased the risk of exposure of males to mosquitoes and sand flies infected with arboviruses. This would help explain the higher incidence of fever among males.

Febrile grippe is associated with the same agents and risk factors implicated in grippe and with a limited set of those associated with fever. This syndrome is less prevalent than grippe because it is a more severe presentation of infection with the same agents that cause grippe. It is less prevalent than fever because there are fewer agents that can cause febrile grippe then there are those that can cause fever.

Chicken pox was the most prevalent of the diagnosed conditions in this group of health problems. This high incidence is partly due to the easy diagnosis of this condition and the highly infectious nature of the varicella-zoster virus that causes it. The high incidence of malaria and leishmaniasis are the result of the endemic presence of the infectious agents associated with these conditions and the essentially outdoor lifestyle of

the Secoya that exposes them to the vectors of these conditions. Both of the conditions require laboratory analysis to be confirmed, and for this reason the rates I uncovered in this study for these conditions may underestimate their actual incidence among the Secoya.

Health Problems with Moderate Rates of Incidence, Concurrence, and Recurrence

The data in table 5.3 compare the various health problems found to be experienced by the Secoya at moderate rates of incidence, concurrence, and recurrence. The majority of these health problems are associated with non-infectious conditions as their most likely cause. The size of the list of health problems experienced at moderate rates is more than twice as large as that of problems with higher rates. The majority of the health problems with moderate concurrence and recurrence also have moderate rates of incidence. However, there are several health problems experienced at the lowest level of incidence that were found to have moderate rates of concurrence and recurrence. This is not due to their concurrence with non-infectious moderately prevalent health problems, but rather with the more prevalent infectious diseases discussed previously. In addition, the cause of recurrence of most of the health problems in this group has less to due with issues of acquired immunity than with exposure to non-infectious agents such as biting or stinging insects and animals and chainsaws. Furthermore, tuberculosis and far sightedness although listed as recurrent conditions are actually chronic or permanent conditions that have persisted through time among the same individuals. On the other hand, the recurrence of the dizzy, weak, or fainting syndrome and of malaria may still be influenced by both incidence and biological issues of immunity related to the agents differentially diagnosed as causing these health problems.

Various syndromes listed in table 5.3 are associated with the same common and abundant agents and risk factors implicated in the most prevalent syndromes. However, their incidence is greatly moderated because they represent extreme pathological

presentations of infections with those agents. Most of these more moderately prevalent syndromes are also associated with less common agents and risk factors not linked to the most prevalent syndromes.

Table 5.3: Moderately prevalent, concurrent, and recurrent health problems.

Incidence	Concurrence	Recurrence
abdominal pain	bites/stings	bites/stings
bites/stings	bloody diarrhea	chainsaw cut
bloody diarrhea	chainsaw cut	dizzy, weak or fainting
chainsaw cut	cough	far sighted
cough	fall	head lice
dengue	fever and chills	headache
diarrhea w/ fever/vomit	generalized bone pain	malaria
fall	head lice	tuberculosis
fever and chills	headache	
head lice	headache/ fever	
headache	joint pain	
miscarriage	malaria	
stomach ache	miscarriage	
	stomach ache	
	urination and/or kidney pain	

Several gastrointestinal syndromes including diarrhea with fever and/or vomit, stomach ache, and bloody diarrhea are moderately prevalent. The main factors contributing to their incidence are the same implicated in diarrhea. The incidence of diarrhea with fever and/or vomit in particular could be further increased by several types of toxic chemical contamination that are also implicated in the incidence of diarrhea with fever and/or vomit. The emergence of peptic ulcers would contribute to the incidence of the stomach ache syndrome. However, the agents contributing to these conditions are not as common as the agents associated with diarrhea. The main factor moderating the incidence of these syndromes is that they tend to be extreme presentations of conditions associated with diarrhea. The presence of fever and bloody stools indicate a more severe

presentation of the infection. The absence of liquid stools, fever, or bloody stools in the stomach ache syndrome indicates a less severe infection, perhaps as the result of partial immunity due to repeated infections.

The headache syndrome was not linked to the various common agents associated with either grippe or diarrhea, but it was associated with several factors linked to the dizzy, weak, or fainting and fever syndromes. In particular it was linked to the nutritional deficiency-infection synergism, heat stress, hypertension, and hypoglycemia. Headaches are likely to be either very mild or premature presentations of these conditions. Such a mild presentation makes it possible that this syndrome was not perceived as a health problem and, thus, was under-reported.

The fever and chills syndrome corresponds to the fever class of symptoms, but is most associated with the agents and risk factors attributed to grippe rather than fever. The incidence of this syndrome is, therefore, likely to be partly due to cases of severe presentations of infection with the agents implicated in grippe. However, it is also associated with malaria, the agents and risk factors of which are known to be relatively common and widely distributed throughout the region. In fact, the risk factors associated with malaria may be increasing with forest fragmentation and increasing population density. Additionally, fever and chills may be the result of a more serious presentation of some of the non-emergent conditions associated with fever, such as heat stress, parasitosis, non-emergent pneumonia, and strep throat. It could also indicate severe presentations of emergent conditions such as reactions to antibiotics, and chlamydial pneumonia. The spread of all of these conditions is facilitated by widespread risk factors including poor hygienic practices, hot humid climate, population influx, and an expanding market.

The gastrointestinal/gynecological syndrome identified as abdominal pain has a relatively low incidence because it is associated only with the female population. However, it had the fourth highest incidence rate of all syndromes experienced by

women. One of the reasons for this is that this syndrome may represent natural physiological conditions experienced by menstruating women. It may however also be the result of several non-emergent conditions including parasitosis, ovarian cysts, or psychosomatic pain. Additionally, abdominal pain may indicate several conditions that could be considered emergent. These include several forms of sexually transmitted endometritis, contamination with toxic chemicals, and an irritable colon. Although poor hygienic practices may be implicated in the parasitosis, the cause of the other disorders is either unknown or the associated agents and risk factors associated with the disorders are not very common. An exception may be the presence of *N. gonorrhea*, which when combined with promiscuous sexual relations, including sex with prostitutes, can contribute to endometritis.

The cough syndrome is not associated with many conditions. Its moderate incidence is likely due to a large number of unusually mild presentations of infections with the agents associated with grippe. It would be very rare for such infections not to have other signs or symptoms associated with them. Such mild infections may indicate partial immunity resulting from repeated infection. In such cases, the abundance and widespread extent of distribution of causal agents and risk factors in the environment contributes to increased immunity and to the incidence of syndromes associated with mild presentations of respiratory infections. It may also be possible, although much less likely, that cough indicates a mild case of histoplasmosis, which is associated with the widespread distribution of bat roosting habitats.

Headache with fever is the least prevalent of the syndromes associated with the agents and risk factors implicated in grippe or fever. For the same reasons noted previously, this suggests more serious and less frequent presentations of the conditions associated with those syndromes. This would explain why it occurs frequently enough to be considered moderately prevalent, yet not as frequently as grippe or fever.

Various of the more moderately prevalent medically diagnosed conditions are associated with the widespread habitat of mosquitoes, sand flies, bot flies, vipers, and sting rays and an outdoor lifestyle. These conditions include malaria, assorted bites and stings, and dengue. Of these conditions, dengue was the least prevalent condition and the most difficult to diagnose. The observation of only one case of tuberculosis may be more reflective of the difficulty in diagnosing the condition than of its actual incidence. All other conditions are relatively obvious and their low incidence is likely due to chance and to an outdoor lifestyle rather than to the extent to which agents are distributed in the environment. This is particularly true for the breaks and sprains, and cuts although the introduction of chainsaws also contributed to the incidence of accidents.

Health Problems with Low Rates of Incidence, Concurrence, and Recurrence

The data in table 5.4 compare the various medically diagnosed conditions and syndromes found to have the lowest levels of incidence, concurrence, and recurrence. The vast majority of the health problems implicate non-infectious conditions in the differential diagnosis. However, several moderately prevalent health problems implicating infectious conditions are found distributed among the least concurrent and recurrent health problems. This suggests that the incidence of health problems has to be considerably high to produce concurrence or recurrence.

Most of the medically diagnosed conditions and syndromes listed in table 5.4 are not associated with any of the common and abundant agents implicated in the more prevalent health problems. Additionally, many of these health problems refer to sex-specific conditions or to conditions most likely to affect the elderly. For example, breast pain, dry (milkless) breast, and uterine pain are syndromes affecting only women. The syndromes including generalized bone pain, joint pain, back pain, and limb numbness tend to be associated with arthritic or rheumatic conditions most associated with the elderly. Additionally, some of the health problems refer to rather uncommon complaints

or observations, such as worm in feces and liver pain. All of these factors contribute to the low incidence of these health problems.

Table 5.4: Health problems with low rates of incidence, concurrence, and recurrence.

Incidence	Concurrence	Recurrence
allergic reaction	abdominal pain	bloody diarrhea
back pain	allergic reaction	febrile grippe
benign cyst	back pain	fever and chills
breast pain	benign cyst	generalized bone pain
deafness	breast pain	joint pain
dry breast	dengue	liver pain
emotional grief	diarrhea and fever	shortness of breath
eyes hurt	diarrhea and vomit	stomach ache
far sighted	dry breast	uterine pain
generalized bone pain	eyes hurt	
headache w/ fever	far sighted	
heaptitis	fever and vomit	
hit by debris in river	hepatitis	
infected injury	hit by debris in river	
irregular heartbeat	irregular heartbeat	
joint pain	limb numbness	
limb numbness	machete cut	
machete cut	menopause	
menopause	poisoned	
poisoned	shortness of breath	
shortness of breath	uterine pain	
tuberculosis	vomit	
UFS	worm in feces	
urinationand/or kidney pain		
uterine pain		
worm in feces		

The only health problem of least incidence that deserves special attention is that of the unidentified fatal syndrome, since it is associated with the highest mortality rate of all syndromes. The diagnoses of this syndrome tentatively associated it with several possible conditions, including acute anemia, tuberculous meningitis, Evan's syndrome, and disseminated histoplasmosis, all of which involve a state of immunodeficiency. The high

incidence of fatal immunodeficient conditions may be associated with the abundance and widespread extent of agents and risk factors that can contribute to the nutritional deficiency-infection synergism.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

At the beginning of this dissertation I stated that indigenous populations experiencing large-scale intrusions into their tropical forests environments stand a high risk of developing emergent diseases that can threaten distant populations. In this chapter I present my conclusions regarding the pattern in which the Secoya experience health problems, the degree to which this pattern includes problems that can be diagnosed as examples of disease emergence, and the biocultural factors that contribute to this pattern. The conclusions I generated from this study should be considered as a preliminary step to better understanding the health risks faced by Secoya and other indigenous populations incurring large-scale intrusions into their environments. For this reason, I also include in this chapter a series of recommendations regarding the path I believe future efforts to identify and address the health problems of the Secoya and similar indigenous cultures should follow.

