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# The Ethnoecology of Dengue Fever

This article employs an ethnoecological analysis to link indigenous, ethnomedical, and Western biomedical ideas of infectious disease causation/prevention. The ethnoecological analysis is expanded to include the cultural and historical context of political will and community participation in dengue fever control activities in an urban neighborhood in the Dominican Republic. Findings indicate that a key source of dengue fever transmission has been overlooked because it falls between established gender-role boundaries, and that mala union, an explanatory concept central to the failure of previous community-based interventions, emerges from local views of national political history. Data were generated through a neighborhood household survey, key respondent interviews, and participant-observation. [Ethnoecology, Caribbean, gender roles, dengue fever, Dominican Republic]

Dominican perceptions of dengue fever challenge medical anthropology models (McElroy and Townsend 1989) because they incorporate biomedical and indigenous knowledge about transmission and prevention in an explicit and unavoidably historical and political frame. Dominicans are sophisticated borrowers of information from Western biomedical public health messages, indigenous African folk traditions, and pan-Caribbean survival strategies. This complex melange of information is framed by Dominicans' overarching fascination with and acute awareness of their own political history. This article presents an ethnoecological analysis of Dominican understanding of dengue fever, including previously unreported consequences of gender-based household labor patterns and the transmission of dengue fever. The research is built on earlier research on health care and vector-borne disease conducted in the Dominican Republic (Gordon 1989; Tidwell 1990; Whiteford 1990, 1992, 1993, in press; Whiteford and Coreil 1989; Whiteford et al. 1991).

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### Ethnoecology

Ethnoecology is the analysis of indigenous perceptions and linguistic categories that frame a bioculturally described environment (Posey et al. 1984). In this article, the ethnoecology model is extended to include the political history of a group, in this case, Dominicans living in the barrio (neighborhood) Villa Francisca in Santo Domingo. The expanded ethnoecological model builds on the medical ecology triad of vector, source, and host, and extends the triad beyond its traditional boundaries to include social relations. During the course of our original research project (Whiteford et al. 1991), we were introduced to the concept of mala *unión*, often applied by Dominicans to explain-the failure of community-participation projects. In the current analysis, mala unión is understood to be lack of political will, a concept derived from historical conditions and influential in the determination of household-based health care responsibilities. In order to understand Dominican beliefs related to transmission and prevention of dengue fever, a model was needed that could incorporate Dominican understandings of disease causation and prevention, and contextualize that information in terms of perceived sociocultural constraints.

In response to those needs, an ethnoecology model was adapted by expanding it to include community history and politics. The resultant model developed here employs the medical ecology categories of transmission, susceptibility, prevention, and control to organize Dominican terms and understandings about dengue fever. The novel aspect of the proposed model is its expanded form and explicit focus on sociocultural constraints, which in the Dominican case are political and historical relations. The advantage of the expanded model is that it demonstrates the interrelatedness of disease etiology, history, and political will, and shows how together they illuminate previously unacknowledged relations between the failure of community-based disease-control activities and gender roles.

## Mala Unión

Villa Franciscans explain the mala unión of their community as a result of the historical and contemporary failure of political and administrative authorities to uphold their responsibilities. Villa Franciscans cite the lack of potable water, electricity, routine garbage pickup, and teachers and health personnel as examples of broken political promises. The community, they say, cannot sustain disease-control/prevention projects while those in authority do nothing. While the concept of mala unión is used to explain lack of political will at the level of the national government, by extension it is also used to explain the lack of community political will. According to Villa Franciscans, this lack of political will is the reason that community-based intervention programs, such as those to control dengue fever, fail. Mala unión and its historical and political context are, therefore, central to any understanding of the ethnoecology of dengue fever.

#### **Dengue Fever**

Unlike the malaria vector, the mosquito Anopheles, which breeds primarily in large bodies of water, Aedes aegypti, the vector for dengue fever transmission, is concentrated in periurban, domestic settings, often breeding in artificially created

water receptacles such as flower pots, discarded automobile tires, and water storage vessels. Because responsibility for household items such as flower pots, domestic water storage, clothes washing, and house cleaning is often assigned to women, this field research focuses on the relationship between household organization and patterns of water use in the transmission of dengue fever. The emphasis on gender roles reflects the literature that shows gender as a significant variable in the distribution of household tasks (Leslie and Paolisso 1989), and that in much of the world women, who are responsible for the provision of food, water, and health care, are also targeted for community health interventions (Briscoe 1984).

Dengue fever is not a new disease. It has been clinically recognized for more than 200 years (Arata 1996). Dengue fever is the result of any one of four mosquito-borne virus strains. The classic dengue fever is a nonfatal infection causing incapacitating bone pain and debilitation. Reason for the increased international concern about dengue fever is that sequential infections with different strains of the dengue virus may produce Dengue Hemorrhagic Fever (DHF), known to cause severe hemorrhaging, shock, and even death.

Air transportation has carried the mosquito vector around the world, and while dengue fever is considered a communicable (and reportable) disease by the World Health Organization (WHO), few countries dependent on tourist-generated income ever report outbreaks of dengue fever. There is no effective long-term vaccine against dengue fever, and in all likelihood such a vaccine will not be available for at least 10 years (Arata 1996). In the meantime, the most promising long-term solution to the rapid spread of the dengue virus encompasses control activities dependent on community participation in the elimination of household and neighborhood breeding sites.

Gender roles were a key organizing concept in our fieldwork because gender plays such a central role in the distribution of household tasks. Of particular concern were women's roles in the procurement, storage, and cleaning of water. In Villa Francisca, women were the primary household water handlers. They were the reservoirs of knowledge about how to let water "sleep" to clean it, how to "fan" mosquitos from depositing their larvae in the water, how to "sweeten" brackish water with drops of lemon, and how to "cleanse" water with charcoal.