Incidence and Important Health Problems

In this study I documented a total of 261 events of health problems experienced by the Secoya between1998-1999. These problems were classified into a total of 27 syndromes and 21 diagnosed conditions spanning 21 symptom classes. In general, the health problems that had the highest incidence rates were also among the most concurrent and recurrent of the syndromes or medically diagnosed conditions. The most common syndromes included grippe, diarrhea, dizzy, weak, or fainting, fever, and febrile grippe syndromes. The most common of the medically diagnosed conditions included GI parasitic infection and skin fungal infection, leishmaniasis, malaria, and chicken pox. Of all the syndromes and medically diagnosed conditions experienced by the Secoya, only the unidentified fatal syndrome was associated with cases of mortality. In addition,

several of the medically diagnosed conditions including tuberculosis, dengue, and viral hepatitis represent cases of disease emergence that can spread from the local population to distant populations. Either due to the high rates or the potentially serious implications of the above syndromes and medically diagnosed conditions, I consider all the above health problems to represent the most important health problems experienced by the Secoya during the period from 1998-1999. With exception of the dizzy, weak, or fainting syndrome, all of these health problems are most likely to represent cases of communicable infectious diseases.

Patterns of Concurrence and Sequelae

The health problems most likely to be experienced concurrently with other health problems were the ones with the highest rates of incidence. As a result, the most prevalent health problems were concurrent with each other more frequently than with other health problems. Diarrhea was experienced concurrently with grippe and with febrile grippe at rates significantly higher than any other paired combinations of concurrent problems. Given that these health problems are related to conditions with very distinct sets of causal agents, these paired combinations are likely unrelated to each other. However, several of the paired health problems that had above average concurrence rates may be related. These include the paired concurrence of the dizzy, weak, or fainting syndrome with diarrhea, and with malaria. They also include the pairing of diarrhea with fever, fever and chills, and headache syndromes, and of fever with grippe and with parasites.

The dizzy, weak, or fainting syndrome was differentially diagnosed as possibly the result of nutritional deficiencies. Both diarrhea and malaria can cause dehydration and tend to deplete the nutritional stores in the body. If severe enough, they could weaken the body sufficiently so that otherwise normal outdoor daily work routines in the hot and humid climate could become stressful and lead to dizziness, weakness, or

fainting. This would be particularly true among women who are experiencing additional metabolic and physiological changes related to their menstrual cycle. The effects of severe diarrhea and malaria on the body can cause long-lasting weakness. Individuals returning to work immediately after the symptoms of these health problems have faded could still be susceptible to the dizzy, weak, or fainting syndrome. Of all the health problems experienced by the Secoya, the relationship between initial cases of diarrhea, malaria, and subsequent nutritional deficiency is the one that most resembles a sequela.

The concurrence of signs and symptoms including diarrhea, fever, fever and chills, and headache is common in cases of severe malaria. However, in such a situation, the concurrence of all of these signs and symptoms would be experienced as a single syndrome rather than as distinct events separated by time. Furthermore, each of these syndromes can be caused by several conditions, which if severe enough, or if allowed to degenerate over time, can eventually lead to the paired concurrence of any of these health problems. As such, it is likely that the manner in which these syndromes were experienced among the Secoya did not represent a sequela of malaria. Rather, it is more likely that they are either the result of distinct unrelated medical conditions or of the natural progression of symptoms of the same.

The concurrence of fever with grippe may appear to be related since fever is commonly experienced as a symptom of the conditions that were diagnosed for grippe. However, in such cases the concurrence of fever and grippe would be reported as a single syndrome, such as febrile grippe. In addition, the degeneration of the conditions diagnosed as possible causes of grippe does not lead to a sequela associated with fever. Therefore, it is likely that grippe and febrile grippe syndromes are related to distinct unrelated medical conditions. On the other hand, fever and GI parasites are not commonly perceived to be related, but severe and prolonged infection of the *E. histolyca* GI parasite is known to produce fever. Commonly the clinical detection of the parasites and the experiencing of fever related to this infection occur at different points in time. As

a result fever, may not be initially recognized as a symptom of a GI parasitic infection, and thus, reported as a distinct syndrome. The relationship between these two health problems does not qualify technically as a sequela, but rather as a natural progression of the symptoms associated with the degeneration of the GI parasitosis. It is nonetheless important to note that *E. histolyca* is diagnosed as a cause of fever only at the third level of diagnosis. This is because such a condition would be typically accompanied by stomach pain and diarrhea as the predominant signs and symptoms. As such, it is likely that cases where GI parasites and fever were the only concurrent signs and symptoms represent the concurrence of unrelated medical conditions.

Patterns of Recurrence and Immunodeficiency

The syndromes most likely to be experienced recurrently included grippe, diarrhea, and fever. The presence of GI parasites was the only medically diagnosed condition with significant recurrence. All of these health problems also had the highest incidence rates in their class. The recurrence of all of these health problems, with exception of GI parasites, can be the result of either secondary immunodeficiency or repeated infection by agents that do not instill acquired immunity among their hosts. Recurrence of GI parasites, on the other hand, is likely due to the abundance of agents in the environment and to a lack of sanitary infrastructure and of rampant poor hygienic practices.

Sex-Specific Variability in the Rates of Health Problems

Morbidity and various of the most important health problems in particular were experienced at significantly different rates by males and females. Significant sex-specific variability was more common among the health problems with upper mean rates of incidence. The syndromes and diagnosed conditions less likely to show sex-specific

variability in any of the rates included those with highest incidence and those with moderate to low incidence.

Females experienced a more diverse set of health problems and higher rates of total morbidity, significant morbidity, and concurrence than did males. Recurrence was the only health pattern experienced considerably more frequently by males than by females. The dizzy, weak, or fainting syndrome was the only one of the most important syndromes affecting the Secoya that females experienced at significantly higher rates of incidence, concurrence, or recurrence than did males.

There was no significant difference in the rates of incidence of the grippe and diarrhea syndromes as experienced by males and females. Fever was experienced by males in all measures of health at rates significantly higher than those experienced by females. In addition, the incidence of febrile grippe, the concurrence of grippe, and the recurrence of diarrhea all had rates significantly higher among males than females. Of the most important diagnosed conditions affecting the Secoya, malaria was the only condition with a incidence among females that was significantly higher than that among males. The incidence of leishmaniasis and dengue and the recurrence of parasites had rates significantly higher among males than females. None of the remaining important medically diagnosed conditions were experienced at rates that were significantly different between males and females.

Diagnosis of Health Problems

Several health problems experienced by the Secoya were medically diagnosed. These diagnoses provide evidence of definite cases of both emergent and non-emergent conditions. Furthermore, the differential diagnosis of the health problems experienced by the Secoya identified conditions that could be considered non-emergent and conditions that could be considered emergent. Of these conditions, those identified as emergent represent possible cases of disease emergence. In the sections below I present a summary

of the most important findings of the medical and differential diagnosis of the Secoya health problems. The conclusions that can be generated from these findings include whether or not the Secoya experience disease emergence and the types of emergence that they are most at risk of experiencing. It is also possible to assess the degree to which outside populations are at risk from conditions definitely or possibly experienced by the Secoya.

Non-emergent conditions

The majority of the health problems experienced by the Secoya could represent cases of non-emergent conditions. All of the non-emergent conditions that could be the cause of the most important health problems are communicable infectious diseases. The non-emergent agents most likely to be associated with the grippe, fever, and febrile grippe syndromes include various forms of non-influenza viruses. Those most likely to be associated with the diarrhea syndrome and the diagnosis of GI parasites include various common helminthic, protozoan, bacterial, and viral agents. The agents most likely associated with the skin fungal infection, leishmaniasis, and malaria include, respectively, various types of ringworm fungi and protozoa of the *Leishmania* and *Plasmodium* genera. It is important to note that although leishmaniasis and malaria are not emergent conditions among the Secoya, they can spread to distant populations.

Definite cases of emergence

Five of the medically diagnosed conditions experienced by the Secoya represent definite cases of emergent conditions. These conditions include chicken pox, dengue, hepatitis (A, C, D, E), tuberculosis, and chainsaw-related injuries. In addition, the unexplained fatal syndrome, which was associated with the medically diagnosed condition identified as hemolytic anemia and death also represents a definite example of emergence among the Secoya. Of these conditions, the chainsaw-related injuries were the

only ones not among the most important health problems experienced by the Secoya and the only conditions that were clearly not communicable conditions.

The majority of the definite cases of disease emergence among the Secoya are communicable infectious diseases. Some of the medical diagnoses of hemolytic anemia and death represent conditions that are non-communicable or highly unlikely to be communicable from person to person. These include disseminated histoplasmosis, which is not communicable, and acute leukemia, which is most commonly transmitted only through breast milk between mother and child. The other condition diagnosed as a possible cause of hemolytic anemia and death includes Evan's syndrome. However, its cause is unknown and therefore, so is its communicability. All other conditions associated with cases of definite emergence represent communicable diseases.

Some of the medically diagnosed conditions could be new or rare among humans and several others can pose a threat to distant populations. The conditions that had as their sources an infective agent new or rare among humans were those associated with hemolytic anemia and death. Although the causal agent of this condition was never verified conclusively, several medical experts who reviewed the details surrounding this condition indicated that it might indeed represent a viral agent previously unrecognized by medical science. The medically diagnosed communicable diseases whose spread poses the greatest threat to distant populations include dengue, hepatitis (A, C, D, E), and tuberculosis. Furthermore, the communicable diseases tentatively identified as the cause of the hemolytic anemia also pose a threat to distant populations. These include tuberculous meningitis and possibly Evan's syndrome. If the source of the cases of hemolytic anemia and death is found to be a previously unrecognized virus, then this would be the condition whose spread poses the highest threat to distant populations.

Possible cases of emergence

Various syndromes experienced by the Secoya could possibly represent emergent conditions. Grippe and diarrhea represent the syndromes most likely to represent cases of disease emergence among the Secoya. Other syndromes with a high likelihood of representing emergent conditions include dizzy, weak or fainting, fever, and febrile grippe. The emergent conditions most likely implicated by these syndromes include influenza, *T. trichuris* parasitosis, nutritional deficiencies, and viral hepatitis (A, C, D, E). It is important to note that various syndromes not included among the most important health problems affecting the Secoya can also be caused by these emergent conditions. Of these conditions, only nutritional deficiencies do not represent a communicable disease. Furthermore, none of these conditions is new or rare among humans. However, the spread of influenza and viral hepatitis could potentially pose a threat to distant populations.

The emergent conditions next most likely to have been experienced by the Secoya include those that were diagnosed at the second level only for the syndromes of moderate to low incidence. These conditions include Norwalk virus parasitosis, *H. pylori* peptic ulcer, endometritis caused by various sexually transmitted bacteria, urinary tract infections caused by *N. gonorrhea*, and liver cirrhosis caused by alcohol. Of these, only the liver cirrhosis represents a non-communicable condition. Moreover, none of these conditions is new or rare among humans nor is their spread a threat to distant populations.

The emergent conditions least likely to have been experienced by the Secoya were those that were identified only at the third level of diagnosis. These conditions include various arboviruses, several conditions caused by the E. Barr virus, *C. pneumonia*, various forms of chemical contamination, a nutritional deficiency-repeated infection synergism, and adverse drug reactions. All of these conditions with exception of the last three are communicable from person to person. Most of the arboviral infections have been rarely documented among humans. This may be more representative of the lack of

laboratory testing for the presence of the viruses than the actual rate at which they occur among humans. None of the other conditions is considered new or rare among humans. Furthermore, with exception of the arboviruses, the spread of these conditions does not pose a threat to distant populations. Even the arboviruses, that can spread to distant populations do not pose much of a threat given their largely benign virulence.

Epidemiology

In this study I found that the health of the Secoya population as a whole is greatly influenced by the abundance and distribution of a variety of health-influencing agents in the environment. In the sections below I identify various inter-related biocultural factors that are responsible for moderating the levels of abundance and distribution of these agents in the Secoya environment. I also explain how factors within the Secoya can contribute to differences in the spread of these agents between males and females of the population. The conclusions that can be generated from this level of analysis include the identity of the processes which are associated with the most important health problems experienced by the Secoya, including possible emergent diseases. Moreover, the identity of cultural or micro-social level factors that can influence differences in the spread of particular health problems may also be uncovered.

Factors most affecting the health of the Secoya population

Various biocultural factors persistent and new to the Secoya environment contribute to both non-emergent and emergent conditions. All of the agents associated with the differentially diagnosed conditions identified as non-emergent have persisted in the environment since prior to the Industrial Period. Most of the factors that can contribute to the introduction of these agents into the Secoya population also have been persistent in the environment since prior to the Industrial Period. However many new factors, all related to intrusions into the Secoya environment since the Industrial Period,

now exacerbate the abundance of these agents in the environment or contribute to new ways in which these can be introduced among the Secoya. Most of the agents associated with the differentially diagnosed conditions identified as emergent are new to the Secoya, but several are old. These agents have only recently entered or re-entered the Secoya population as a result of the same post-Industrial Period intrusions into the environment. These intrusions and the manner in which they were carried out have been driven by historical macro-social forces.

The most persistent of the macro-social forces include the beliefs, values, and attitudes among the members of the Ecuadorian government toward the Amazon and the indigenous cultures therein. These may be characterized as views of the Amazon exclusively as a source of potential wealth and of indigenous cultures as savages in need of conversion to the national culture. Some of the other historical macro-social forces, include demographic, economic, and geopolitical pressures. These forces, present since at least the end of the 19th century, have only intensified over time, particularly since the recent shift during the Industrial Period towards a dependence on an oil based economy. The result has been the pursuit of the social and economic transformation of the Amazon by the Ecuadorian government with little effort to prevent the consequences to the local environment an indigenous cultures.

The intrusions into the Secoya environment are largely in the form of industrial development and agricultural colonization of the region. Macro-social forces stimulate these activities so as to generate uncontrolled population growth, solid waste and toxic contamination, and fragmentation of the forest. They are also responsible for the development of densely crowded frontier towns, the expansion of an unregulated market economy into the region, and the entry of ecotourism agencies. As a result of the combination of all of these macro-social activities, new infectious and non-infectious health influencing agents have been introduced into the region, vector-transmitted agents are allowed to increase in abundance, and the ability of all of these agents to persist in the

environment are enhanced. Furthermore, the indigenous cultures in the region are increasingly circumscribed by industrial developments, agricultural settlers, and protected territories comprised of ecological preserves. As a result, the Secoya are becoming increasingly more sedentary in an environment with escalating concentrations of previously extant infectious agents and various new agents, and diminishing traditional subsistence resources.

All of the environmental changes associated with the intrusion of the macro-social activities into the Secoya environment occurred in a manner consistent with the historical attitudes of the Ecuadorian government towards the Amazon and its indigenous inhabitants. The most significant of these patterns involved neglecting the development of any infrastructure to compensate for the environmental changes caused by these newly introduced activities. As population size, solid waste, and toxic contamination in the region increase unabatedly, this neglect makes good hygienic practices increasingly difficult to achieve. This is further complicated by Secoya ethnomedical perceptions that most of the conditions transmitted through poor hygienic practices are not real health problems and that sickness is not caused by poor hygiene. As a result, the majority of non-emergent and emergent infectious agents are most likely transmitted into and among the Secoya through poor hygienic practices. Of highest risk are the conditions associated with the diarrhea, grippe, and febrile grippe syndromes and the conditions diagnosed as tuberculosis, and hepatitis.

Other highly significant patterns in the manner in which the Ecuadorian government allowed environmental changes to occur are noted in the official regulations regarding the legal titling of the land. Based on these policies, colonists were required to clear their land for agricultural production, thereby contributing to the ecological alteration and fragmentation of the forest. These changes are associated with increases in the abundance of vector-transmitted diseases in the region. These conditions are the most likely to be implicated in the fever syndromes and in the conditions diagnosed as malaria,

leishmaniasis, and dengue. Furthermore, the demarcation of indigenous and protected territories neglected considerations of how this titling would affect traditional subsistence practices. This procedure has led to a reduction of the size of territories indigenous cultures can use to satisfy their subsistence needs and a trend towards increasing sedentism. These patterns decrease the availability of regional subsistence resources while contributing to the depletion of resources within the occupied territories. These factors contribute to nutritional deficiencies, which were most likely to be implicated in the dizzy, weak, or fainting syndrome.

Factors contributing to patterns of sex-specific variability of health problems

There was no significant difference in the sex-specific incidence rates for grippe, diarrhea, GI parasitic infection, and dermatological fungal infection, which were the syndromes and diagnosed conditions with the significantly highest incidence rates. This indicates that the agents that are the source of these health problems are among the most abundant in the environment. Poor hygienic practices are the main means of spread of the majority of the agents implicated by the differential diagnosis of these health problems. Therefore, it can also be inferred that poor hygienic practices are shared equally common among males and females and that they provide the main means of spread of the majority of the communicable diseases experienced by the Secoya.

The factors contributing to the variability in the sex-specific rates of the most important health problems experienced by the Secoya can be related to the sexual division of labor and to the influence of menstruation on females. Males are more likely than females to take part in hunting, or other subsistence-related activities inside the forest. Males are also more likely than the females to be involved in the market economy and are the only ones conscripted into military service. These activities provide males with a more ready access to diverse food resources than females, but also increases their exposure to insects, wildlife, and humans who could be carrying infective agents. The

latter cause males to experience a greater variety of vector-borne infectious diseases and infectious diseases communicable from person to person than females. These conditions include leishmaniasis and dengue, which were among the conditions medically diagnosed most frequently among males than females. They also include a number of conditions associated with the fever and febrile grippe syndromes, which had significantly higher incidence rates among males than females.

The differences in the access to diverse food resources contribute to making females more likely to experience nutritional deficiencies than males. These differences in nutritional intake become more pronounced during the women's menstrual cycles, which can cause females to experience metabolic changes and the depletion of various nutrients. Nutritional deficiencies are associated with the dizzy, weak, or fainting syndrome, which had significantly higher rates of incidence, concurrence, and recurrence among females than males.

Although malaria, which is a vector-borne disease was diagnosed at a rate significantly more frequent among females than males, I do not believe it indicates that females are more prone to malarial infections than are males. Rather, it likely indicates that females are more likely than males to suffer more severe symptoms and more frequently seek medical treatment for malarial infections than males. Since repeated malarial infections reduce the severity of its symptoms, individuals with less frequent malarial infections are the ones who suffer the more severe symptoms. Therefore, a higher rate of diagnosis of malaria among females may actually indicate a decreased rate of infection in comparison to males.

RECOMMENDATIONS

The findings from this study indicate that much additional work needs to be done among the Secoya to address immediate health problems and to develop preventive health care. In the sections below I elaborate my ideas for such future immediate and preventive

health care strategies. However, the Secoya represent just one example of the many tropical rainforest indigenous cultures facing health threats as the result of large-scale ecologically degrading intrusions into their environment driven by population growth and economic globalization. For this reason, I present these strategies as general blueprints for the development of broader international efforts to address the health problems of other indigenous cultures facing similar intrusions into their environment.

The recommendations I present derive largely from existing health care and rainforest conservation efforts as practiced by two non-profit, non-governmental organizations operating in the Ecuadorian and Peruvian Amazon. These organizations include Project Amazonas Incorporated, located in the upper Amazon River region of Perú, and the Foundation for Integrated Education and Development (FUNEDESIN), located in the Napo River region of Ecuador. All health care activities of Project Amazonas are designed and conducted as part of their Medical Civil Action Purpose (MEDCAP) program and all future references to these activities are credited to this program.

Immediate Health Care

Immediate health care needs to be prioritized to address the health problems that both the Secoya and biomedical experts identify as the most important or of greatest concern. During the time of my study, the health problem of greatest overall concern was the unexplained fatal syndrome. Other health problems considered to be of greatest concern by either the biomedical experts, the Secoya, or both included tuberculosis, dengue, and viral hepatitis, dizzy, weak, or fainting, GI parasites, leishmaniasis, malaria. Neither the Secoya nor the medical biomedical experts were greatly concerned over the grippe, diarrhea, fever, and febrile grippe syndromes, or about the skin fungal infections. However, given the high rates of incidence, concurrence, and recurrence of most of these

health problems and the possibility that emergent infectious agents could contribute to these, I would recommend that these problems also receive top priority.

I recommend that immediate health care be provided to the Secoya by complementing the existing *promotor de salud* with strategies similar to those employed by MEDCAP and FUNEDESIN. The position of *promotor de salud* is a post within the official national health program occupied a member or members of the community elected to the position. Many Secoya felt unsatisfied with the existing *promotor de salud* system of health care. The main points of contention are that it does not provide for a means to deal with severe health problems or emergencies, the *promotor de salud* cannot be counted on to be available when needed, and medicines are hardly ever available or too expensive when they are available.

The *promotor de salud* typically undergoes training for a period of two to three months in a city away from the indigenous community. Once graduated, the *promotor de salud* is qualified to provide first aid treatment, provide basic maternal and infant health care, and to treat common health ailments such as fevers, cuts, breaks, sprains, burns, gastrointestinal parasitosis, and respiratory infections. During the time of my study there was only one acting *promotor de salud* within the Aguarico River region. He often treated individuals who traveled by canoe in excess of 20 km to see him. He also made visits to different households on occasions when the patients were to sick to travel. Due to lack of support from the health ministry, he was forced to work under less than optimal conditions. He worked out of a clinic commonly under-equipped and under-supplied with medicines and with questionable hygienic conditions. In addition, he was commonly not found in his office being involved instead in subsistence activities like fishing, hunting, or taking care of his gardens.

Some of the strategies that MEDCAP and FUNEDESIN are routinely involved in and that can contribute to complement the include regularly scheduled medical visits to the communities and emergency transportation to a local hospital when necessary.

During the regularly scheduled community visits these organization provide inoculations, treat patients for assorted health problems beyond those provided by the *promotor de salud*, and provide preventive health care education. In addition to providing community visits, FUNEDESIN has established a local clinic equipped to perform surgical operations that can not be treated in the clinic of the *promotor de salud*. Although neither MEDCAP nor FUNEDESIN provide a constant presence within the communities, with proper radio communication and support, health care could potentially be provided when requested by physicians working in the local clinic.

I strongly believe that health services to the Secoya and other indigenous groups can be best achieved by increasing the number of qualified *promotores de salud* and by better supporting them with medications, communication, and training. I also believe that expanding the efforts of existing organizations like MEDCAP and FUNEDESIN to include areas currently not serviced by health experts is of urgent importance. This expansion can be in the form of additional health clinics scattered near areas of largest concentrations of population within indigenous territories. These additional traveling clinics can provide health care to residents living in more isolated areas or to patients unable or unwilling to travel to the nearby clinics.