While the domain of water responsibilities rested primarily with women, the gender focus in this research documented an unexpected role that men played in water handling and the transmission of dengue fever. Given the erratic and unreliable municipal provision of water, most Dominicans store water. Those who can afford to buy bottled water do so while others get water from stand pipes, public dispensaries, or by tapping into communal water pipes. Regardless of where the water comes from, there are many times each week when there is no water available, and in preparation for those times most Dominicans maintain containers of water in their kitchens, bathrooms, and/or patios. People whose dwellings do not include private kitchens or bathrooms (or patios) store their water in large 55 gallon drums outside of their immediate living area. Unlike the household water containers, these drums were considered men's responsibilities.

This study found that community-based infectious disease-control programs failed in Villa Francisca because of the mala unión engendered by Dominican history and politics. In addition, we found that because public health messages about keeping water covered and uncontaminated were targeted at women, the large outdoor water containers, attended to by men, remained uncovered (and were therefore exposed to Aedes aegypti).

## **Ethnoecology and Dengue Fever**

### Ethnoecology

The analysis employed here reflects an evolution of ideas. That history is pertinent because it provides the intellectual genealogy of the current attempt to integrate the several related points of view that together form the basis of this article. The original research proposal was based on the investigators' previous work: my earlier work in the Dominican Republic and Coreil's work in Haiti. My work in the Dominican Republic employed a critical medical anthropology/political economy of health perspective, while Coreil's work in Haiti used a medical ecology framework. Our collaborative work on dengue fever relied upon a modified medical ecology frame, that of household ecology, and was conducted in the Dominican Republic (Coreil et al. in press; Whiteford et al. 1991).

In preparing this article, I found that the household-ecology perspective failed to capture information central to the understanding of community-based dengue fever-control activities. During the data analysis, a series of questions emerged that the household-ecology model was unable to adequately address: Can research intended to illuminate peoples' beliefs and behaviors about disease transmission and prevention ignore their larger sociopolitical history, particularly if that history is locally discussed as a reason for the failure of previous community-based disease-control activities? Can indigenous beliefs and behaviors surrounding dengue fever, water-related activities, and disease prevention be understood without recourse to the larger socioeconomic and political history in which they are embedded? Can the widely referred to concept of mala unión be understood without knowledge of Dominican history and politics? While not rejecting the householdecology frame, the topics addressed in the current analysis required a different framework.

Discussions between advocates of a medical ecology perspective and a critical medical anthropology view have been ongoing for a number of years (Armelagos et al. 1992; Brown and Inhorn 1990; Leatherman et al. 1993; McElroy 1990; Morgan 1993; Singer 1989, 1990, 1993; Wiley 1992, 1993). Without attempting to recap those complex and varied discussions, suffice it to say that the medical ecology view, in general, has tended not to emphasize the political and historical aspects of analysis enough for some anthropologists (except for the work of Doyal 1995 and Turshen 1977, 1984, 1989).

These discussions, conferences, and a number of scholarly symposia were catalysts for conceptual links forged among the ideas of medical ecologists, physical anthropologists, and critical medical anthropologists, and stimulated new analytic directions, two of which are directly relevant to the current article. The first direction, laid out by Leatherman et al. (1993) in their seminal article "On Seeking Common Ground between Medical Ecology and Critical Medical Anthropology," summarized some of the issues in the debate, but more importantly, pointed to a new synthesis of ideas—a common ground between medical ecology and critical medical anthropology. They pair the ideas of Andrea Wiley's "new approaches to

biocultural adaptation" and Merrill Singer's "critical bioculturalism" (1993:203). The second direction, spelled out in an introductory article by Greenberg and Park (1994), defined political ecology as the "common ground where various disciplines interact" and on which questions can be viewed in their "bio-cultural-political complexity" (1994:1). Their article provided a rich, brief overview of the role ecological ideas have played in the sciences, the social sciences, and political economy, resulting in political ecology. The analysis employed in this article traces its roots to and is embedded in these research literatures.

The article, however, is not a political ecology analysis of dengue fever per se. Rather it is an "ethnoecological" analysis of dengue fever. The term *ethnoecology* (Posey el al. 1984) denotes that indigenous perceptions and linguistic categories are used to frame a described biocultural environment. In the Dominican case, the ethnoecology of dengue fever includes the political arena. Although my inclusion of politics in folk descriptions of disease prevention may reflect the idiosyncratic political history and development of health care in that country (Whiteford 1990, 1992, 1993, 1995), I do not so. I think that it is more likely that ethnomedicine is deeply embedded in and a result of politics and history. That these forces are often overlooked in ethnomedical research may be less a reflection of their lack of importance than their absence of an explicit focus on politics in perspectives such as medical ecology.

Thus the ethnoecology model used in this article explicitly includes an examination of the political and historical arenas. But it is not a macrolevel analysis of public health policies and practices that the Dominican government employs in disease prevention. Rather, it focuses on how the Dominican people living in one barrio in the capital city of Santo Domingo perceive the threats to their ability to prevent dengue fever and their responses to those threats.

Ethnomedicine has been defined in a variety of ways (Ackerknecht 1972; Fabrega 1974; Hughes 1968), including Fabrega's classic 1975 definition: "the study of how members of different cultures think about disease and organize themselves toward medical treatment and the social organization of treatment itself" (Fabrega 1975:51). Within medical anthropology, ethnomedical approaches that reify indigenous knowledge about health and illness are no longer unusual (Nichter 1990), while ecological research has tended to reify more formalistic and Western models (see, for instance, the list of categories of disease etiology listed by Brown and Inhorn: genetic, nutritional, environmental, psychogenic, iatrogenic, and infectious [1990:198–202]).