It is important that the manner in which health care is provided to the indigenous communities not create dependency of those communities on external health care. Instead, health care should be combined with an educational program that helps to increase the self-reliance of the indigenous communities. To this end both MEDCAP and FUNEDESIN educate the indigenous communities on how to use modern and own traditional knowledge of medicine and of the land to improve their well-being. Both of these organizations incorporate biomedical and traditional remedies and treatments in their health care and teach these techniques to local residents willing to learn. Accordingly, I suggest that clinics intended to serve the Secoya should be staffed with Secoya personnel trained in both biomedicine and local ethnomedical healing strategies.

Initially, the staff may involve biomedical experts and Secoya trainees, however, the goal should be to ultimately eliminate the dependence on outside medical intervention. During this time, the biomedical staff should include individuals who have received ethnographic training to help them become more sensitive to the Secoya cultural system.

Ideally, the traveling clinics should be able to service more than one indigenous community, and therefore, should be staffed by members of several indigenous communities. By including a diversified set of ethnomedical experts in these clinics, the Secoya and other patients are provided with more ample alternatives with regard to treatment. Furthermore, the efficacious resolution of a health problem though the application of ethnomedical practices serves to strengthen the respect for traditional cultural beliefs and practices of the local indigenous groups.

In addition to providing curative treatment, the staff of the clinics should be involved in helping to monitor the health problems throughout the region and to maintain surveillance of emerging diseases. Although not specifically focused on emerging diseases, both MEDCAP and FUNEDESIN actively report to the relevant regional, national, and international agencies the health problems they are involved in treating. This practice helps to build statistical information regarding the different types of health problems treated. Of particular importance is the reporting of conditions that pose serious endemic or pandemic threats. Traveling clinics in particular, are ideally suited to become involved in the rapid assessment of potential disease emergence through the practice of syndromic surveillance. The staff of these traveling clinics can be trained to identify syndromic evidence indicative of disease emergence.

Preventive Health Care

The development of preventive health care is a more difficult task to address than that of immediate health care. This is because prevention involves redressing the persistent macro-social forces that are driving the intrusions into the Secoya environment

and the manner in which they occur. The macro-social problems need to be addressed in a manner that will include changing the pejorative attitude towards indigenous cultures and reducing economic, demographic, and geopolitical pressures. Several factors including a lack of political representation of indigenous groups and territorial disputes between Ecuador and Perú have helped contribute to the persistence of these factors. Recent developments including an increasing political presence among indigenous organizations in Ecuador and the normalization of relations between Ecuador and Perú may facilitate the means to bring about these needed changes. Unfortunately, new threats to the region have recently appeared on the horizon which can neutralize much of the progress that could be gained by these recent developments. I refer specifically to the consequences to Ecuador, and especially the region of Sucumbíos, resulting from the implementation of the U.S. backed *Plan Colombia.* This operation is largely a military strategy drafted by the Colombian government as a means to counter violence and drug trafficking in Colombia (INOTA 2001).

Addressing the macro-social factors in the existing context

In chapter 2 I delineated the historical background that led to the reality I encountered in the field in 1999. In the sections below I provide a brief update of some developments in the area of indigenous politics and geopolitical conflict. I suggest that any effort designed to help address the macro-social factors contributing to health problems among the Secoya do so with consideration of all the above developments in Ecuador and the surrounding region.

Indigenous political power

Since their formation in the early to mid 1980's several indigenous organizations, particularly the *Confederación de Nacionalidades Indígenas de la Amazonia Ecuatoriana* (CONFENIAE) and the *Confederación Nacional de Indígenas del Ecuador* (CONAIE)

have been gaining increasing local and national political influence in Ecuador. The main objectives of CONFENIAE are the defense and legalization of indigenous territories and the preservation of ecosystems and natural resources. On the other hand, CONAIE has served as the principal vehicle for providing indigenous peoples of Ecuador a political voice through which they can express their needs and goals. The growing influence of CONAIE may be noted in the rising number of indigenous individuals being elected to political office in the last couple of years. A significant example of this is the election of Luis Maldonado, a member of the Quichua indigenous culture, to the position of *ministro de Bienestar Social del Gobierno* (El Comercio 2001d, 2001e). The increasing political influence of indigenous peoples in Ecuador may also be noted by the growing national support of the *Pachakutik* indigneous movement. Created in 1995 as a response to the call of CONAIE to create a political presence that unifies social and indigenous movements into a single force, the *Pachakutik* movement is now regarded as one of Ecuador's strongest political parties (Native Web 2000). The Secoya have not been left out of the growing indigenous political movement. On October of 2001, Aniseto Piaguaje, with whose family I resided during my field work in San Pablo, was elected as the Secoya representative to *El Consejo de Nacionalidades y Pueblos* which serves as a legislative council for CONAIE (Native Web 2001). It is hoped that the Secoya and all other indigenous organizations can use their new found political power to better control the encroachments into their territories and to better guide the path of their own development.

Peace accord between Ecuador and Perú

The tensions surrounding the territorial disputes between Ecuador and Perú led to numerous armed conflicts with the last one occurring in 1995. However, Ecuador and Perú signed the *Acta de Brasilia* peace accord in 1998 and the relations between their two countries appears to have continually improved since then. As part of the normalization

of the relations, Ecuador reopened the Napo and the Aguarico rivers to travel between the two countries. This action has had the effect of increasing the level of trade in both countries and has helped to reunite many Secoya families who can now freely travel across the borders by canoe (El Comercio 2001f). In addition, due to the relaxing of tensions between the two countries Ecuador has removed much of its military presence form the borders and is planning on reducing its military budget. The increase in trade between Ecuador and Perú resulting from the peace accord goes a far way to help the economic pressures of the country. This is because a more diversified economy reduces the dependence on the oil industry which would enhance the stability of the national economy and make it development plans less subservient to the corporate interests of the oil industry.

Plan Colombia

In 1999 the Colombian government drafted *Plan Colombia* and subsequently received pledges of financial support for the plan from the United States, the European Union, and other countries. A description of the *Plan Colombia* and its consequences to Ecuador is included in the Colombia Report (INOTA 2001). The plan involves using the military to destroy drug crops and to battle leftist guerrillas, drug traffickers, and rightist paramilitary groups active in the Putumayo region of Colombia. According to the Colombia Report, the total budget for the plan is $7.5 billion of which $1.3 billion was pledged as an aid package by the U.S. in July 2000. Over 53% of the $1.3 billion committed by the U.S. was directed to finance military and police assistance in Colombia. By comparison, only 1.5% was pledged to Ecuador to help compensate for the social and environmental consequences they might incur as the result of implementing the plan. The area in and around Sucumbíos has been the hardest hit and is expected to continue to suffer the greatest consequences from *Plan Colombia* given its shared border with the Putumayo region of Colombia. For over a decade prior to *Plan Colombia* Sucumbíos had

already been experiencing the influx of armed guerrilla groups seeking safe haven from the Colombian military (El Comercio 2001b, Vickers 2001). Since *Plan Colombia* began thousands of Colombian refugees have also escaped into Sucumbíos. It has also experienced an increase in violent crimes like kidnaping and murder as well as the emergence of coca cultivation and processing in its soils. In January of 2001 members of four indigenous communities in Sucumbíos were forced to leave their homes under threats of death from heavily armed Colombian groups (INOTA 2001). In addition, within Sucumbíos there are increasing reports of health problems and crop damage related to the use of the chemical Glyphosate as an herbicide to destroy drug crops (El Comercio 2001c, 2001a).

Citing that *Plan Colombia* ignores human rights violations, destruction of the environment, and civil unrest the European Union withdrew its support for the plan insisting instead on the implementation if development projects in the area (INOTA 2001). I would recommend that the U.S. and Ecuadorian governments follow suit and reconsider their support for the plan and instead consider more humane projects to promote local and national development, create jobs, promote environmental protection, and to protect the well-being of indigenous communities.

Addressing micro-social factors

Several cultural factors that contribute to poor hygienic practices among the Secoya need to be addressed as components of preventive health care. The main factor contributing to poor hygienic practices is the lack of a sanitary infrastructure. However, if such an infrastructure could be developed to ensure the easy access to potable water, the Secoya would still have to be convinced of the value of using the potable water for washing, cooking, and drinking. They would also have to be convinced of the value of using sanitary waste management techniques over the conventional practice of defecating in rivers and streams. I believe the best way to do this involves recruiting volunteer

households willing to show by example how changes in hygienic practices reduces their health problems. If such practices yield better well-being among the residents of the household it is likely that other households are going to be willing to make similar changes. Such a program may initially require the assistance of health care practitioners to train the household members with regard to appropriate hygienic practices. The members of these households can then help teach other households the same practices, thereby helping to accelerate the spread of such practices.

Cultural factors that contribute to the exposure of the Secoya to infected vectors also need to be addressed. These are more difficult to address given that the largest factor contributing to the exposure to infected vectors is an outdoor lifestyle. In addition, in repellants and bed netting are the most commonly recognized ways of preventing exposure to infected vectors. Many if not most of the Secoya use bed nets, but repellants are usually too expensive for the Secoya to afford. Furthermore, most of the Secoya consider the health problems associated with mosquito and sand fly bites to be only minor nuisances and are unlikely to take measures to avoid their bites. Efforts should nonetheless be made to increase the accessability of repellants as well as to educate the Secoya with regard to the potential threat of vector borne diseases.

Addressing bioecological factors

In this dissertation I indicated that reduced game availability, chemical contamination, and forest fragmentation could be responsible for many of the health problems experienced by the Secoya. However, documentation regarding the current abundance and distribution of game animals or of toxic chemicals and heavy metals in the Secoya territory does not exist. In addition, although much evidence exists to demonstrate the levels of forest fragmentation experienced in the region, studies measuring the impact of this fragmentation on the abundance and distribution of infective vectors within the region are also lacking. Therefore, I suggest that future studies should

be directed to fill these voids of information. In the meantime, the Ecuadorian government should develop and support with sincerity programs directed at redressing known ecological problems in the region. These programs should emphasize the reduction of chemical and infective agents and sources that are known to be in the region surrounding the Secoya. This includes cleaning up all areas known to have experienced contamination and taking measures to provide immediate and preventive health care for all colonists in the region. The government programs should also be involved in helping to protect existing areas from future ecological degradation. This includes limiting the extent of industrial development in the region and imposing and enforcing of more stringent environmental protection regulations on existing industrial activities.

FINAL STATEMENT

During my visits with the Secoya I have been impressed with how hard and long they work taking care of their gardens, hunting, building their homes and just generally living day-to-day. In order to be able to prosper by their arduous labors in such a hot and humid climate full of potentially dangerous flora and fauna they have to be in excellent health. It would be an easy, but premature assumption to consider that because the Secoya are surviving and increasing in number that they must therefore, not be suffering serious health problems. Indeed, most of the health problems experienced by the Secoya could be considered to be non-life threatening and even of little impact to their social way of life. However, concluding that this indicates that their health is not being seriously threatened must be deemed an absolute falsehood. It is precisely such fallacious thinking that permits the perpetuation of the activities that have so rapidly and drastically modified their environment without any efforts to counterbalance the health risks they might pose. I strongly urge that any concern over the health of the Secoya and of other indigenous cultures undergoing similar environmental stresses focus as much on the potential threats as on actual health problems. My study reveals signs that increasingly serious health

problems may already be affecting the Secoya. Several unexplained deaths and a high incidence of individuals suffering from syndromes associated with nutritional and immune system deficiencies should serve as a warning of things to come unless immediate action is taken to treat existing problems and prevent future ones from developing. Such action requires shifts in the fundamental ways the Ecuadorian government has perceived indigenous cultures and the Amazonian environment in relation to its pursuit of economic growth. Given that the health problems facing the Secoya are increasingly becoming health risks to outside populations, it would benefit the global population to become involved in ensuring the evolution of such new healthier ways of viewing and treating the world and its peoples.

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APPENDIX

DESCRIPTION OF SYMPTOM CLASSES

Gastrointestinal

The Secoya experienced a number of health problems associated with several types of abnormal gastrointestinal signs and symptoms. These commonly included some form of diarrhea, which varied according to duration, frequency of onset, consistency, odor and color. The presence of absence of blood in the stool was also noted. Sometimes fever and vomiting were reported as also present, but in these cases the chief complaint was the diarrhea. Although diarrheas comprise the majority of the gastrointestinal complaints, most of the cases were reported only after being prompted about whether they had recently experienced any diarrhea. The Secoya also reported experiences of *dolor de estomago* or stomach aches that occurred without any other related signs or symptoms. Macroscopic worms were observed to be present in stool both with and without the aid of laboratory facility. Microscopic parasites were observed clinically only. The cases in which worms were not observed clinically are classified as undiagnosed. The cases reported to be identified clinically are considered to be diagnosed conditions even if the taxonomic nomenclature of the parasites involved was not specified. The case of a woman suffering from chronic stomach pain as the result of being the victim of arsenic poisoning was also classified as a gastrointestinal symptom class.

Respiratory tract

The two most commonly reported types of respiratory syndromes included *grippe* and *grippe fuerte* (strong grippe). Simple *grippe* was associated with a runny nose and general malaise. There was considerable variability in the manner in which *grippe fuerte* was distinguished. It could but did not necessarily include a runny nose, coughing (mild to severe, with phlegm or dry), and mild to severe headaches. Yet, it always included a fever. For this reason I classified *grippe fuerte* as "febrile grippe." Another commonly reported problem was the chronic presence of cough without any other perceptible signs or symptoms. The cases reported varied according to whether the cough was dry or accompanied by phlegm or blood. During the period of my study, several of the chronic coughing cases were investigated clinically for the possibility of Tuberculosis. Only the cases that tested positive for Tuberculosis are considered as diagnosed conditions of Tuberculosis. All others are listed as "cough" syndromes. A less commonly reported syndrome was that of a sudden, short-lived difficulty in breathing. It was generally not accompanied by any other sign or symptom. I classified this syndrome as "shortness of breath."

Fever

The Secoya reported experiencing fever along with several other types of signs and symptoms and sometimes just by itself. In order to reduce the number of possible diagnoses of health problems that included fever, I classified the reported health problem as a fever only if it was the primary or only complaint offered. Health problems that were reported to have been medically diagnosed as either malaria or dengue also were classified in this symptom class, since they are the characteristic symptoms associated with these diseases. Fevers were perceived either simply as "fevers" or as "fever with chills."

Dermatological

The Secoya experienced several health problems that affected the skin in different ways, but rarely reported any of those experiences. Instead, the majority of the health problems in this class were diagnosed either by myself or by a medical doctor based on readily apparent signs. This was particularly true for cases of fungal infection, leishmaniasis, and head lice, the symptoms of which were never reported by the Secoya. There was an outbreak of chicken pox during the period of my study. The raised vesicles on the skin were sometimes indicated by the parents of the infected children but never by the children. Other cases were observed but not reported. At the beginning of the outbreak, the Secoya did not recognize the condition as chicken pox but rather as an unknown condition. At later stages, subsequent cases were immediately recognized and reported by the Secoya as chicken pox. One girl reported an outbreak of *picazónes* (itches) after having eaten a fish and was subsequently diagnosed as having experienced an allergic reaction.

Syncopal

A set of symptoms characterized by sudden fainting spells, general weakness, and dizziness were reported. Most of the cases were reported by women many of whom who reported this as a chronic problem, which they have endured for several years. Generally, the symptoms were more pronounced early in the morning and after some type of physical activity such as the weeding of the garden. This was commonly the first of the health problems that women reported. The problem was less reported by men and children.

Head

Headaches occurring by themselves or with fever only were somewhat commonly reported. These were sometimes reported to occur following some form of strenuous physical activity while at other times the complaints were chronic. One girl was impaled in the leg by a rusty nail and subsequently developed an infection. She suffered from a headache until the infection was cured. As a result, the headache she reported was classified as diagnosed condition associated with an infected injury.

Skeletomuscular

Several Secoya reported experiencing various forms of aches and pains I classified into the skeletomuscular symptom class. Aches and pains of the bones that did not have a central locus but were generally spread over different parts of the body were classified as "generalized bone pain." Other aches and pains were indicated to affect specific areas like joints or the back. Most of these pains were reported to be chronic but a few were said to appear suddenly and then disappear for no apparent reason. Limb numbness or tingling of the legs or arms was also reported mostly as a chronic condition.

GI/Gynecological

A number of women reported experiencing pain around the abdominal area. They did not refer to this pain as *dolor de estomago.* Instead, they pointed to their lower abdominal region to indicate the locus of the pain. They also indicated that sometimes the pain would radiate to their lower back. Most of them indicated that this occurs once a month or every other month. Given these indications, I was unable to differentiate whether the locus of the pain was a gastrointestinal system or the gynecological system so I classified this health problem as potentially either a gastrointestinal or gynecological symptom class.

Fatal

During the period of my study there was a great concern over a series of deaths that had occurred among the Secoya. The deceased shared a common set of signs and symptoms that were attributed to cause their deaths. However, there was a considerable difference regarding

how long and how intensely each individual experienced these symptoms prior to their death. The post-mortem condition also presented a highly unusual pattern. The signs and symptoms shared by all the deceased included a sudden onset of a severe headache, followed by pain in the upper right abdominal region, hemolytic anemia, jaundice, large skin lesions, mental disorientation, coma, and death. The post-mortem progression was characterized by an extremely rapid decomposition with liquefaction of the body reported to occur within 48 hours of death. This was the only fatal syndrome that occurred during the period of my study. Various medical doctors from distinct hospitals, clinics, and laboratories were unsuccessful in developing a single diagnosis for this condition. I refer to this set of signs and symptoms as the unidentified fatal syndrome (UFS).

Gynecological

Several women reported experiencing a variety of problems that can only be classified as gynecological. Some of these women reported cases of miscarriage as health problems. One woman reported sudden and rapid sensations of heat and chills and feelings of unexplained panic. Upon further inquiry she also indicated that her monthly period had recently become less "severe" or had stopped occurring altogether. The Secoya women regard their menses as a sickness, whose perceived severity is based on the amount of pain and bleeding associated with the sickness. For these reasons, the medical doctor who was present when these signs and symptoms were reported, diagnosed the woman with menopause. Additionally, one woman reported that she has endured pain in her uterus for a number of years. She had at one time been diagnosed with an inflamed uterus. It is likely that since then, she regards any pain perceived to be within the same region as a painful uterus. I therefore, classified "uterine pain" as an undiagnosed gynecological syndrome.

Optic

Several Secoya reported suffering from *dolor de ojos* (eye pain) particularly when reading, or studying, but they did not know why. Therefore, I classified eye pain as an undiagnosed syndrome. Other Secoya reported that they had a difficult time focusing on close objects but could see objects at a distance without any problems. They indicated that a medical doctor had at one time diagnosed them with needing prescription glasses, but could not afford them. I classified this health problem as diagnosed cases of far-sightedness.

Urinary tract

The only set of signs and symptoms that correspond to this symptom class include frequent and painful urination and pain in the kidney region. Although this is likely to represent a urinary tract infection, none of the Secoya identified it as being diagnosed as such. Additionally, it could also be other less likely conditions including diabetes or gall stones. Therefore, I classified these signs and symptoms into the "urination and/or kidney pain" syndrome.

Breast

Some women complained of suffering from painful breasts. One woman complained of not having milk in her breasts to nurse their children. These were classified respectively as "breast pain" and "dry breast" syndromes.

Cut, Sting/Bite, Break/Sprain

There were several different types of injuries that I classified into separate symptom classes according to whether they were cuts, breaks, sprains, or stings or bites from various types of animals and insects. Since the source of these injuries could be identified, I considered each of them as a separate diagnosed condition.

Hepatic

Several Secoya pointed to the upper right abdominal region as an area where they have experienced pain. Since this is where the liver is located, I classified this syndrome as liver pain. Others reported that they had been diagnosed with hepatitis either by a medical doctor or by the indigenous medical practitioner. Given that hepatitis is a pathological liver condition I classified it as a hepatic syndrome.

Cardiac

One individual reported that he has suffered for a number of years from an undiagnosed problem that causes his heart to suddenly stop or to suddenly speed up. Although this is a problem that emerged several years ago, he still suffers from it and therefore, I consider it to be prevalent health problem during 1998-1999.

Neoplastic

A woman showed me a deep cyst of about one to two inches in diameter in the back of her knee. She indicated that it suddenly appeared the year before. I consulted with the medical doctor who told me that he had examined her and diagnosed her with having a benign cyst. I classified this diagnosed condition into the neoplastic symptom class since a benign cyst is a form of a neoplasm, the medical term for an abnormal tissue growth.

Auditory

A man and his family told me that he was deaf. Apparently he was not completely deaf, since he was able to respond to my questions, but he did perceive a loss of some hearing. This loss of hearing began when he started working with chainsaws on a regular basis. I considered this deafness to be a diagnosed condition, since it did not appear to be related to any other condition.

Emotional

A woman reported that she has suffered from a very debilitating sadness since the sudden death of her husband and daughter from the unidentified fatal syndrome. Additionally, she was unable to concentrate, felt tired for no reason and often found herself crying. She considered this grief to be an abnormal condition and, therefore, reported it as a health problem.