In dengue research these two models (ethnomedical and biomedical) coexist but are rarely combined. Ethnomedical analyses describe indigenous perceptions of illness causation, diagnosis, and treatment (Agar 1996; Daltabuilt n.d.; Kendall and Winch 1992; Salazar 1993; and Whiteford et al. 1991), while the ecological studies describe formally quantifiable variables such as energy expenditure, quantity of water used, and vector density (Tidwell et al. 1990). In short, ethnographic descriptions of peoples' experience of illness too often keep separate ecological descriptions of the nonhuman influences of disease, thus creating and maintaining an artificial portrait of ill health in which the interaction of human and nonhuman is not presented as interdependent.

#### Dengue Fever

Dengue fever (sometimes known as "classic" dengue to distinguish it from its more deadly cousin, Dengue Hemorrhagic Fever) has been called "the fastest spreading tropical disease" (Arata 1996:3). Dengue is a mosquito-transmitted virus that is one of the leading causes of pediatric morbidity and mortality in tropical and subtropical areas (Halstead 1980). Dengue is transmitted when a female *Aedes aegypti* mosquito takes a blood meal from an infected human host, and after an incubation period, again takes another blood meal, transmitting the virus to another human host. Most countries in the Caribbean have had confirmed cases of dengue since 1985 (Gordon 1989; Tidwell et al. 1990), although the largest number of cases in the Americas have been reported in Brazil, Colombia, Mexico, and Puerto Rico.

Public health concern for the spread of dengue fever stems from several disparate problems associated with the illness, not the least of which is the rapid increase worldwide of reported cases and the increasing frequency of those cases in the Caribbean. Between 1985 and 1987 the number of reported cases in the Caribbean almost doubled, from 68,998 cases to 128,400 cases (Gordon 1989:3). Nor is the United States immune to dengue fever; cases of classic dengue have been reported in Florida, New Jersey, and Texas. In addition to concern about its growing incidence is concern about the consequences of an attack of dengue fever, which include fatigue, depression and weakness, and loss of work days. Because dengue fever is a communicable disease, outbreaks are supposed to be reported to the WHO in order to alert travelers. National governments are reluctant to do so, however, for fear of discouraging tourism and business trade; therefore, outbreaks of the disease may be significantly underreported.

Even more dangerous from a public health standpoint is the increased possibility of an epidemic of dengue or the more serious form of dengue, dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS), either of which are potentially fatal (Gordon 1989). An attack of classical dengue fever, distinctive from and preliminary to DHF or DSS, is marked by bone-breaking pain, severe headaches, fevers and chills, loss of appetite and energy, and often a rash. Dengue fever therefore has social and economic, as well as physical, consequences. There are no known immunological methods for the control of dengue fever. As a result, there is considerable interest in source control and community-based methods to reduce the number of *Aedes aegypti* reaching maturity. The failure of national vector control programs to reduce the number of cases of dengue fever further focused attention on community-based methods.

## **Barrio Villa Francisca and Environs**

#### Dengue Fever in the Dominican Republic

Classic dengue fever is so common in the Dominican Republic that people accept it as part of life, albeit a painful part. The warm temperatures, frequent and plentiful rain, unscreened living places, and storage of water in uncovered containers create a perfect breeding ground for many types of mosquitoes, including *Aedes aegypti*, in the Dominican Republic. In response to the lack of a reliable supply of piped water, Dominicans store water in containers varying in size from 55 gallon drums to quart jars. Some but not all of these water containers are covered. These uncovered containers serve as larval environments for *Aedes aegypti*. According to Tidwell et al. (1990), surveys in the Dominican Republic report that dengue fever is endemic, with antibody rates of approximately 70 percent in children younger than 10 years old. By 1988 approximately 40 percent of the blood samples from febrile children in Santo Domingo showed a positive screen for dengue fever, and both DHF and DSS, as well as "classical" dengue serotypes (exposure to all four viral types of dengue fever), were found to be present in the area (Tidwell et al. 1990).

## Dengue Fever in Barrio Villa Francisca

Tidwell and colleagues (1990) collected baseline data on *Aedes aegypti* (both adult and larval)in three neighborhoods adjacent to barrio Villa Francisca. Although Villa Francisca was not part of the Tidwell study, Tidwell reported to me that similar densities of the mosquito probably occur there. Tidwell et al. found high densities of *Aedes aegypti*; in one house the researchers were able to catch 134 female mosquitoes in 10 minutes (Tidwell et al. 1990:520). Their research showed high numbers of mosquitos regardless of the type of measure used (premise, container, and Breteau indices at maximal levels). Tidwell et al. concluded: "This is the highest category on the scale; as such it could lead to high adult densities with the potential for substantial transmission of dengue" (1990:521).

In the late 1970s larval surveys conducted in the Dominican Republic indicated that approximately 30 percent to 40 percent of houses contained *aegypti* larvae (Tidwell et al. 1990:521). In the 20 years that have passed since those surveys, it is likely that the mosquito populations have increased rather than decreased because *Aedes aegypti* control programs (DDT spraying) have been effectively curtailed. At the same time rural to urban migration has increased the number of urban families without regular access to water. Simultaneously, the municipal water supply and sanitation systems have continued to deteriorate. Tidwell et al. warn: "In view of the high population densities of *Aedes aegypti*, the endemicity of all four dengue serotypes, and the continuing use of essential water storage containers, it is probable that Santo Domingo will experience a serious epidemic of dengue hemorrhagic fever" (1990:521).

### Santo Domingo

Between 1950 and 1960 the population of Santo Domingo increased sixfold; simultaneously, the percent of the population living in urban centers doubled. The majority of that increase was due to rural migration to the capital city of Santo Domingo, with the result that 25 percent of the nation's population is concentrated in 3.2 percent of the Dominican Republic's geographic area (Beestra 1984). By 1989, the capital city had a population of 2.25 million inhabitants (Tadeu and Rauner 1989). This rapid population increase was not matched by a concomitant increase in public services infrastructure such as an expansion in water and sanitation systems or housing. As a result, by the early 1990s large sections of the popu-

lation were crowded into squatter developments, with multiple families sharing whatever kind of housing they could find.

Santo Domingo exhibits a pattern of urban settlement common throughout the developing world. Squatter settlements line the banks of the river, cover the tidal areas near the port, and encircle the city. Older, established urban neighborhoods (barrios) with homes that once housed a single family have been transformed into warrens with 7–10 people in every room, all of them sharing a single patio (the open space or interior courtyard of the house). These courtyards are filled with all sorts of activities. They house the kitchens (a butane burner or two), laundry areas, shower, and toilets for every family. Older homes with enclosed backyards (*patios*) now rent out this space to families as well.

Sixteen percent of urban Dominican families are headed by women, as a result of either male out-migration or the breakup of marital or consensual unions. When a woman migrates to the city for work, children are often left with family in the rural countryside (Brown 1975). Other times, children may follow their mother into the city, where they may all live together in a patio room.

## Barrio Villa Francisca

Barrio Villa Francisca is an economically marginal neighborhood, neither squatter settlement nor middle class. Villa Francisca occupies an older corner of the capital, not far from the colonial heart of the city. The barrio is an older, urban neighborhood of Santo Domingo that consists of single-family dwellings, *multifa-miliares* (apartment houses), and patios. Often a single patio might house 20–40 families in small, single rooms, sharing a single common latrine and water tap. Some patios house more than a hundred families, often living in dense clusters without access to water disposal except for a ditch that runs through the interior patio. Some residents have access to middle-class amenities such as piped water and latrines, but most have neither. Few dwelling places have electrical power for more than two or three hours a day.

The loss of electricity means more than a temporary loss of light; in most cases it also means a loss of water. Most water pumps in barrio Villa Francisca are electric and few households can afford their own electrical generators. Thus, when the flow of electricity is cut off, everyone without a private generator loses water. As a result of these frequent interruptions, water becomes more precious, its storage more critical, and its lack more common.

According to the 1980 National Census, the barrio of Villa Francisca was home to more than 34,000 people (Censo Nacional 1985:69). Until recently there were few large apartment houses; most houses were single-family dwellings and multifamily patios. In 1988, however, President Balaguer widened Calle Duarte, the central avenue through the barrio, cutting a swath through the neighborhood and building five-story apartment houses (multifamiliares) along the street. The street-widening, apartment construction, and the creation of a massive lighthouse project (*el faro Colón*) were undertaken in anticipation of the 500th anniversary of Columbus's 1492 landing. The construction projects changed the face of the barrio Villa Francisca and engendered extensive and poignant discussions in the community about politics, government projects, and governmental responsibilities. Most of the residents whose houses were destroyed or who were forced to move out of the way of the new apartment houses were not eligible to live in the newly constructed apartments.

Neighborhood residents expressed ambivalent feelings about the massive construction projects. They were proud to host the promised international celebration; they enjoyed the idea of the new multifamiliares, and those not living in them often wished they had been provided one; and they all agreed that the country needed the jobs that the construction projects provided.

But at the same time, however, they resented the allocation of scarce resources for construction of international hotels while their communities needed water and sanitation. "If we only had water, everything would be better for us. But the reality is, we do not. And there you have those *tanques* (55 gallon metal water storage tanks) full of *gusarapos* (mosquito larvae). We have to keep water in those tanques because we cannot do otherwise. But the government is putting the money into the *faro Colón* instead of putting it into piped water for us" (community interview).

Barrio Villa Francisca is a heterogeneous community by occupation, number of urban-born residents, and to a less extent, family structure. Some families have lived in Villa Francisca for more than three generations, while others have moved in recently. Families tend to be matrifocal. Mothers and their married daughters tend to live near one another. In our sample, the average household consisted of an older woman, her daughters, and their children. Men were present either as sons or males in consensual unions with the senior woman or her daughters. Men tended to live with their mothers until labor opportunities or a serious relationship caused them to move out of their mothers' lodgings.

Many of the men of Villa Francisca were unemployed; almost all were underemployed. In our sample, 23 percent of the men held professional or semiprofessional jobs, 25 percent worked as "unskilled" laborers, 39 percent worked as "skilled" laborers, and the remaining 13 percent were unemployed. Unemployment in Villa Francisca was relatively low given that unemployment in the country averages around 25 percent (Whiteford 1992).

People living in Villa Francisca were employed in a wide range of occupations and often worked more than one job at a time. Villa Franciscans were employed as physicians, tailors, laborers, and secretaries. Most women (77 percent) did not work outside of their homes. This reflects both traditional views about women's roles as well as the lack of economic opportunities for women. Women also carried the major burden for the time-consuming household tasks, leaving little extra time available.

The limited in-ground public water distribution system in Santo Domingo was originally laid out by U.S. Marines in 1918 (Whiteford 1992) and has not been substantially improved upon since then. Pipes are broken and leaking in many places, and according to some estimates, more water leaks out of the system than is delivered to peoples' homes. Only 28 percent of the families in our sample had piped water some of the time. The majority of others bought purified water occasionally, but more often collected water from the public water plant, from standpipes, and from their neighbors.

As previously mentioned, the water shortages in Villa Francisca were exacerbated by the electrical shortage throughout the Dominican Republic. Blackout periods occurred unpredictably and lasted from a few hours to half a day. Villa Franciscans never knew when they might have water and light and when they would not.