Table A.1: Syndromes concurrent with each other.

	abdominal pain	back pain	bloody diarrhea	breast pain	cough	diarrhea	diarrhea w/ fever/ vomit	dizzy, weak, or fainting	dry breast	eyes hurt	febrile grippe	fever	fever and chills
abdominal pain	0	0	0	0	0	2	1	1	0	0	0	1	0
back pain	0	0	1	1	0	0	0	0	0	0	1	0	0
bloody diarrhea	0	1	0	1	0	0	1	1	0	0	1	2	0
breast pain	0	1	1	0	0	0	0	0	0	0	0	1	0
cough	0	0	0	0	0	2	0	0	0	0	0	0	0
diarrhea	2	0	0	0	2	1	2	4	1	1	5	3	3
diarrhea w/ fever/ vomit	1	0	1	0	0	2	0	0	0	0	0	2	0
dizzy, weak, or fainting	1	0	1	0	0	4	0	0	0	0	0	1	1
dry breast	0	0	0	0	0	1	0	0	0	0	0	0	0
eyes hurt	0	0	0	0	0	1	0	0	0	0	0	0	0
febrile grippe	0	1	1	0	0	5	0	0	0	0	0	1	1
fever	1	0	2	1	0	3	2	1	0	0	1	0	0
fever and chills	0	0	0	0	0	3	0	1	0	0	1	0	0
generalized bone pain	0	0	0	0	1	0	0	0	0	0	0	1	0
grippe	0	1	3	0	2	19	1	1	0	0	0	4	1
headache	1	0	1	0	0	3	0	1	0	0	0	4	0
headache with fever	0	0	0	0	0	1	0	0	0	0	0	1	1
irregular heartbeat	0	0	0	0	1	0	0	0	0	0	0	0	0
joint pain	0	0	0	0	0	3	0	0	0	0	0	0	0
limb numbness	0	0	0	0	0	2	0	0	0	0	0	0	0
shortness of breath	0	0	0	0	1	0	0	1	0	0	0	0	0
stomach ache	1	0	0	0	0	1	0	2	0	0	0	1	0
urine/kidney pain	0	0	0	0	0	1	0	1	0	0	0	0	0
uterine pain	1	0	0	0	0	0	0	0	0	0	0	0	0
worm in feces	0	0	0	0	0	0	1	0	0	0	0	0	0

Table A.1 continued.

	generalized bone pain	grippe	headache	headache with fever	irregular heartbeat	joint pain	limb numbness	shortness of breath	stomach ache	urine/kidney pain	uterine pain	worm in feces
abdominal pain	0	0	1	0	0	0	0	0	1	0	1	0
back pain	0	1	0	0	0	0	0	0	0	0	0	0
bloody diarrhea	0	3	1	0	0	0	0	0	0	0	0	0
breast pain	0	0	0	0	0	0	0	0	0	0	0	0
cough	1	2	0	0	1	0	0	1	0	0	0	0
diarrhea	0	19	3	1	0	3	2	0	1	1	0	0
diarrhea w/ fever/ vomit	0	1	0	0	0	0	0	0	0	0	0	1
dizzy, weak, or fainting	0	1	1	0	0	0	0	1	2	1	0	0
dry breast	0	0	0	0	0	0	0	0	0	0	0	0
eyes hurt	0	0	0	0	0	0	0	0	0	0	0	0
febrile grippe	0	0	0	0	0	0	0	0	0	0	0	0
fever	1	4	4	1	0	0	0	0	1	0	0	0
fever and chills	0	1	0	1	0	0	0	0	0	0	0	0
generalized bone pain	0	0	0	0	0	0	0	0	1	0	0	0
grippe	0	1	0	2	0	0	0	0	0	1	0	0
headache	0	0	0	0	0	0	0	0	0	0	0	0
headache with fever	0	2	0	0	0	0	0	0	0	0	0	0
irregular heartbeat	0	0	0	0	0	0	0	0	0	0	0	0
joint pain	0	0	0	0	0	0	0	0	0	1	0	0
limb numbness	0	0	0	0	0	0	0	0	0	0	0	0
shortness of breath	0	0	0	0	0	0	0	0	0	0	0	0
stomach ache	1	0	0	0	0	0	0	0	0	0	0	0
urine/kidney pain	0	1	0	0	0	1	0	0	0	0	0	0
uterine pain	0	0	0	0	0	0	0	0	0	0	0	0
worm in feces	0	0	0	0	0	0	0	0	0	0	0	0

Table A.2: Syndromes and diagnosed conditions concurrent with each other.

	allergic reaction	benign cyst	bites/stings	chainsaw cut	chicken pox	dengue	emotional grief	fall	far sighted	fungal infection
abdominal pain	0	0	0	0	0	0	0	0	0	0
back pain	0	0	0	0	0	0	0	0	0	0
bloody diarrhea	0	0	0	0	0	0	0	0	0	1
breast pain	0	0	0	0	0	0	0	0	0	0
cough	0	0	0	0	1	1	1	1	1	1
diarrhea	0	0	1	0	3	0	0	1	0	4
diarrhea w/ fever/ vomit	0	0	0	0	0	0	0	0	0	0
dizzy, weak, or fainting	0	1	1	2	0	0	0	0	0	0
febrile grippe	1	0	0	0	1	0	0	0	0	1
fever	0	0	0	0	0	0	0	0	0	0
fever and chills	0	0	0	0	0	0	0	0	0	1
generalized bone pain	0	0	0	1	0	0	0	0	0	0
grippe	0	0	0	0	0	0	0	0	0	0
stomach ache	0	0	0	0	0	1	0	0	0	0
chicken pox	0	0	0	0	0	0	0	0	0	0
hepatitis	0	0	0	0	1	0	0	0	0	0

Table A.2 continued.

	head lice	hepatitis	hit by debris in river	leishmaniasis	machete cut	malaria	menopause	miscarriage	parasitic infection	poisoned
abdominal pain	0	0	0	0	0	1	0	1	0	0
back pain	0	0	0	0	0	0	1	0	0	0
bloody diarrhea	0	0	0	1	0	0	1	0	0	0
breast pain	1	0	0	0	0	0	0	0	1	0
cough	0	0	1	0	0	0	0	0	0	0
diarrhea	0	0	0	1	1	0	0	0	0	1
diarrhea w/ fever/ vomit	0	0	0	0	0	0	0	0	1	0
dizzy, weak, or fainting	0	0	0	0	0	2	0	0	1	0
febrile grippe	0	0	0	0	0	0	0	0	0	0
fever	0	0	0	1	0	0	0	0	3	0
fever and chills	0	0	0	0	0	0	0	0	0	0
generalized bone pain	0	0	0	0	0	0	0	0	0	0
grippe	1	0	0	1	0	0	0	1	1	0
stomach ache	0	0	0	0	0	0	0	0	0	0
chicken pox	0	1	0	0	0	0	0	0	0	0
hepatitis	0	0	0	0	0	0	0	0	0	0

Table A.3: Symptom classes concurrent with each other.

	auditory	break/sprain	breast	cardiac	cut	dermatological	emotional	fever	gastrointestinal	gi/gynecological
auditory	0	0	0	0	1	0	0	1	2	0
break/sprain	0	1	0	0	0	0	0	0	0	0
breast	0	0	0	0	0	1	0	2	3	0
cardiac	0	0	0	0	0	0	0	1	0	0
cut	1	0	0	0	0	1	0	0	1	0
dermatological	0	0	1	0	1	3	1	2	10	0
emotional	0	0	0	0	0	1	0	0	0	0
fever	1	0	2	1	0	2	0	0	12	2
gastrointestinal	2	0	3	0	1	10	0	12	4	1
GI/gynecological	0	0	0	0	0	0	0	2	1	0
gynecological	0	0	1	0	0	0	0	2	0	0
head	0	0	0	0	0	3	0	3	4	0
hepatic	0	0	0	0	0	1	0	0	0	0
neoplastic	0	0	0	0	0	0	0	0	0	0
optic	0	0	0	1	0	0	0	0	1	0
respiratory	1	0	2	2	0	15	0	10	17	0
skeletomuscular	0	0	2	1	2	0	0	1	3	1
sting/bite	1	1	0	0	0	0	0	1	1	0
syncopal	1	0	1	0	0	1	0	2	5	0
urinary	1	0	0	0	0	0	0	0	2	0

Table A.3 continued.

	gynecological	head	heaptic	neoplastic	optic	respiratory	skeletomuscular	sting/bite	syncopal	urinary
auditory	0	0	0	0	0	1	0	1	1	1
break/sprain	0	0	0	0	0	0	0	1	0	0
breast	1	0	0	0	0	2	2	0	1	0
cardiac	0	0	0	0	1	2	1	0	0	0
cut	0	0	0	0	0	0	2	0	0	0
dermatological	0	3	1	0	0	15	0	0	1	0
emotional	0	0	0	0	0	0	0	0	0	0
fever	2	3	0	0	0	10	1	1	2	0
gastrointestinal	0	4	0	0	1	17	3	1	5	2
GI/gynecological	0	0	0	0	0	0	1	0	0	0
gynecological	0	0	0	0	0	1	1	0	0	1
head	0	0	0	0	0	1	0	0	1	0
hepatic	0	0	0	0	0	0	0	0	0	0
neoplastic	0	0	0	0	0	0	0	0	1	0
optic	0	0	0	0	0	0	0	0	0	0
respiratory	1	1	0	0	0	1	1	1	1	0
skeletomuscular	1	0	0	0	0	1	0	0	0	0
sting/bite	0	0	0	0	0	1	0	0	0	0
syncopal	0	1	0	1	0	1	0	0	0	0
urinary	1	0	0	0	0	0	0	0	0	0

Table A.4: Differential diagnosis of non-emergent Secoya health problems (1998-99).

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
BITE/STING	diagnosed	insect bite	*Dermatobia hominis*
BITE/STING	diagnosed	snake bite	*Bothrops* spp.
BITE/STING	diagnosed	stingray sting	*Potamotrygon hystrix*
BREAK/SPRAIN	diagnosed	break/sprain	N/A
BREAST	breast pain	breast engorgement	N/A
BREAST	breast pain	Mastitis	*Staphylococcus* spp.
BREAST	breast pain	Mastitis	*Streptococcus* spp
BREAST	breast pain	menopause	N/A
BREAST	breast pain	premenstrual syndrome	N/A
BREAST	dry breast	dry breast	N/A
CARDIAC	irregular heartbeat	Pericarditis	*Neisseria meningitidis*
CARDIAC	irregular heartbeat	Pericarditis	*Streptococcus pyogenes*
CARDIAC	irregular heartbeat	Rheumatic Heart Disease	*Streptococcus pyogenes*
DERMATOLOGICAL	fungus	Ringworm	*Microsporum* spp.
DERMATOLOGICAL	fungus	Ringworm	*Trichopyton* spp.
DERMATOLOGICAL	lice	Pediculosis	*Pediculus humanus capitis*
DERMATOLOGICAL	diagnosed	allergic reaction	Unknown
DERMATOLOGICAL	diagnosed	Leishmaniasis	*Leishmania* spp.
EMOTIONAL	grief	emotional grief	N/A
FEVER	diagnosed	Malaria	*Plasmodium* spp.
FEVER	fever	Amoebiasis	*Entamoeba histolyca*
FEVER	fever	Febrile respiratory disease	Coronaviruses
FEVER	fever	Febrile respiratory disease	Coxsakievirus (A,B)
FEVER	fever	Febrile respiratory disease	Echoviruses
FEVER	fever	Febrile respiratory disease	Parainfluenza virus (1,2,3)
FEVER	fever	Febrile respiratory disease	Respiratory Syncytial Viruses
FEVER	fever	heat stress/dehydration	heat
FEVER	fever	Pneumonia	*Haemophilus influenzae*
FEVER	fever	Pneumonia	*Mycoplasma pneumoniae*
FEVER	fever	Pneumonia	*Streptococcus pneumoniae*
FEVER	fever	Strep Throat	*Streptococcus pyogenes*
FEVER	fever	Viral gastroenteritis	Rotavirus A
FEVER	fever and chills	Amoebiasis	*Entamoeba histolyca*
FEVER	fever and chills	Febrile respiratory disease	Coronaviruses
FEVER	fever and chills	Febrile respiratory disease	Coxsakievirus (A,B)
FEVER	fever and chills	Febrile respiratory disease	Echoviruses
FEVER	fever and chills	Febrile respiratory disease	Parainfluenza virus (1,2,3)
FEVER	fever and chills	Febrile respiratory disease	Respiratory Syncytial Viruses
FEVER	fever and chills	Heat stress/dehydration	heat
FEVER	fever and chills	Malaria	Plasmodium spp.
FEVER	fever and chills	Pneumonia	*Haemophilus influenzae*
FEVER	fever and chills	Pneumonia	*Mycoplasma pneumoniae*
FEVER	fever and chills	Pneumonia	*Streptococcus pneumoniae*
FEVER	fever and chills	Strep Throat	*Streptococcus pyogenes*
GASTROINTESTINAL	diagnosed	poisoned	Cyanide
GASTROINTESTINAL	bichos	Amoebiasis	*Entamoeba histolyca*
GASTROINTESTINAL	bichos	Giardiasis	*Giardia lambli*
GASTROINTESTINAL	bloody diarrhea	Amoebiasis	*Entamoeba histolyca*

Table A.4 continued

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
GASTROINTESTINAL	bloody diarrhea	Diarrhea	*Escherichia coli* (EPEC)
GASTROINTESTINAL	bloody diarrhea	Giardiasis	*Giardia lambli*
GASTROINTESTINAL	diarrhea	Cryptosporidiosis	*Cryptosporidium* spp.
GASTROINTESTINAL	diarrhea	bacterial enteritis	*Escherichia coli* (EPEC)
GASTROINTESTINAL	diarrhea	bacterial enteritis	*Escherichia coli* (ETEC)
GASTROINTESTINAL	diarrhea	food poisoning	*Clostridium* spp.
GASTROINTESTINAL	diarrhea	Giardiasis	*Giardia lambli*
GASTROINTESTINAL	diarrhea	Viral gastroenteritis	Rotavirus A
GASTROINTESTINAL	diarrhea with fever and/or vomit	Amoebiasis	*Entamoeba histolyca*
GASTROINTESTINAL	diarrhea with fever and/or vomit	Anemia	*Giardia lambli*
GASTROINTESTINAL	diarrhea with fever and/or vomit	Bacterial dysentery	*Shigella* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Campylobacter enteritis	*Campylobacter* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	food poisoning	*Clostridium* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	bacterial enteritis	*Escherichia coli* (EPEC)
GASTROINTESTINAL	diarrhea with fever and/or vomit	bacterial enteritis	*Escherichia coli* (ETEC)
GASTROINTESTINAL	diarrhea with fever and/or vomit	food poisoning	*Bacillus cereus*
GASTROINTESTINAL	diarrhea with fever and/or vomit	food poisoning	*Staphylococcus* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Giardasis	*Giardia lambli*
GASTROINTESTINAL	diarrhea with fever and/or vomit	Malaria	*Plasmodium* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Salmonellosis	*Salmonella* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Viral gastroenteritis	Rotavirus A
GASTROINTESTINAL	stomach ache	Amoebiasis	*Entamoeba histolyca*
GASTROINTESTINAL	stomach ache	Anemia	*Giardia lambli*
GASTROINTESTINAL	stomach ache	irritable colon	N/A
GASTROINTESTINAL	stomach ache	psychosomatic pain	N/A
GASTROINTESTINAL	worm	Ascariasis	*Ascaris lumbricoides*
GI/GYNECOLOGICAL	lower abdominal pain	Amoebiasis	*Entamoeba histolyca*
GI/GYNECOLOGICAL	lower abdominal pain	mittelschmerz	N/A
GI/GYNECOLOGICAL	lower abdominal pain	ovarian cyst	N/A
GI/GYNECOLOGICAL	lower abdominal pain	premenstrual syndrome	N/A
GI/GYNECOLOGICAL	lower abdominal pain	psychosomatic pain	N/A
GYNECOLOGICAL	diagnosed	menopause	N/A
GYNECOLOGICAL	diagnosed	miscarriage	N/A
GYNECOLOGICAL	diagnosed	miscarriage	*Plasmodium* spp.
GYNECOLOGICAL	uterine	inflameted uterus	N/A
HEAD	diagnosed	infected wound	*Staphylococcus* spp.
HEAD	headache	heat stress/dehydration	heat
HEAD	headache	hypertension	N/A
HEAD	headache	hypoglycemia	N/A
HEAD	headache	menstruation	N/A
HEAD	headache	muscle tension	N/A
HEAD	headache	stress	N/A
HEAD	headache	tumor	Unknown
HEAD	headache w/ fever	Amoebiasis	*Entamoeba histolyca*
HEAD	headache w/ fever	Febrile respiratory disease	Coronaviruses
HEAD	headache w/ fever	Febrile respiratory disease	Coxsakievirus (A,B)
HEAD	headache w/ fever	Febrile respiratory disease	Echoviruses
HEAD	headache w/ fever	Febrile respiratory disease	Parainfluenza virus (1,2,3)

Table A.4 continued

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
HEAD	headache w/ fever	Febrile respiratory disease	Respiratory Syncytial Viruses
HEAD	headache w/ fever	heat stress/dehydration	heat
HEAD	headache w/ fever	Pneumonia	*Haemophilus influenzae*
HEAD	headache w/ fever	Pneumonia	*Mycoplasma pneumoniae*
HEAD	headache w/ fever	Pneumonia	*Streptococcus pneumoniae*
HEAD	headache w/ fever	Strep Throat	*Streptococcus pyogenes*
HEPATIC	liver pain	Giardiasis	*Giardia lambli*
NEOPLASTIC	diagnosed	benign cyst	Unknown
OPTIC	diagnosed	far sighted	N/A
OPTIC	eyes hurt	Glaucoma	N/A
OPTIC	eyes hurt	Iritis	Unknown
RESPIRATORY	cough	Viral Rhinitis	Adenoviruses
RESPIRATORY	cough	Viral Rhinitis	Coronaviruses
RESPIRATORY	cough	Viral Rhinitis	Enteroviruses
RESPIRATORY	cough	Viral Rhinitis	Parainfluenza viruses
RESPIRATORY	cough	Viral Rhinitis	Respiratory Syncytial Viruses
RESPIRATORY	cough	Viral Rhinitis	Rhinoviruses
RESPIRATORY	febrile grippe	Febrile respiratory disease	Coronaviruses
RESPIRATORY	febrile grippe	Febrile respiratory disease	Coxsakievirus (A,B)
RESPIRATORY	febrile grippe	Febrile respiratory disease	Echoviruses
RESPIRATORY	febrile grippe	Febrile respiratory disease	Parainfluenza virus (1,2,3)
RESPIRATORY	febrile grippe	Febrile respiratory disease	Respiratory Syncytial Viruses
RESPIRATORY	febrile grippe	Pneumonia	*Haemophilus influenzae*
RESPIRATORY	febrile grippe	Pneumonia	*Mycoplasma pneumoniae*
RESPIRATORY	febrile grippe	Pneumonia	*Streptococcus pneumoniae*
RESPIRATORY	febrile grippe	Strep Throat	*Streptococcus pyogenes*
RESPIRATORY	grippe	Viral Rhinitis	Adenoviruses
RESPIRATORY	grippe	Viral Rhinitis	Coronaviruses
RESPIRATORY	grippe	Viral Rhinitis	Enteroviruses
RESPIRATORY	grippe	Viral Rhinitis	Parainfluenza viruses
RESPIRATORY	grippe	Viral Rhinitis	Respiratory Syncytial Viruses
RESPIRATORY	grippe	Viral Rhinitis	Rhinoviruses
RESPIRATORY	shortness of breath	asthma	allergens
RESPIRATORY	shortness of breath	hyperventilation	N/A
SKELETOMUSCULAR	back pain	menstruation	N/A
SKELETOMUSCULAR	back pain	over-exertion	N/A
SKELETOMUSCULAR	back pain	pinched nerve	N/A
SKELETOMUSCULAR	back pain	poor posture	N/A
SKELETOMUSCULAR	back pain	rheumatism	N/A
SKELETOMUSCULAR	generalized bone pain	Arthritis	Unknown
SKELETOMUSCULAR	generalized bone pain	Malaria	*Plasmodium spp.*
SKELETOMUSCULAR	generalized bone pain	Osteomyelitis	*Staphylococcus spp.*
SKELETOMUSCULAR	generalized bone pain	rheumatism	N/A
SKELETOMUSCULAR	joint pain	Arthritis	Unknown
SKELETOMUSCULAR	joint pain	Malaria	*Plasmodium spp.*
SKELETOMUSCULAR	joint pain	Osteomyelitis	*Staphylococcus spp.*
SKELETOMUSCULAR	joint pain	rheumatism	N/A
SKELETOMUSCULAR	limb numbness	nerve disorder	N/A

Table A.4 continued

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
SYNCOPAL	dizzy, weak, or fainting	Anemia	*Giardia lambli*
SYNCOPAL	dizzy, weak, or fainting	heat stress/dehydration	heat
SYNCOPAL	dizzy, weak, or fainting	hypertension	N/A
SYNCOPAL	dizzy, weak, or fainting	hypoglycemia	N/A
SYNCOPAL	dizzy, weak, or fainting	stress	N/A
SYNCOPAL	dizzy, weak, or fainting	tumor	Unknown
URINARY	urination and/or kidney pain	Cystitis	person's own bacteria
URINARY	urination and/or kidney pain	Inflammed ureter	N/A
URINARY	urination and/or kidney pain	Pyelonephritis	*Escherichia coli*
URINARY	urination and/or kidney pain	Ureteritis	*Blastomyces*
URINARY	urination and/or kidney pain	Ureteritis	*Candida*
URINARY	urination and/or kidney pain	Ureteritis	*Escherichia coli*
URINARY	urination and/or kidney pain	Ureteritis	person's own bacteria
URINARY	urination and/or kidney pain	Urethritis	person's own bacteria

Table A.5: Differential diagnosis of emergent Secoya health problems (1998-99).