One response to the capricious provision of water was the Dominicans' constant concern with getting and storing it. Another was the wide variety of sources from which people get water: People tap into city pipes for water, they get water from their friends' and family members' homes (if they have piped water), they stand in line to get water from a public distribution point, and they use communal standpipes. Wherever and whenever water is running, people line up with buckets, gallon jugs, bowls, and various containers in which to carry water back to their living quarters.<sup>1</sup>

## Methods

The objectives of the original study were to conduct an ethnography of dengue fever, describe the household ecology of *Aedes aegypti*, identify constraints to community-participation activities, and propose feasible means to overcome the constraints. The project was conducted over a period of nine months in 1989–90.

Integrated ethnographic methods were used to design and conduct a community study and small-scale survey to learn about people's knowledge of and behavior toward dengue fever. A walking survey and map of the community were drawn up, and key informant interviews, structured observations of households, and indepth interviews were conducted with a limited sample of men and women. In addition, school-based essay competitions provided access to families in the community.

Based on the qualitative data acquired through ethnographic techniques, a survey was constructed to elicit information concerning water-handling behavior, distribution of household tasks, the ethnoecology of dengue, knowledge about dengue fever and its causes, means of prevention, and perception of relative severity. The survey was administered to a random sample of 100 adults living in Villa Francisca and was augmented by historical and ethnographic information. One individual per household was surveyed. Fifty-six males and 44 females responded to the 64-item interview schedule.

Following the ethnographic and survey components of the research, nine households were selected for structured direct observations. Day-long observations were designed to validate information provided during the survey concerning allocation of tasks, duration of tasks, and behaviors related to dengue fever. During the household observations, the project field director took special note of the physical and social environment of each household.

Nine individuals were selected as key informants based on their knowledge of the history and population of the community. They clarified and provided amplification on the issues raised during the survey and follow-up interviews. These individuals were interviewed multiple times during the course of the fieldwork.

Demographic and epidemiological data provided a national context in which to examine individual interviews and other qualitative data, which were coded for linguistic variation and ethnosemantic analysis. Quantitative data were subjected to standard statistical tabulations using SPSS to provide measures of association between selected variables. Official documents, research reports, and other related literature were reviewed in order to gain an understanding of the history of vector control programs in the Dominican Report (and elsewhere in the Caribbean), their successes, and failures.

## **Ethnoecological Analysis of Dengue Control**

This section presents an ethnomedical analysis of Villa Franciscans' indigenous typology of water, their ethnomedical model of dengue fever, and a description of their gender-based patterns of water handling. Perceptions about water, water-handling patterns, and beliefs about disease causation and prevention are linked through an ethnoecological analysis that offers insights into possible future community-based disease control activities.

## An Indigenous Typology of Water

Unlike approaches used by public health and environmental assessment studies (which classify water according to externally recognized categories), the ethnoecological approach used here includes a typology of water based on local perceptions and practices, and ethnoscientific understanding of water quality, source, and use.

Most Villa Franciscans used tap water to wash with but preferred not to drink it. Its brackish quality made it unpleasant for people to drink or cook with. "Sweet" water was preferred for drinking and cooking, but could only be secured outside of the home from a standpipe or purchased from a public water source. Purified water, the most rarely used and most highly prized type, was bottled in heavy glass containers and purchased from local stores. Use of purified water was reserved only for rare occasions of health crisis or for important visitors, even though Villa Franciscans recognized that it was the only "safe" water. When they could, they boiled their water, but that quickly became too costly because of the scarcity of fuel for cooking.

Although Villa Franciscans preferred good, clear, sweet-tasting, clean-smelling water, most residents were forced to use brackish water at least part of the time. They were pleased if they did not have to rely entirely on its use. In our sample, 27 percent of the households depended on a combination of sweet and brackish water; another 29 percent of the households used sweet water only. No household relied exclusively on purified water. Purified water was purchased only rarely by 19 percent of the households. Only 3 percent of the sample relied exclusively on the brackish, tap water.

Yet, at the time of this research only 60 percent of the households in urban areas of the Dominican Republic had running water, and of those without, only 15 percent were relatively close to public water systems (Silva et al. 1989:53). Even in those households with running water, the tap water was often brackish and unsafe to drink. Mercedes, for instance, who lived in a new multifamilia apartment, told us that "even the water from the tap is not good. Sometimes it comes out with pieces of straw and dirt, and it smells bad."

Laundry and house cleaning were done with brackish water, sometimes available from households taps, while 91 percent of the households used sweet water for drinking. In all but the poorest homes, people relied on drinking water that was brought into the house. While the majority of people spent their time and money securing sweet water for drinking and cooking, at least half of the sample reported washing dishes, doing laundry, cleaning the floors, and bathing with brackish water.

Sweet water was stored in cooking pots, jugs, and other containers such as five-gallon bottles. These bottles were used to transport the water and then store the water inside the house, patio, or room. Brackish water and rainwater was stored outside of the house in large, 55-gallon metal drums that were acquired for that purpose.

This typology of water use demonstrates a hierarchy that reflects the constraints of scarce resources (such as money or labor) on the acquisition of water. It is worth noting that 97 percent of the sample brought water in from sources outside of the house. Securing, storing, and treating water is therefore an important part of daily life in Villa Francisca.

## Ethnomedical Model of Dengue Fever

In Villa Francisca, the indigenous model of dengue fever shares many key features with the scientific or public health (biomedical) model. Both are concerned with identifying people who are at risk, how they become infected, what is done to prevent the disease, and how people can protect themselves from the disease, or in the language of public health: transmission, susceptibility, prevention, and control.

Mosquitos, water, and *gusarapos* (larvae) were all associated in the ethnomedical model of dengue fever. In-depth interviews with barrio residents revealed that most people correctly associated gusarapos and mosquitos with illnesses like dengue fever. Eighty-five percent of the people questioned in the survey associated mosquitos with the transmission of dengue fever, and 65 percent incorporated the concept of "vector" into their answer. The description of the exact transmission process, as well as the specific constellation of diagnostic symptoms of the disease, varied somewhat from the biomedical view, but the Villa Franciscan ethnomedical model was striking for its coherence and accuracy. Likewise, community awareness of vector life-cycle and breeding places was remarkable for its congruence with public health descriptions.

Over the years Villa Francisca and other periurban communities in Santo Domingo had been targets of multiple public health television and radio campaigns, and community organizing efforts to warn communities about the dangers of flies and mosquitos and how to control them. While the prescribed behavioral changes did not always follow, residents became cognizant of public health information about disease transmission routes.

The Villa Franciscan model of dengue fever is a fairly complex mix of ethnomedical and biomedical etiologies. According to Villa Franciscans, dengue fever is transmitted by contact (with larvae), by injection (by mosquitos), and through microbes. In both ethnomedical and biomedical models children were considered to be most at risk of infection. Among Villa Franciscans, the folk image of dengue fever was not clearly distinguishable from malaria (*paludismo*). There was, however, clear name recognition of dengue fever. People described dengue fever as a type of gripe (fever, severe headaches, muscular pains) associated with diarrhea and vomiting. Whether or not the fever was associated with gastrointestinal distress, Villa Franciscans considered dengue to be painful throughout the entire body (*todas las coyunturas*), particularly in the joints, and a disease that left people with a feeling of *derrengue*, or being out of control. Their descriptions correspond fairly closely with the clinical description of dengue fever symptoms: fever, pain in the joints, severe headaches, and debilitation.

Key informants agreed that while those suffering from dengue may wish they were dead, dengue was rarely seen as a fatal disease. Community members listed the following points concerning dengue fever: (1) it was dangerous for those whose health was most vulnerable ( $d\acute{e}bil$ ), such as babies; (2) it was transmitted to humans through mosquitos; (3) mosquitos bred in garbage and deposited their larvae in water; and that (4) communities alone could do little to protect themselves from dengue fever. The ethnoecological view held by Villa Franciscans was that the environment surrounding them was full of places for the vectors of dengue fever to hide and to multiply, and that they, the members of the community, were powerless to change their environment.

*Transmission.* Many barrio residents shared a common local description of dengue transmission, expressed by Inocencia when she said that "dengue is transmitted by the mosquito." Another common view, expressed by Inocencia's neighbor, was that: "The mosquito breeds in places where there is a lot of garbage and a lot of standing water; where there is water in water vessels. Gusarapos (larvae) give birth to mosquitos." Villa Franciscans correctly recognized that mosquitos bred in places where water collected such as broken gutters and puddles from rain water. They also said (incorrectly) that mosquitos bred in garbage and in plants. Thirty percent of those interviewed thought that mosquitos bred in plants because of the humidity trapped in the plant. Another 30 percent thought that mosquitos bred there because the plants provided shelter and concealed them from view.

While most Villa Franciscans said that dengue was transmitted through mosquitos, others believed that the gusarapos infected people through direct contact, and that drinking water or bathing in water contaminated by gusarapos exposed one to the risk of infection.

Susceptibility. Villa Franciscans were aware that some members of the community were at higher risk of illness and death than others. According to their ethnomedical model of disease causation, children and people who were anemic or whose health was already compromised were most susceptible to dengue fever. All children, however, were seen as vulnerable to diseases such as dengue fever: "children are fragile; they are weak and susceptible" (los niños son muy frágiles; son muy debiles). Mothers who wanted to keep their children healthy were told to keep them clean to prevent illness. To keep children clean entailed washing children and their clothes. Laura, one of the women from the barrio, captured the women's sense of their children's fragility when she said that children were like crystals from Bethlehem (cristales de Belén): pure, fragile, and difficult to protect.

Ana, another woman from barrio Villa Francisca, interwove information about typhus, malaria, and evil eye when she said that to keep children healthy they needed to be kept clean (hygienic precautions against typhus), away from dirty water (breeding places of the Anopheles mosquitos, the malaria vector), and away from the direct gaze of jealous people. "Our cristales de Belén are clean and pure, but the force of a strong glance is enough to break them" (se quiebran con la sola mirada, se quiebran de sólo mirarlos). Ana, Inocencia, and Laura exemplify the ways in which Villa Franciscans incorporate biomedical public health information into the local ethnomedical model of dengue fever.

*Prevention.* Both men and women in Villa Francisca reported that babies and people who were sick were particularly vulnerable to infections carried by dirty water, and that they should drink only purified water. Few Villa Franciscans, however, could afford to purchase purified water. Among the 81 percent of our sample who could not afford to purchase purified water, other methods of cleaning water were often discussed. Various informal methods to clean water such as adding lemon or charcoal were commonly relied upon in the barrio, even though the women recognized that such "cleansing" might only be superficial.

Women selected particular cleansing methods depending on the quality of the water and on its intended use. Water for bathing, washing clothing, and cleaning the house were not given special treatment. Water used for cooking, however, was "cleaned." Brackish water from the tap might be allowed to stand overnight to allow it to clear and might also be treated with charcoal or lemon to remove the unpleasant taste. Even though women discussed the many ways they tried to clean their water, they agreed that most of the suggested methods were insufficient to protect their *cristales* (very young children) and other people vulnerable to waterborne infections. They uniformly expressed their desire for free, clean water, or for affordable purified water.

Women were concerned about the dirty appearance and salty taste of the water that they got from their taps, cisterns, and standpipes. But they recognized that even water that appeared clear and did not taste salty could be loaded with microbes. Other preventive measures included "fanning" the air near the water storage containers to keep mosquitos from settling on the surface of the water and depositing eggs. Women often used hand-held fans to clear the air of mosquitos and "blow them away." In sum, ethnomedical views about prevention, for the most part centered on cleaning water and on restricting vector access.