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
BITE/STING	diagnosed	insect bite	*Dermatobia hominis*
BITE/STING	diagnosed	snake bite	*Bothrops* spp.
BITE/STING	diagnosed	stingray sting	*Potamotrygon hystrix*
BREAK/SPRAIN	diagnosed	break/sprain	N/A
BREAST	breast pain	breast engorgement	N/A
BREAST	breast pain	Mastitis	*Staphylococcus* spp.
BREAST	breast pain	Mastitis	*Streptococcus* spp
BREAST	breast pain	menopause	N/A
BREAST	breast pain	premenstrual syndrome	N/A
BREAST	dry breast	dry breast	N/A
CARDIAC	irregular heartbeat	Pericarditis	*Neisseria meningitidis*
CARDIAC	irregular heartbeat	Pericarditis	*Streptococcus pyogenes*
CARDIAC	irregular heartbeat	Rheumatic Heart Disease	*Streptococcus pyogenes*
DERMATOLOGICAL	fungus	Ringworm	*Microsporum* spp.
DERMATOLOGICAL	fungus	Ringworm	*Trichopyton* spp.
DERMATOLOGICAL	lice	Pediculosis	*Pediculus humanus capitis*
DERMATOLOGICAL	diagnosed	allergic reaction	Unknown
DERMATOLOGICAL	diagnosed	Leishmaniasis	*Leishmania* spp.
EMOTIONAL	grief	emotional grief	N/A
FEVER	diagnosed	Malaria	*Plasmodium* spp.
FEVER	fever	Amoebiasis	*Entamoeba histolyca*
FEVER	fever	Febrile respiratory disease	Coronaviruses
FEVER	fever	Febrile respiratory disease	Coxsakievirus (A,B)
FEVER	fever	Febrile respiratory disease	Echoviruses
FEVER	fever	Febrile respiratory disease	Parainfluenza virus (1,2,3)
FEVER	fever	Febrile respiratory disease	Respiratory Syncytial Viruses
FEVER	fever	heat stress/dehydration	heat
FEVER	fever	Pneumonia	*Haemophilus influenzae*
FEVER	fever	Pneumonia	*Mycoplasma pneumoniae*
FEVER	fever	Pneumonia	*Streptococcus pneumoniae*
FEVER	fever	Strep Throat	*Streptococcus pyogenes*
FEVER	fever	Viral gastroenteritis	Rotavirus A
FEVER	fever and chills	Amoebiasis	*Entamoeba histolyca*
FEVER	fever and chills	Febrile respiratory disease	Coronaviruses
FEVER	fever and chills	Febrile respiratory disease	Coxsakievirus (A,B)
FEVER	fever and chills	Febrile respiratory disease	Echoviruses
FEVER	fever and chills	Febrile respiratory disease	Parainfluenza virus (1,2,3)
FEVER	fever and chills	Febrile respiratory disease	Respiratory Syncytial Viruses
FEVER	fever and chills	Heat stress/dehydration	heat
FEVER	fever and chills	Malaria	Plasmodium spp.
FEVER	fever and chills	Pneumonia	*Haemophilus influenzae*
FEVER	fever and chills	Pneumonia	*Mycoplasma pneumoniae*
FEVER	fever and chills	Pneumonia	*Streptococcus pneumoniae*
FEVER	fever and chills	Strep Throat	*Streptococcus pyogenes*
GASTROINTESTINAL	diagnosed	poisoned	Cyanide
GASTROINTESTINAL	bichos	Amoebiasis	*Entamoeba histolyca*
GASTROINTESTINAL	bichos	Giardiasis	*Giardia lambli*
GASTROINTESTINAL	bloody diarrhea	Amoebiasis	*Entamoeba histolyca*

Table A.5 continued

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
GASTROINTESTINAL	bloody diarrhea	Diarrhea	*Escherichia coli* (EPEC)
GASTROINTESTINAL	bloody diarrhea	Giardiasis	*Giardia lambli*
GASTROINTESTINAL	diarrhea	Cryptosporidiosis	*Cryptosporidium* spp.
GASTROINTESTINAL	diarrhea	bacterial enteritis	*Escherichia coli* (EPEC)
GASTROINTESTINAL	diarrhea	bacterial enteritis	*Escherichia coli* (ETEC)
GASTROINTESTINAL	diarrhea	food poisoning	*Clostridium* spp.
GASTROINTESTINAL	diarrhea	Giardiasis	*Giardia lambli*
GASTROINTESTINAL	diarrhea	Viral gastroenteritis	Rotavirus A
GASTROINTESTINAL	diarrhea with fever and/or vomit	Amoebiasis	*Entamoeba histolyca*
GASTROINTESTINAL	diarrhea with fever and/or vomit	Anemia	*Giardia lambli*
GASTROINTESTINAL	diarrhea with fever and/or vomit	Bacterial dysentery	*Shigella* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Campylobacter enteritis	*Campylobacter* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	food poisoning	*Clostridium* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	bacterial enteritis	*Escherichia coli* (EPEC)
GASTROINTESTINAL	diarrhea with fever and/or vomit	bacterial enteritis	*Escherichia coli* (ETEC)
GASTROINTESTINAL	diarrhea with fever and/or vomit	food poisoning	*Bacillus cereus*
GASTROINTESTINAL	diarrhea with fever and/or vomit	food poisoning	*Staphylococcus* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Giardasis	*Giardia lambli*
GASTROINTESTINAL	diarrhea with fever and/or vomit	Malaria	*Plasmodium* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Salmonellosis	*Salmonella* spp.
GASTROINTESTINAL	diarrhea with fever and/or vomit	Viral gastroenteritis	Rotavirus A
GASTROINTESTINAL	stomach ache	Amoebiasis	*Entamoeba histolyca*
GASTROINTESTINAL	stomach ache	Anemia	*Giardia lambli*
GASTROINTESTINAL	stomach ache	irritable colon	N/A
GASTROINTESTINAL	stomach ache	psychosomatic pain	N/A
GASTROINTESTINAL	worm	Ascariasis	*Ascaris lumbricoides*
GI/GYNECOLOGICAL	lower abdominal pain	Amoebiasis	*Entamoeba histolyca*
GI/GYNECOLOGICAL	lower abdominal pain	mittelschmerz	N/A
GI/GYNECOLOGICAL	lower abdominal pain	ovarian cyst	N/A
GI/GYNECOLOGICAL	lower abdominal pain	premenstrual syndrome	N/A
GI/GYNECOLOGICAL	lower abdominal pain	psychosomatic pain	N/A
GYNECOLOGICAL	diagnosed	menopause	N/A
GYNECOLOGICAL	diagnosed	miscarriage	N/A
GYNECOLOGICAL	diagnosed	miscarriage	*Plasmodium* spp.
GYNECOLOGICAL	uterine	inflameted uterus	N/A
HEAD	diagnosed	infected wound	*Staphylococcus* spp.
HEAD	headache	heat stress/dehydration	heat
HEAD	headache	hypertension	N/A
HEAD	headache	hypoglycemia	N/A
HEAD	headache	menstruation	N/A
HEAD	headache	muscle tension	N/A
HEAD	headache	stress	N/A
HEAD	headache	tumor	Unknown
HEAD	headache w/ fever	Amoebiasis	*Entamoeba histolyca*
HEAD	headache w/ fever	Febrile respiratory disease	Coronaviruses
HEAD	headache w/ fever	Febrile respiratory disease	Coxsakievirus (A,B)
HEAD	headache w/ fever	Febrile respiratory disease	Echoviruses
HEAD	headache w/ fever	Febrile respiratory disease	Parainfluenza virus (1,2,3)

Table A.5 continued

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
HEAD	headache w/ fever	Febrile respiratory disease	Respiratory Syncytial Viruses
HEAD	headache w/ fever	heat stress/dehydration	heat
HEAD	headache w/ fever	Pneumonia	*Haemophilus influenzae*
HEAD	headache w/ fever	Pneumonia	*Mycoplasma pneumoniae*
HEAD	headache w/ fever	Pneumonia	*Streptococcus pneumoniae*
HEAD	headache w/ fever	Strep Throat	*Streptococcus pyogenes*
HEPATIC	liver pain	Giardiasis	*Giardia lambli*
NEOPLASTIC	diagnosed	benign cyst	Unknown
OPTIC	diagnosed	far sighted	N/A
OPTIC	eyes hurt	Glaucoma	N/A
OPTIC	eyes hurt	Iritis	Unknown
RESPIRATORY	cough	Viral Rhinitis	Adenoviruses
RESPIRATORY	cough	Viral Rhinitis	Coronaviruses
RESPIRATORY	cough	Viral Rhinitis	Enteroviruses
RESPIRATORY	cough	Viral Rhinitis	Parainfluenza viruses
RESPIRATORY	cough	Viral Rhinitis	Respiratory Syncytial Viruses
RESPIRATORY	cough	Viral Rhinitis	Rhinoviruses
RESPIRATORY	febrile grippe	Febrile respiratory disease	Coronaviruses
RESPIRATORY	febrile grippe	Febrile respiratory disease	Coxsakievirus (A,B)
RESPIRATORY	febrile grippe	Febrile respiratory disease	Echoviruses
RESPIRATORY	febrile grippe	Febrile respiratory disease	Parainfluenza virus (1,2,3)
RESPIRATORY	febrile grippe	Febrile respiratory disease	Respiratory Syncytial Viruses
RESPIRATORY	febrile grippe	Pneumonia	*Haemophilus influenzae*
RESPIRATORY	febrile grippe	Pneumonia	*Mycoplasma pneumoniae*
RESPIRATORY	febrile grippe	Pneumonia	*Streptococcus pneumoniae*
RESPIRATORY	febrile grippe	Strep Throat	*Streptococcus pyogenes*
RESPIRATORY	grippe	Viral Rhinitis	Adenoviruses
RESPIRATORY	grippe	Viral Rhinitis	Coronaviruses
RESPIRATORY	grippe	Viral Rhinitis	Enteroviruses
RESPIRATORY	grippe	Viral Rhinitis	Parainfluenza viruses
RESPIRATORY	grippe	Viral Rhinitis	Respiratory Syncytial Viruses
RESPIRATORY	grippe	Viral Rhinitis	Rhinoviruses
RESPIRATORY	shortness of breath	asthma	allergens
RESPIRATORY	shortness of breath	hyperventilation	N/A
SKELETOMUSCULAR	back pain	menstruation	N/A
SKELETOMUSCULAR	back pain	over-exertion	N/A
SKELETOMUSCULAR	back pain	pinched nerve	N/A
SKELETOMUSCULAR	back pain	poor posture	N/A
SKELETOMUSCULAR	back pain	rheumatism	N/A
SKELETOMUSCULAR	generalized bone pain	Arthritis	Unknown
SKELETOMUSCULAR	generalized bone pain	Malaria	*Plasmodium spp.*
SKELETOMUSCULAR	generalized bone pain	Osteomyelitis	*Staphylococcus spp.*
SKELETOMUSCULAR	generalized bone pain	rheumatism	N/A
SKELETOMUSCULAR	joint pain	Arthritis	Unknown
SKELETOMUSCULAR	joint pain	Malaria	*Plasmodium spp.*
SKELETOMUSCULAR	joint pain	Osteomyelitis	*Staphylococcus spp.*
SKELETOMUSCULAR	joint pain	rheumatism	N/A
SKELETOMUSCULAR	limb numbness	nerve disorder	N/A

Table A.5 continued

SYMPTOMS		CONDITION	
CLASS	**SYNDROMES**	**DIAGNOSIS**	**AGENT**
SYNCOPAL	dizzy, weak, or fainting	Anemia	*Giardia lambli*
SYNCOPAL	dizzy, weak, or fainting	heat stress/dehydration	heat
SYNCOPAL	dizzy, weak, or fainting	hypertension	N/A
SYNCOPAL	dizzy, weak, or fainting	hypoglycemia	N/A
SYNCOPAL	dizzy, weak, or fainting	stress	N/A
SYNCOPAL	dizzy, weak, or fainting	tumor	Unknown
URINARY	urination and/or kidney pain	Cystitis	person's own bacteria
URINARY	urination and/or kidney pain	Inflammed ureter	N/A
URINARY	urination and/or kidney pain	Pyelonephritis	*Escherichia coli*
URINARY	urination and/or kidney pain	Ureteritis	*Blastomyces*
URINARY	urination and/or kidney pain	Ureteritis	*Candida*
URINARY	urination and/or kidney pain	Ureteritis	*Escherichia coli*
URINARY	urination and/or kidney pain	Ureteritis	person's own bacteria
URINARY	urination and/or kidney pain	Urethritis	person's own bacteria