*Control.* Women living in Villa Francisco tried to protect their children from illnesses associated with unclean water. They tried to keep their children clean, to secure clean water, or to clean the water they got. They tried to cover the small vessels containing drinking water, and they sprayed their homes with commercial insecticides. These measures, however, were inadequate to guard against mosquitoborne diseases. As a result, women often felt that their efforts to create a safe environment for themselves and their families were ineffectual. They said they could not provide a safe environment alone and that the government would not help them. Villa Franciscan men and women were overwhelmed by the magnitude of their problems and the apparent indifference on the part of their government. This, they said, created mala unión or a lack of political will. So although the concept originated in the government's lack of interest in the community, mala unión became interpreted by the community as an explanation for its own unwillingness and inability to engage in communal social action.

### Gender Roles and Water Handling

In the Caribbean, work roles both inside and outside the household are defined principally by gender (Blumberg 1991; Brown 1975; Finlay 1989; Georges 1990; Grasmuck and Pessar 1991; Safa 1995; Safa and Antrobus 1990). Part of our original research project investigated women's household labor activities and how they related to water handling tasks. Analysis (Whiteford et al. 1991) showed that Villa Franciscans understood that water stored in uncovered jars was a breeding ground for mosquitos (people even identified the larvae in the water containers). Although women said they tried to keep the water jars covered, on-site observations revealed uncovered water containers.

The role of women as domestic managers of water collection, storage, and use has been well documented in the health and development literature (Elmendorf and Isley 1982). While much attention has been given to the links between domestic water supply and health through the mechanisms of water-borne and water-washed infections, particularly diarrheal diseases (Arlosoroff et al. 1987; Kendall n.d.; Okun 1987; Roark 1989), comparatively few studies have addressed the ethnoecology of *domestic* water and vector-borne diseases such as dengue fever.

Women, especially older mothers, traditionally have the greatest responsibility for the health and nutrition of their families. In Villa Francisca they were responsible for purchasing, producing and processing food, collecting and carrying water, providing home treatment of common ailments, and teaching their children about health and nutrition. According to Leslie et al. (1989:309) approximately 75 percent of all health care takes place at the family level.<sup>2</sup>

Women in Villa Francisca were responsible for cleaning, cooking, and health care. In the barrio the senior woman of the house had the major responsibility for household maintenance. She controlled the household money (contributed by all employed members of the household), was responsible for buying food, preparing the meals, cleaning the house and the commons, and to a lesser extent, minding the children. In some cases she was also responsible for getting water as well.

In 31 percent of the cases we surveyed, the senior woman was in charge of getting water for the house. Households without men like Eugenia's were common, but unlike most women Eugenia paid someone to bring her household water to her. Eugenia lived with her daughter and her granddaughter in a three-room flat without running water. Eugenia ran a small seamstress shop from the front of her three rented rooms. During the day she sewed and watched her five-year-old granddaughter while her daughter went to school.

I do everything here at home. My granddaughter helps me. Although I am old, I can do my work and I do not have to depend on anyone. The only thing I feel I cannot do is carry water. Because of that I pay a man to carry [drinking] water for me. I pay him ten pesos [approximately \$1.50 US in 1992].

Eugenia was unusual in our sample. While 80 percent of the households in our sample had to collect water from sources outside of the home, only five percent of them paid someone to carry water for them; the vast majority found someone in the house to collect water for the household.

Both male and female Villa Franciscans identified senior women in the household as being responsible for preparing the morning, midday, and evening meals. Dominicans enjoy their main meal (*la comida*) at midday, and senior women in the households reported that they spent about two and a half hours every morning shopping and cooking. They also reported spending an additional hour and a half cleaning the house and, if they lived in a patio, cleaning the open area (often with help from younger women in the household); another hour each day was spent carrying water.

Survey responses suggested that all members of the household spent some time during the day collecting, transporting, storing, or disposing of water for domestic use. Young men and women both reported that they spent an hour and a half each day carrying water; older men reported that water collection consumed an hour and a half of their day as well.

Although we anticipated finding that everyone in the household spent time daily in water-related activities, we did not anticipate how many senior men would be involved. Men carried the heavy, large water vessels used to store brackish water. Senior males were involved in as much as 20 percent of all the reported cases of water handling, a percentage that increases to 29 percent when both men and boys are included in the analysis.

Some water-related tasks were gender-specific. Women were primarily responsible for the food-related water activities (cleaning water, covering the small water containers), while men had responsibility for the water used for clothes washing, house cleaning, and personal bathing. The unavoidable question is if Villa Franciscans understood the role of uncovered water vessels in the spread of dengue fever, why did they leave large water-storage vessels uncovered or only partially covered? Furthermore, why were only the small water vessels routinely covered and protected from infestations? The answer to this conundrum is found by expanding the ethnoecological analysis to include gender-based patterns of water handling, the ethnomedical model, and an understanding of mala unión at the level of the family and neighborhood. In Villa Francisca women are responsible for managing the small water containers; men are responsible for the management of the large water containers. Mala unión means that no one is accountable for activities that fall between the gender-based spheres of responsibility, where the spheres fail to overlap. They fail to overlap in the nexus between large water containers that men fill and store outside of the family living space and health-related information that women apply in covering the small water containers inside the dwelling. Women as guardians of health-related knowledge protect the water containers in their sphere of responsibility (inside the house); men uphold their responsibility by getting water for bathing and washing. The lack of communal spheres of responsibility excludes the outside water tanks from women's health responsibilities, while health responsibilities are excluded from men's work. Therefore, the large water containers are left uncovered.

The large containers are heavy and can be filled only by making several trips to the communal tap. Men, traditionally underemployed in the Dominican Republic, have fewer household, food preparation, and childcare responsibilities than do women. Therefore, men are available to stand in line and haul water. As Leonardo told us: "We never know when we'll have water. You always have to be alert, waiting for the water to come. We use brackish water only to wash our clothing and to bathe in. For drinking and cooking we collect sweet water in *galones* (small plastic vessels like those used for cooking oil)." Whenever the tap water runs, people line up at the communal tap to fill their large containers with the slightly salty water that comes from the faucet.

## Conclusion

The expanded ethnoecological perspective places Villa Franciscans' indigenous and biomedical views of dengue fever in a community setting that includes culturally prescribed gender roles and historical perceptions of leadership responsibilities. It enlarges its definition of ecology to include folk and formal, cultural and historical influences on the environment of Villa Franciscans. When Villa Franciscans describe their inability to effect change as a reflection of the community's mala unión, they acknowledge a history of unfulfilled political promises. According to Villa Franciscans, mala unión, or the lack of political will and the lack of belief in community-based social action, leads to failure of community participation in public health projects such as source-control activities for dengue fever.

For Villa Franciscans, lack of action to prevent dengue fever stems not from lack of knowledge of disease transmission, but from a sense of powerlessness. As the data demonstrate, Villa Franciscans have absorbed multiple public health messages centering on the dangers of vector-borne diseases. Residents' descriptions of disease-prevention techniques suggests a clear awareness of the dangers of standing water and uncovered water vessels. Yet only the small water vessels were routinely and carefully covered. The large water vessels were often only haphazardly covered, if at all. Even the presence of gusarapos in the water failed to provoke household members to be more vigilant. As one community member said: "When we do not have the power to get rid of the garbage, to kill the rats, or keep out the flies, why should we think we can stop the mosquitos?"

For families living in the patios, the sense of powerlessness is even more intense. Ana, whose family lives in one of the patios, said: "The neighbors here do not get along; no one is willing to be in charge of cleaning up shared things, like the latrine. As a result, it never gets cleaned. It's too much just for one person and it's too expensive to buy the supplies." The implication is that the community has no positive experience working together or faith in its own leadership or its government's.

Conceptual divergences between biomedical and ethnomedical models of disease transmission often create barriers to effective disease-control interventions. In the present analysis, the use of the ethnoecological model provides a bridge between the two by emphasizing their shared domains. Community members in barrio Villa Francisca demonstrated levels of knowledge about the biomedical/public health explanations of dengue fever. Their ethnomedical understandings, notably their general understanding of the mode of reproduction and transmission of *Aedes aegypti*, overlapped with biomedical knowledge.

The ethnoecological model proposed in this article is appropriate for framing policy that considers the intersections between biomedical and ethnomedical models, in addition to historical and political factors. This enhanced or expanded application of the ethnoecology model facilitates the unraveling of the cultural riddles that beset, for instance, community-participation vector control programs.

The proposed ethnoecological analysis suggests that gender roles, community cooperation, and perception of one's social and physical environment are significant determinants of water handling. In Villa Francisca, the fact that men and boys are responsible for a significant amount of water-related activities could be used to develop separate gender-based source-control strategies. One possible application of the results of this ethnoecological analysis might be a new source-control strategy. According to the model of the ethnoecology of dengue fever developed in this analysis, men play a previously unreported role in water procurement for the large tanques in which gusarapos are most commonly found. Men's role in water gathering was already locally understood and acknowledged within the community. Given the existing responsibilities that women have, adding to their responsibilities might not be a feasible solution in the reduction of vector breeding sites. However, men and boys who were already collecting water for the large tanques could be encouraged to assume responsibility for other tasks related to those tangues. Such tasks might include cleaning and covering the tanques; both activities would reduce the breeding sites, thereby reducing the presence of Aedes aegypti.

The contribution made by the use of an expanded ethnoecological perspective is that it bridges the medical ecology and political ecology models. The development of ethnomedical models is a good descriptive and analytical technique for gaining insight into how people perceive their surroundings and organize information. But it fails to give us enough information to explain people's behaviors. Proponents of medical ecology argue that their model incorporates the social as well as physical environment, including history and politics. To date, however, few have shown that they clearly incorporate a political and historical perspective in their application of the model.

Political ecology, in contrast, defines itself as an interdisciplinary "common ground" where various disciplines can share information in a "biocultural-political context," but with little emphasis on indigenous knowledge. The expanded ethnoe-cological framework proposed here attempts to bridge these two perspectives by including an explicit focus on both ethnomedicine and its historical and political contexts.

#### Notes

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1. The community of Villa Francisca also includes the political and historical reality of the "last Caudillo," as Joaquin Balaguer has been called. Balaguer had been president of the Dominican Republic for seven four-year terms since 1960, and before that was Trujillo's vice-president and mind behind the dictatorship. No discussion of Dominican life can omit his presence, as Dominicans are justly aware. Fond of building large public works projects, Balaguer has not been a friend to the poor. Per capita spending on health has steadily decreased since the mid-1980s (Whiteford, 1990, 1992, 1993), while levels of infectious disease and severe malnutrition have risen (Whiteford 1993). Revered, feared, and little understood, Balaguer is not seen by the residents of Villa Francisca as someone who has their concerns at heart; indeed, he is seen as someone who has contributed to the mala unión for almost fifty years.

2. Among Villa Franciscans, the average household size was nine people. Based on World Health Organization estimates, each person needs between 18 to 20 liters of water each day (INSTRAW 1989:3); therefore, an average Villa Franciscan household needed to acquire between 162 and 180 liters of water daily. The energy needed for the task of collecting and transporting water might well consume one-third of the daily caloric intake of the laborer.

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